Synapse Documentation

Release 2.215.0

The Vertex Project

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Star us on GitHub | Watch Synapse 101

CHAPTER

ONE

INTRODUCTION

Synapse is a versatile central intelligence and analysis system created to support analyst teams in every stage of the intelligence life cycle.

The Vertex Project designed and developed Synapse to help analysts and algorithms answer complex questions which require the fusion of large data sets from disparate sources that span multiple disciplines.

Synapse's data store (known as a *Cortex*) is organized as a hypergraph. Combined with its structured and extensible *Data Model* and the powerful and intuitive *Storm* query language, Synapse gives analysts unparalleled power and flexibility to ask and answer any question, even over large and complex data sets.

> **Note**
>
> A *Cortex* may easily grow to billions of nodes, but is not designed to consume and create billions of nodes per day. In other words, Synapse is not meant to replace your big-data/data-lake storage; Synapse is designed to connect to your data sources on demand in order to ingest data relevant for your analysis into the Synapse intelligence platform.

1.1 Key Features

Extensible Data Model

Synapse includes an extensive (and extensible) *Data Model* capable of representing real-world objects, relationships, and events in an intuitive and realistic manner.

Strong Typing

Synapse uses *Type Normalization* and *Type Enforcement* to apply meaningful constraints to data to ensure it is well-formed, preventing "bad data" from cluttering the knowledge store. *Type Awareness* simplifies use of the Storm query language and helps analysts discover novel relationships in the data.

Powerful and Intuitive Query Language

Synapse's *Storm* query language is a powerful, intuitive "data language" used to interact with data in a Synapse Cortex. Storm frees analysts from the limitations of "canned" queries or hard-coded data navigation and allows them to ask - and answer - **any** analytical question.

Unified Analysis Platform

Synapse's unified data store provides analysts with a shared view into the same set of data and analytical annotations, allowing them to better coordinate, collaborate, and peer-review their work.

Designed and Tested in Partnership with Analysts

Synapse is the product of a unique close collaboration between Vertex developers and analysts that leverages innovative software design and engineering to directly support analyst needs and workflows.

Modular Architecture

Synapse is extensible through **Power-Ups** (see *Power-Up*) that add functionality, integrate with third-party data sources, or connect to external databases.

Record Analytical Assessments

Synapse allows analysts to annotate data with assessments and observations through a flexible and extensible set of tags (see *Tag*). By recording assessments **and** data in a structured manner, analysts and algorithms can leverage **both** in their queries and workflows.

"Git for Analysis"

Synapse supports the use of layers (see *Layer*) to comprise a *View* into Synapse's data store. Analysts can create a *Fork* of a given view and use it for testing or research without modifying the underlying production data. Once work in the fork is complete, changes can be merged into the production view or discarded.

Fine-Grained Access Controls

Synapse provides access controls and detailed permissions that can be applied to users or roles. Permissions can be specified broadly or to a level of detail that restricts a user to setting a single property on a single form.

Flexible Automation

Synapse allows you to create custom automation for both analytical and administrative tasks, ensuring consistency and eliminating tedious or time-consuming workflows. Automation (see *Storm Reference - Automation*) is provided using event-based triggers (*Trigger*), scheduled cron jobs, or stored macros.

API Access

Synapse includes multiple well-documented APIs for interacting with the data store and other Synapse components. (See *Synapse HTTP/REST API* and *Synapse Python API*.)

Lightning Fast Performance

Synapse uses LMDB for high-performance key-value indexing and storage, combined with asynchronous, streaming processing. This means queries start returning results as soon as they are available - so your "time to first node" is typically milliseconds, regardless of the size of your result set.

Horizontally and Vertically Scalable

A single Synapse Cortex can easily scale vertically to hold tens of billions of nodes. In addition, Synapse supports high-availability topologies such as mirroring.

1.2 What's Next?

Get Started!	• There are several options for you to deploy and start using Synapse! See our *Getting Started* guide to see which one is right for you. • Watch a Guided Tour
Users	• *Synapse User Guide* • *Storm Reference* • Changelog • Ask a question in Slack
DevOps	• *Synapse Devops Guide* • *Synapse Deployment Guide* • Synapse sizing guide
Developers	• *Synapse Developer Guide* • *Synapse HTTP/REST API* • *Synapse Python API* • *Synapse Data Model* • *Storm Library Documentation*
Admins	• *Synapse Admin Guide*
Synapse UI (commercial)	• Synapse UI ("Optic") documentation (includes guides for users, devops, and developers)
Learn More	• Upcoming Webinars • Video Library • Visit The Vertex Project Website
Connect With Us!	• Slack • Twitter • LinkedIn • "Star" us on Github

CHAPTER

TWO

GETTING STARTED

So you've looked over our *Introduction* to Synapse and want to try it out! What do you do next?

Open-source Synapse and demo versions of commercial Synapse (Synapse Enterprise) are both available for you to deploy and test. Both versions include the **same key features,** including Synapse's core architecture and functionality, our extensive data model, and the full capabilities of the Storm query language and libraries.

Open-source versions of Synapse provide a **command-line interface** (the Storm CLI) to interact with Synapse and its data. You can download *Open-Source Synapse* from our Github repository or use *Synapse Quickstart* to easily load a basic instance of Synapse.

Demo instances of Synapse Enterprise include Synapse's **web-based UI**, also known as **Optic.**

- If you want to get started with Synapse as quickly as possible, then a *Synapse Demo Instance* or *Synapse Quickstart* are right for you.
- If you're interested in deploying your own test or production environment, then take a look at *Open-Source Synapse*.

We'll explain each option in more detail below.

2.1 Synapse Quickstart

Synapse Quickstart is a Docker container that includes everything you need to start using Synapse and the Storm CLI right away. Because Synapse Quickstart is self-contained, you can easily install and launch this basic Synapse instance on Linux, Windows, or MacOS.

You can find the instructions to download and install Synapse Quickstart here.

Synapse Quickstart is best for:

- Individual users.
- Users who want to test Synapse without the need for a formal deployment.
- Users who are most interested in learning about Synapse's data and analytical models and the Storm query langauge (vs. deployment or development tasks).
- Users who want to test or use Synapse with proprietary or sensitive data that must be hosted locally.

Synapse Quickstart is **not** pre-loaded with any data.

2.2 Open-Source Synapse

The full open-source version of Synapse is available from our Github repository. Instructions for deploying a test or production environment are available in the *Synapse Deployment Guide*.

Open-source Synapse is best for:

- Users who want to work with or try out a full version of Synapse.
- Supporting multiple users and / or networked users, including the (optional) ability to configure roles and permissions.
- Developers who want to build on or integrate with Synapse.
- Users who want to test or use Synapse with proprietary or sensitive data that must be hosted locally.

Open-source Synapse is **not** pre-loaded with any data. However, some of Synapse's Power-Ups are available as open source and can help you automate adding data to Synapse:

- Synapse-MISP
- Synapse-MITRE-ATTACK
- Synapse-TOR

2.3 Synapse Demo Instance

Commercial Synapse (Synapse Enterprise) and our commercial demo instances include the web-based Synapse UI (Optic). **Demo instances** are **cloud-hosted,** so there is nothing for you configure or deploy to get started - all you need is a web browser (we recommend Chrome).

You can request a demo instance from our web site.

> **Note**
>
> Synapse Enterprise can be deployed either on premises or in the cloud. Only the demo instances are cloud-only.

Demo instances provide access to all of Synapse's Rapid Power-Ups, both open-source and commercial. Any Rapid Power-Up can be installed in your demo instance (although some Power-Ups may reqiure API keys and / or paid subscriptions from the associated third-party).

Demo instances are updated automatically each week with any new releases of Synapse and Optic. New or updated Rapid Power-Ups are available upon release and can be updated manually from the Power-Ups Tool.

In addition, demo instances are **pre-loaded** with sample data and tags (just under 300,000 objects). You can explore the data on your own, or use our APT1 Scavenger Hunt as a guided way to learn about the Synapse UI and Storm query language.

A **demo instance** is best for:

- Users who want to test all of Synapse's features and capabilities, including those only available with Synapse Enterprise.
- Supporting multiple users and / or networked users, including the (optional) ability to configure roles and permissions.
- Simple deployment - no hardware/software needed (other than a web browser).
- Developers who want insight into developing Power-Ups or Workflows.
- Users and developers who want access to the "latest and greatest" releases and features during testing.
- Users who want to take advantage of all of Synapse's features (including built-in Help for Synapse's data model, Storm auto-complete, etc.) while learning - even if you ultimately deploy an open-source version.

> **Note**
>
> Because demo instances are cloud-based, they are **not suitable** for hosting any sensitive or proprietary data.

CHAPTER

THREE

SYNAPSE USER GUIDE

This User Guide is written by and for Synapse users and is intended to provide a general overview of Synapse concepts and operations. Technical documentation appropriate for Synapse deployment and development can be found elsewhere in the Document Index.

The User Guide is a living document and will continue to be updated and expanded as appropriate. The current sections are:

3.1 Background

3.1.1 Why Synapse?

Synapse is a versatile central intelligence and analysis system created to support analyst teams in every stage of the intelligence life cycle. We designed Synapse to answer complex questions which require the fusion of large data sets from a broad range of sources that span multiple disciplines. Analysis is based on representing all data in a structured model that allows analysts or algorithms to query, annotate, navigate, and reason over the collected data.

> **Tip**
>
> See Synapse's *Key Features* for an overview of Synapse's advantages!

Synapse is based on a proven methodology informed by real-world experience. Synapse grew out of the need to track a complex, diverse, and very large data set: namely, cyber threat data. Synapse is the successor to the proprietary, directed graph-based analysis platform (Nucleus) used within Mandiant to produce the APT1 Report.

Synapse and its predecessors were designed from the beginning to support the following critical elements:

- The use of a **shared analytical workspace** to give analysts access to the same data and assessments in real time.
- The principle that **relationships among and conclusions about data should be self-evident.** That is, to the extent possible, data and analytical findings must be represented so that analysis captured within the system should "speak for itself".

These features give Synapse the following advantages:

- Synapse allows (and requires) analysts to "show their work" in a reasonably concise manner. Analysts should not have to refer to long-form reporting (or rely on the unquestioned word of a subject matter expert) to trace a line of analytical reasoning.
- Synapse allows analysts to better review and validate their findings. Conflicting analysis is highlighted through the structure of the data itself. Analysis can readily be questioned, reviewed, deconflicted, and ultimately improved.

- Because Synapse's knowledge store is continually expanded, updated, and revised, it always represents the current, combined understanding of its data and analysis. Unlike prose reports or tickets, Synapse is never stale or outdated.

Synapse's hypergraph design addresses many of the shortcomings we identified with earlier directed graph and prototype hypergraph systems. In addition, because our experience taught us the power of a flexible analysis platform over any large and disparate data set, Synapse has been designed to be flexible, modular, and adaptable to **any** knowledge domain - not just cyber threat data.

Many of the real-world examples in this User Guide reference data from the fields of information technology or cyber threat intelligence, given Synapse's history. But Synapse's structures, processes, and queries can be applied to other knowledge domains and data sets. **The intent of Synapse is that any data that could be represented in a spreadsheet, database, or graph database can be represented in Synapse using an appropriate data model.**

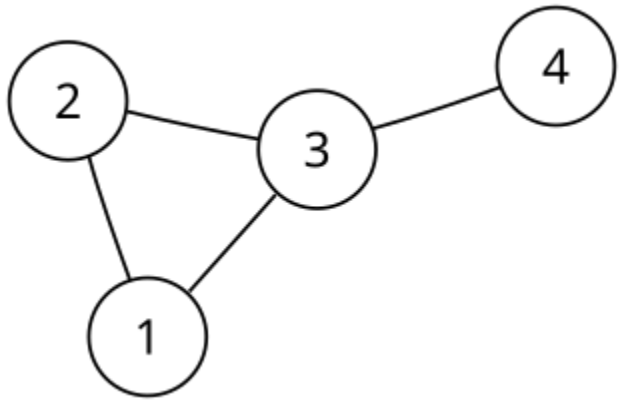
3.1.2 Graphs and Hypergraphs

To understand the power of Synapse, it helps to have some additional background. Without delving into mathematical definitions, this section introduces key concepts related to a **hypergraph,** and contrasts them with those of a **graph** or a **directed graph.** Most people should be familiar with the concept of a graph – even if not in the strict mathematical sense – or with data that can be visually represented in graph form.

Graphs

A **graph** is a mathematical structure used to model pairwise relations between objects. Graphs consist of:

- **vertices** (or **nodes**) that represent objects, and
- **edges** that connect two vertices in some type of relationship.



Edges connect exactly two nodes; they are "pairwise" or "two-dimensional". Both nodes and edges may have properties that describe their relevant features. In this sense both nodes and edges can be thought of as representational objects within the graph: nodes typically represent things ("nouns") and edges typically represent relationships ("verbs").

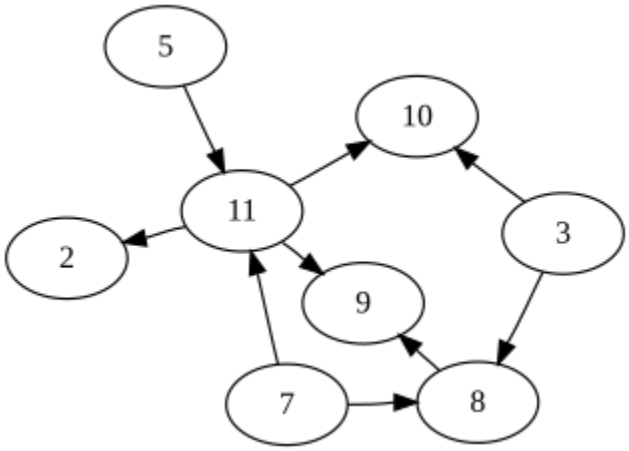
Examples

Cities and Roads. A simple example of data that can be represented by a graph are cities connected by roads. If abstracted into graph format, each city would be a vertex or node and a road connecting two cities would be an edge. Since you can travel from City A to City B or from City B to City A on the same road, the graph is **directionless** or **undirected.**

Social Networks. Another example is social networks based on "connections", such as LinkedIn. In this case, each person would be a node and the connection between two people would be an edge. In most cases, LinkedIn requires a mutual connection (you must request a connection and the other party must accept); in this sense it can be considered a directionless graph. (This is a simplification, but serves our purpose as an example.)

Directed Graphs

A **directed graph** is a graph where the edges have a direction associated with them. In other words, the relationship represented by the edge is one-way. Where an edge in an undirected graph is often represented by a straight line, an edge in a directed graph is represented by an arrow.



Examples

Cities and Roads. In our cities-and-roads example, the graph would be a directed graph if the roads were all one-way streets: in this case you can use a particular road to go from City A to City B, but not from City B to City A.

Social Networks. Social networks that support a "follows" relationship (such as Twitter) can be represented as directed graphs. Each person is still a node, but the "follows" relationship is one way – I can "follow" you, but you don't have to follow me. If you choose to follow me, that would be a second, independent one-way edge in the opposite direction. (This is also a simplification but works for a basic illustration.)

Other Examples. Many other types of data can be represented with nodes and directed edges. For example, in information security you can represent data and relationships such as:

```
malware_file --(performed DNS lookup for)--> domain
```

or

```
domain --(resolves to)--> ip_address
```

In these examples, files, domains, and IP addresses are nodes and "performed DNS lookup for" and "resolves to" are edges (relationships). The edges are directed because a malware binary can contain programming to resolve a domain name, but a domain can't "perform a lookup" for a malware binary; the relationship (edge) is one-way.

In addition to nodes and edges, some directed graph implementations may allow labeling or tagging of nodes and edges with additional information. These tags can act as metadata for various purposes, such as to create analytically relevant groups of objects.

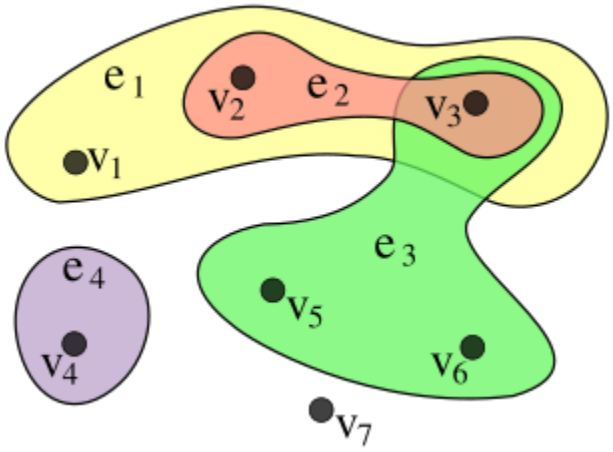
Many tools exist to visually represent various types of data in a directed graph format.

Analysis with Graphs

When working with graphs and directed graphs, analysts typically select (or lift) objects (nodes) and navigate the graph by traversing the edges (relationships) that connect those nodes. A key limitation to this approach is that all relationships (edges) between objects must be explicitly defined. You must know all of the relationships that you want to represent in advance, which makes the discovery of novel relationships among the data extremely difficult.

Hypergraphs

A **hypergraph** is a generalization of a graph in which an edge can join any number of nodes. Because an edge is no longer limited to joining exactly two nodes, edges in a hypergraph are often called **hyperedges.**



Looked at another way, the key features of a hypergraph are:

- **Everything is a node.** In a hypergraph, objects ("nouns") are still nodes, similar to a directed graph. However, relationships ("verbs", commonly represented as edges in a directed graph) may also be represented as nodes. An edge in a directed graph consists of three objects (two nodes and the edge connecting them), but in a hypergraph the same data may be represented as a single multi-dimensional node.
- **Hyperedges connect arbitrary sets of nodes.** An edge in a directed graph connects exactly two nodes. A hyperedge can connect an arbitrary number of nodes; this makes hypergraphs more challenging to visualize in a "flat" form. As in the image above, hyperedges are commonly represented as a set of disconnected nodes encircled by a boundary; the boundary represents the hyperedge "joining" the nodes into a related group. Just as there is no limit to the number of edges to or from a node in a directed graph, a node in a hypergraph can be joined by any number of hyperedges (i.e., be part of any number of "groups").

Analysis with a Synapse Hypergraph

Synapse is a specific implementation of a hypergraph model. Synapse's data store is called a **Cortex.** A Cortex is a scalable hypergraph implementation which includes key/value-based node properties and a data model that facilitates normalization.

In Synapse, all objects and most relationships are nodes (though Synapse uses what we call "lightweight" or "light" edges, similar to directed edges, in some cases). This means that most relationships in Synapse are based on nodes sharing a common property value. Instead of an FQDN being related to an IPv4 using a "resolves to" edge:

- the FQDN node is related to a DNS A record because the FQDN is a **property** of the DNS A node;
- the DNS A node is related to an IPv4 because the IPv4 is a **property** of the DNS A node.

So, in Synapse to understand the relationship between an FQDN and the IPv4 it resolves to, you navigate (pivot) from the FQDN to the DNS A node to the IPv4 node using those nodes' shared property values.

This means that in Synapse, you are not limited to navigating the data using explicitly defined edges; you primarily navigate (**pivot**) among nodes with shared property values. Synapse can readily identify these shared values, which both simplifies navigation (Synapse can "show you" the relationships; you don't need to know them in advance) and help users discover novel relationships that you may not know existed.

Synapse uses mechanisms such as **type enforcement** to ensure that properties conform to their expected values (e.g., Synapse does its best to prevent you from entering an email address where you need a URL, and that any URL you enter looks reasonably like a URL) and **property normalization** to ensure property values are represented consistently

(e.g., in many cases Synapse converts string-based values to all lowercase for consistency). These methods make the data as consistent and "clean" as possible to facilitate navigation and discovery.

3.2 Data Model

Synapse's knowledge graph is built on a robust, extensible data model that can represent a broad range of data and relationships. The data model (and associated *Analytical Model*) allow both data and assertions to be represented in a structured, consistent manner. This means that instead of analysts needing to review prose reports to understand current state (and fuse those reports into still more prose to revise their assessments), analysts (and algorithms) can ask analytical questions directly of the data - and answer those questions quickly and easily.

Capturing data and analysis in a structured model abstracts away some of the subtleties and caveats that can be conveyed in prose, and finished reporting is still appropriate in many cases. But a **good** data model can represent enough information so that key objects, relationships, and assessments are well-defined, unambiguous, and self-evident upon examination.

This section provides background on the components of Synapse's data model and their use.

Tip

There are various ways to examine Synapse's data model in greater detail:

- Synapse Enterprise customers or users who have requested a Synapse demo instance and have access to the Synapse UI (Optic) can use the Data Model Explorer to view Synapse's forms and light edges and their relationships to each other. The Tag Explorer can be used to view the tags that exist in your instance of Synapse.
- Data model components such as types, forms, and properties are generated as runtime nodes ("runt nodes") when a Cortex is initialized and can be viewed as meta-objects within Synapse itself. See the *Storm Reference - Model Introspection* section for details.
- The data model is defined in the Synapse source code. The *Synapse Data Model* provides a technical reference of individual types and forms, and includes our data model deprecation policy.

3.2.1 Data Model Objects

To work effectively with Synapse and the Storm query language, you need to understand the basic elements of the Synapse data model.

Type

A **type** is the definition of a data element within the Synapse data model. A type describes what the element is and enforces how it should look, including how it should be normalized, if necessary, for both storage (including indexing) and representation (display).

Synapse's data model includes standard types such as integers and strings, but further defines a broad range of types such as globally unique identifiers (`guid`), date/time values (`time`), time intervals (`ival`), and tags (`syn:tag`).

Objects (nodes) may also be specialized types. For example, an IPv4 address (`inet:ipv4`) is its own type. An IPv4 address is stored as an integer, but the `inet:ipv4` type has additional constraints (e.g., to ensure that IPv4s created in Synapse only use integer values that fall within the allowable IPv4 address space). These constraints may be defined by a *Constructor* that specifies how a property of that type can be created (constructed) in Synapse.

Synapse uses *Type Enforcement*, *Type Normalization*, and *Type Awareness* to ensure consistency in the way data is entered, stored, and represented, and to facilitate navigation of the knowledge graph.

Type-Specific Behavior

Synapse includes optimizations for some types to improve performance and functionality. Some of these are "back end" optimizations (i.e., for indexing and storage) while some are more "front end" in terms of how users can interact with data. See *Storm Reference - Type-Specific Storm Behavior* for additional detail.

Form

A **form** is the definition of an object in the Synapse data model. A form acts as a "template" that tells you how to create a particular object (node). While the concepts of form and node are closely related, it is useful to maintain the distinction between the **template** for creating an object (a form) and an **instance** of a particular object (a node). `inet:fqdn` is a form; `inet:fqdn = vertex.link` is a node.

All forms must have a **primary property.** The primary property is the name of the form and the definition of the value to be provided for individual instances (nodes) of that form. The primary property must be defined so that it is unique across all possible instances of that form. For example, FQDNs are unique, based on the way they are defined and registered (two different organizations cannot both register the FQDN `vertex.link`). So the primary property value of an `inet:fqdn` is simply the FQDN itself.

All properties in Synapse must have a defined **type;** in many cases, a form is also its own type (for example, the form `inet:fqdn` has a type of `inet:fqdn`).

Forms may have **secondary properties** that record additional information about the form or further describe it. Secondary properties are form-specific. In most cases, secondary properties are explicitly defined for each form. If similar forms should share a subset of common properties, the properties may be defined as an **interface** that is **inherited** by those forms.

Synapse also supports a set of universal secondary properties (**universal properties**) that are valid for all forms.

Extended properties may be added to forms to store specialized or use case-specific data related to the form.

Form Namespace

Synapse uses a structured namespace for forms. Each form name consists of at least two elements separated by a colon (`:`). For example:

- `file:bytes`
- `inet:fqdn`
- `ou:org`
- `risk:threat`

The first element in the namespace represents a rough "category" for the form (i.e., `inet` for Internet-related objects). The Synapse data model is broad and extensible. The ability to group portions of the data model into related categories makes a large model easier to manage, and also allows Synapse users to focus on those portions of the model most relevant to them.

The second and / or subsequent elements in the form name define the specific "subcategory" or "thing" within the form's primary category (e.g., `inet:fqdn` represents a fully qualified domain name (FQDN) within the "Internet" (`inet`) category.

Properties have a namespace that extends the form namespace (form names are also primary properties). See *Property* and *Property Namespace* below for additional detail.

Extended Form

Synapse users can add their own **extended forms** to the data model using the *$lib.model.ext* libraries.

> **Note**
>
> We **strongly encourage** Synapse users who are considering extending the data model by creating custom forms to reach out to The Vertex Project first - you can readily contact us through our Slack channel. If there are gaps or missing elements in the data model, we would prefer to expand Synapse's data model for all users vs. individual users making numerous one-off customizations. If an extended form is appropriate for the use case, we can also offer feedback to help ensure the form's design is consistent with best practices.

Interface

An **interface** defines a set of secondary properties that should be present on a particular subset of forms. Instead of explicitly defining each secondary property on each form, the forms can be defined as **inheriting** a particular interface and its associated properties. This both simplifies and ensures consistency in the data model.

For example, Synapse uses several forms to represent activity occurring on a host, such as a file being added (`it:exec:file:add`) or a process being executed (`it:exec:proc`). These forms represent similar operations, so they all share a subset of secondary properties such as the time of execution (`:time`) or the file (`:exe`) or process (`:proc`) responsible for the activity. These properties are defined as an `it:host:activity` **interface** which is then declared / inherited for each form.

Interfaces can be inherited by other interfaces. For example, the `inet:proto:request` interface, which represents a client (host) requesting a network connection, inherits the `it:host:activity` interface.

Interfaces can be used in Storm lift, filter, and pivot operations to make it easier to work with nodes of all forms that share the interface (vs. specifying each kind of node separately). See the appropriate sections of the *Storm Reference* for details.

Node

A **node** is a unique object within Synapse; they are specific instances of generic forms. Every node consists of:

- A **primary property**, represented by the form of the node plus its value (`<form> = <valu>`). All primary properties must be unique for a given form; the uniqueness of the `<form> = <valu>` pair ensures there can be only one node in Synapse that represents the domain woot.com (`inet:fqdn = woot.com`). Because this unique pair "defines" the node, the comma-separated form / value combination (`<form>,<valu>`) is also known as the node's *Ndef* (short for "node definition").
- One or more **universal properties** and an associated property value. As the name implies, universal properties apply to all nodes.
- Optional **secondary properties**. Similar to primary properties, secondary properties consist of a property name (of a specific **type**) and the property's value (`<prop> = <pval>`).
- Optional **tags**. A tag acts as a label with a particular meaning that can be applied to a node to provide context.
- Optional **extended properties** and their associated values.

Node Example

The Storm query below lifts and displays the node for the domain `www.google.com`:

```
storm> inet:fqdn=www.google.com
inet:fqdn=www.google.com
```

(continues on next page)

(continued from previous page)

```
        :domain = google.com
        :host = www
        :issuffix = false
        :iszone = false
        :zone = google.com
        :_virustotal:reputation = 497
        :_virustotal:votes:harmless = 318
        :_virustotal:votes:malicious = 53
        .created = 2025/07/03 18:39:25.880
        #rep.moz.500
```

In the output above:

- `inet:fqdn = www.google.com` is the **primary property** (`<form> = <valu>`).
- `.created` is a **universal property** showing when the node was added to the Cortex.
- `:domain`, `:host`, etc. are form-specific **secondary properties** with their associated values (`<prop> = <pval>`). For readability, secondary properties (including universal properties and extended properties) are displayed as **relative properties** within the namespace of the form's primary property (e.g., `:domain` as opposed to `inet:fqdn:domain`).
- The various `:_virustotal:*` properties are **extended properties** added to the data model by the Synapse-VirusTotal Power-Up to represent specialized data provided by VirusTotal.
- `#rep.moz.500` is a **tag** indicating that `www.google.com` has been reported by web analytics company Moz as one of their top 500 most popular websites.

See *Kinds of Nodes* below for additional detail on how nodes are used to represent various objects in Synapse.

Property

Properties are the individual elements that define a **form** or (along with their values) that comprise a **node.** All properties in Synapse must have a defined **type**.

Primary Property

Every form consists of (at minimum) a **primary property:** the name of the form and the definition of the value to be provided for individual instances (nodes) of that form. All forms must be designed so that their primary property value is unique across all instances (nodes) of that form.

This uniqueness is straightforward for simple objects such as FQDNs or email addresses. Ensuring "uniqueness" for more complex nodes (such as those representing a *Relationship* or an *Event*) can be more challenging; these forms are often *GUID* forms.

Because a primary property uniquely defines a node, **it cannot be modified once the node is created.** To "change" a node's primary property value you must delete and re-create the node.

Secondary Property

A form can include optional **secondary properties** that provide additional detail about the form. Secondary properties are specific to a given form and further describe that form. A node may include secondary properties with their associated values (`<prop> = <pval>`).

Some secondary properties are based on (derived from) a node's primary property value. For example, an email address (`inet:email`) has secondary properties for both the associated FQDN (`inet:email:fqdn`) and username (`inet:email:user`). When you create the node `inet:email=info@vertex.link`, Synapse automatically sets the

associated secondary property values. Any secondary properties derived from a node's primary property are read-only (just like the primary property they are based on) and cannot be changed once set.

Any secondary properties **not** based on a node's primary property are **optional.** Their values can be set if the data is available and relevant to your use case; otherwise they can remain unset. For example, an IPv4 node (`inet:ipv4`) has an optional secondary property for its associated Autonomous System (AS) number (`inet:ipv4:asn`). All optional secondary property values can be set, modified, or removed as needed.

Universal Property

Synapse defines a subset of secondary properties as **universal properties** that are applicable to all forms:

- `.created`, which is set automatically by Synapse for all nodes and whose value is the date/time that the node was created within that instance of Synapse (Cortex).
- `.seen`, which is optional for all nodes and whose value is a time interval (minimum or "first seen" and maximum or "last seen") during which the node was observed, existed, or was valid.

Extended Property

Synapse supports the addition of specialized ("extended") properties outside of Synapse's baseline data model. Extended properties may be used to represent specialized data that is relevant for specific use cases and can be added using the *$lib.model.ext* libraries.

For example, third-party vendors that provide threat intelligence or cybersecurity data may include vendor assessments, such as "risk" or "reputation" scores. These values may only be "interesting" to security researchers, and are provided by a very specific data source. Instead of adding these specialized values to the baseline data model, extended properties can be added as needed to accommodate specialized needs.

Extended properties must start with an underscore (`:_<extended_property>`) to avoid name collisions with baseline data model properties (current or future). In addition, we recommend using the name of the vendor or data source (if appropriate) as the first element in the property namespace (e.g., `:_virustotal:reputation`).

> **Note**
>
> We **strongly encourage** Synapse users who are considering extending the data model by creating custom properties to reach out to The Vertex Project first - you can readily contact us through our Slack channel. If there are gaps or missing elements in the data model, we would prefer to expand Synapse's data model for all users vs. individual users making numerous one-off customizations. If an extended property is appropriate for the use case, we can also offer feedback to help ensure the property's design is consistent with best practices.

Property Namespace

Properties extend the *Form Namespace*. Form names are **primary properties**, and consist of at least two elements separated by a colon (`:`).

- **Secondary properties** exist within the namespace of their primary property (form). Secondary properties are preceded by a colon (`:`) and use the colon to separate additional namespace elements, if needed.
- **Universal properties** are preceded by a period (`.`) to distinguish them from form-specific secondary properties.
- **Extended properties** are preceded by a colon and an underscore (`:_`).

For example, the secondary (both universal and form-specific) properties of `inet:fqdn` include:

- `inet:fqdn.created` (universal property)
- `inet:fqdn:zone` (secondary property)

The VirusTotal Power-Up adds extended properties to various forms, including `inet:fqdn`:

- `inet:fqdn:_virustotal:reputation`

Secondary properties (including extended and universal properties) also make up a relative namespace (set of **relative properties**) with respect to their primary property (form). The Storm query language allows (or in some cases, requires) you to reference a property using its relative property name (i.e., `:zone` vs. `inet:fqdn:zone`).

Relative properties are also used for display purposes within Synapse for visual clarity (see the *Node Example* above).

Secondary properties (including extended properties) may have their own namespace. Both primary and secondary properties use colons to separate elements of the property name. However, not all separators represent property "boundaries"; some act more as "sub-namespace" separators.

For example `file:bytes` is a primary property / form. A `file:bytes` form may include secondary properties such as `:mime:pe:imphash` and `:mime:pe:compiled`. In these examples, `:mime` and `:mime:pe` are not secondary properties, but sub-namespaces for individual MIME data types and the "PE executable" data type specifically.

Tag

Tags are annotations applied to nodes. They can be thought of as labels that provide context to the data represented by the node.

Broadly speaking, within Synapse:

- Nodes represent **things:** objects, relationships, or events. In other words, nodes typically represent observables that are verifiable and largely unchanging.
- Tags typically represent **assessments:** observations that could change if the data or the analysis of the data changes.

For example:

- An Internet domain is an "observable thing" - a domain exists, was registered through a domain registrar, and can be created as a node such as `inet:fqdn = woot.com`.
- Whether a domain has been sinkholed is an assessment. A researcher may need to evaluate data related to that domain (such as domain registration records or current and past IP resolutions) to decide whether the domain appears to be sinkholed. This assessment can be represented by applying a tag such as `cno.infra.dns.sink.holed` to the `inet:fqdn = woot.com` node.

Tags can include *Tag Timestamps* and support the addition of *Tag Properties*.

Tags are unique within the Synapse model because tags are both **nodes** and **labels applied to nodes.** The tag `cno.infra.dns.sink.holed` can be applied to another node; but the tag itself also exists as the node `syn:tag = cno.infra.dns.sink.holed`. This difference is illustrated in the example below.

> **Tip**
>
> Synapse does not have any pre-defined tags. Users are free to create tags that are meaningful for their analysis. See *Analytical Model* for more detail.

Tag Example

The Storm query below displays the **node** for the tag `cno.infra.dns.sink.holed`:

```
storm> syn:tag=cno.infra.dns.sink.holed
syn:tag=cno.infra.dns.sink.holed
        :base = holed
```

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```
        :depth = 4
        :doc = A domain (zone) that has been sinkholed.
        :title = Sinkholed domain
        :up = cno.infra.dns.sink
        .created = 2025/07/03 18:39:25.904
```

The Storm query below displays the **tag** `cno.infra.dns.sink.holed` applied to the **node** `inet:fqdn = hugesoft.org`:

```
storm> inet:fqdn=hugesoft.org
inet:fqdn=hugesoft.org
        :domain = org
        :host = hugesoft
        :issuffix = false
        :iszone = true
        :zone = hugesoft.org
        .created = 2025/07/03 18:39:25.907
        #cno.infra.dns.sink.holed
```

Note that a tag **applied to a node** uses the "hashtag" symbol (`#`). This is a visual cue to distinguish tags on a node from the node's secondary properties. The symbol is also used within the Storm query language syntax to reference a tag as opposed to a `syn:tag` node.

Lightweight (Light) Edge

Lightweight (light) edges are used in Synapse to provide greater flexibility and improved performance when representing certain types of relationships. A light edge is similar to an edge in a traditional directed graph; each light edge links exactly two nodes (`n1` and `n2`), and consists of:

- A **direction.** Light edge relationships only "make sense" in one direction, given the forms that they link. For example, an article can reference an indicator such as an MD5 hash, but an MD5 hash does not "reference" an article.
- A **"verb"** that represents the relationship (e.g., `refs` for "references" in the example above).

Light edges do not have properties, and you cannot apply tags to light edges - hence the "light" in light edge.

Light edges are used for performance and flexibility in certain use cases. For example:

- When the **only** information you need to record about a relationship is that it exists (that is, no properties are required to further "describe" the relationship). An example is `meta:ruleset -(contains)> meta:rule`.
- When the objects (nodes) involved in the relationship may vary. That is, either the `n1` or `n2` node (or both) may be **any** kind of node, depending on the context of the relationship. Examples include `meta:source -(seen)> *` (where a data source may "see", observe, or provide data on any `n2` object) and `* -(refs)> *` (where a variety of `n1` nodes may "reference" or contain a reference to any `n2` node).
- When the objects (nodes) to be linked do not share any properties in common (i.e., that could allow the nodes to be implicity linked via a shared property value / pivot relationship).

Synapse's source code includes some pre-defined light edges that represent The Vertex Project's conventions. While we recommend the use of these conventions, we do not enforce their use. Synapse users are free to create / define their own light edges and use them as they see fit. (Note that Synapse Power-Ups provided by The Vertex Project will create light edges according to our conventions when ingesting data.)

> **Tip**
>
> Light edges should not be used as a convenience to short-circuit proper data modeling using forms. Using forms and nodes (combined with Synapse's strong typing, type enforcement, and type awareness) are key to the powerful analysis and performance capabilities of a Synapse hypergraph.

3.2.2 Kinds of Forms

Synapse forms can be broadly grouped based on how their **primary properties** (`<form> = <valu>`) are formed. Recall that primary properties must be defined so that they are unique for all possible instances of that form.

Simple Form

A simple form refers to a form whose primary property is a single value. Simple forms are commonly used to represent an *Object* and are the most readily understood from a modeling perspective. The "object itself" is unique by definition, so the form's primary property value is the object. Examples of simple forms include FQDNs, IP addresses (IPv4 or IPv6), hashes, and so on.

Composite (Comp) Form

A composite (comp) form is one where the primary property is a comma-separated list of two or more elements. While no single element makes the form unique, a set of elements may be sufficiently unique to define the form. Comp forms are often (though not universally) used to represent a *Relationship*.

Fused DNS A records are an example of a comp form. A DNS A record can be uniquely defined by the combination of the domain (`inet:fqdn`) and the IP address (`inet:ipv4`) in the A record. In Synapse, an `inet:dns:a` form represents the knowledge that a given domain resolved to a specific IP at some time, or within a time window. (The universal `.seen` property captures "when" (first observed / last observed) the resolution took place.)

Guid Form

A guid (Globally Unique Identifier) form is uniquely defined by a machine-generated 128-bit number. Guids account for cases where it is impossible to uniquely define a thing based on a property or set of properties. Guids are also useful for cases where the amount of data available to create a particular object (node) may vary greatly - that is, not all properties or details are available from all data sources. A guid form gives you the flexibility (through secondary properties) to capture as much (or as little) data as is available to you.

A guid form can be considered a special case of a **simple form** where the form's value is a `<guid>`.

Forms that represent one-time events are often guid forms. Examples include host execution activity (such as `it:exec:file:add` nodes) or network activity (such as `inet:dns:request` nodes). Guid forms are also used to represent entities such as people (`ps:person`) or organizations (`ou:org`).

> **Note**
>
> Guid values can be arbitrary (generated ad-hoc by Synapse) or predictable / deconflictable (generated based on a specific set of inputs). See the *guid* section of *Storm Reference - Type-Specific Storm Behavior* for a more detailed discussion of this concept.

Edge (Digraph) Form

An edge (digraph) form is a specialized **composite form** where the set of values for the primary property includes at least one **ndef** ("node definition, or `<form>,<valu>` pair). An edge form is a specialized relationship form that can be used when one or both of the forms to be linked could be an arbitrary (i.e., any) form. For example, a `meta:seen` node (now replaced by a `seen` light edge) was previously used to link a `meta:source` (using the node's guid value)

to an arbitrary node that was "seen" by the source (such as the domain "woot.com", using the ndef value `inet:fqdn, woot.com`).

Edge forms predate the introduction of light edges to the Synapse data model; light edges were added in order to address some of the performance overhead incurred by edge forms (i.e., it is easier and faster to create a light edge for simple relationships vs. creating an entire node simply to link two other nodes).

Edge forms may be appropriate for particular use cases, but light edges are generally preferred where possible.

Generic Form

The Synapse data model includes a number of "generic" forms that can be used to represent metadata and / or arbitrary data.

Synapse's data model can be expanded as needed, so ideally all data in Synapse would be represented using an appropriate form. However, designing a new form may require discussion, subject matter expertise, and testing against "real world" data, as well as time to implement the changes. Analysts may have a need to capture data "in the moment" without waiting for model updates. Alternatively, some data may be "one off" information that needs to be represented, but does not necessarily require its own form for a limited or unique use case.

In the above cases, generic forms may be used to capture data where a more specific form does not exist. Generic forms reside in two primary parts of the data model: `meta:*` forms and `graph:*` forms.

The `meta:rule` form is an example of a generic form. Synapse includes more specific forms to represent common detection logic such as antivirus (`it:av:sig` and `it:av:filehit`) or YARA rules (`it:app:yara:rule` and `it:app:yara:match`). Other technologies or organizations may have their own specific (and often "black box") detection logic.

A `meta:rule` form can represent an arbitrary detection rule, with a `-(matches)>` light edge used to link the rule to the "thing" (file, network traffic, etc.) that the rule fired on.

3.2.3 Kinds of Nodes

Nodes represent standard objects ("nouns") such as IP addresses, files, people, conferences, or airplanes. They can also represent more abstract objects such as industries, risks, attacks, or goals. However, in Synapse nodes can also represent relationships or specific time-based events. You can think of a node generically as a "thing" - most "things" you want to model within Synapse are nodes.

Broadly speaking, nodes can be thought of in terms of some generic categories:

Object

Nodes can represent atomic objects or entities, whether real or abstract. Entities are often (though not always) represented as a *Simple Form*. An email address (`inet:email`) is a basic example of an entity-type node / simple form:

```
storm> inet:email=kilkys@yandex.ru
inet:email=kilkys@yandex.ru
        :fqdn = yandex.ru
        :user = kilkys
        .created = 2025/07/03 18:39:25.914
```

Relationship

Nodes can represent specific **relationships** among entities. Examples include a domain resolving to an IPv4 address, a malware dropper containing or extracting another file, a company being a subsidiary of another business, or a person being a member of a group.

Relationship nodes are often represented as a *Composite (Comp) Form*. Comp forms have a primary property consisting of a comma-separated list of two or more values that uniquely define the relationship. A DNS A record (`inet:dns:a`) is a basic example of a relationship node:

```
storm> inet:dns:a=(google.com,172.217.9.142)
inet:dns:a=('google.com', '172.217.9.142')
        :fqdn = google.com
        :ipv4 = 172.217.9.142
        .created = 2025/07/03 18:39:25.919
```

Event

Nodes can represent individual time-based occurrences. The term **event** implies that an entity existed or a relationship occurred at a specific point in time. Events represent the combination of a node and a timestamp for when the node was observed. Examples of event forms include an individual login to an account, a specific DNS query, or a domain registration (whois) record captured on a specific date.

The structure of an event node may vary depending on the specific event being modeled. A "simple" event may be represented as a *Composite (Comp) Form* that combines an entity and a timestamp; for example, a domain whois record (`inet:whois:rec`) consists of the whois record and the time that record was observed or retrieved.

Other more complex events are represented as a *Guid Form* with the timestamp as one of several secondary properties on the form. A specific, individual DNS query (`inet:dns:request`) is an example of an event node:

```
storm> inet:dns:request=00000a17dbe261d10ce6ed514872bd37
inet:dns:request=00000a17dbe261d10ce6ed514872bd37
        :query = ('tcp://199.68.196.162', 'download.applemusic.itemdb.com', '1')
        :query:name = download.applemusic.itemdb.com
        :query:name:fqdn = download.applemusic.itemdb.com
        :query:type = 1
        :reply:code = NOERROR
        :server = tcp://178.62.239.55
        :time = 2018/09/30 16:01:27.506
        .created = 2025/07/03 18:39:25.924
```

Instance Knowledge vs. Fused Knowledge

For some types of data, event nodes and relationship nodes can encode similar information but represent the difference between **instance knowledge** and **fused knowledge.**

- Event forms represent the specific point-in-time existence of an entity or occurrence of a relationship - an **instance** of that knowledge.
- Relationship forms can leverage the universal `.seen` property to set "first observed" and "last observed" times during which an entity existed or a relationship was true. This date range can be viewed as **fused** knowledge - knowledge that summarizes or "fuses" the data from many individual observations (instances) of the node over time.

Instance knowledge and fused knowledge represent differences in data granularity. Whether to create an event node or a relationship node (or both) depends on how much detail is required for your analysis. This consideration often applies to relationships that change over time, particularly those that may change frequently.

DNS records are a good example of these differences. The IP address that a domain resolves to may change infrequently (e.g., for a website hosted on a stable server) or may change quite often (e.g., where the IP is dynamically assigned or where load balancing is used).

One option to represent and track DNS A records is to create individual events every time you check the domain's current resolution (e.g., `inet:dns:request` and `inet:dns:answer` forms). This represents a very high degree of

granularity as the nodes will record the exact time a domain resolved to a given IP. The nodes can also capture additional detail such as the querying client, the responding server, the response code, and so on. However, the number of such nodes could readily reach into the hundreds of millions if you create nodes for every resolution of every domain you want to track.

On the other hand, it may be sufficient to know that a domain resolved to an IP address during a given **period** of time – a "first observed" and "last observed" (`.seen`) range. A single `inet:dns:a` node can be created to show that domain `woot.com` resolved to IP address `1.2.3.4`, where the earliest observed resolution was 2014/08/06 at 13:56 and the most recently observed resolution was 2018/05/29 at 7:32. These timestamps can be extended (earlier or later) if additional data changes our observation boundaries.

This second approach loses some granularity:

- The domain is not guaranteed to have resolved to that IP **continuously** throughout the entire time period.
- Given only this node, we don't know **exactly** when the domain resolved to the IP address during that time period, except for the earliest and most recent observations.

However, this fused knowledge may be sufficient for our needs and may be preferable to creating thousands of nodes for individual DNS resolutions.

Of course, a hybrid approach is also possible, where most DNS A record data is recorded in fused `inet:dns:a` nodes but it is also possible to record high-resolution, point-in-time `inet:dns:request` and `inet:dns:answer` nodes when needed.

3.3 Analytical Model

Synapse's *Data Model* provides a structured way to record, query, and navigate "observables" - objects, relationships, and events that can be captured and are unlikely to change.

Synapse also gives analysts a structured way to record observations or assessments through the use of labels (**tags**) applied to data (nodes). Assessments represent conclusions based on the data available to you at the time. As new data becomes available, your analysis is revised. As labels on nodes, tags are flexible and can be easily added, updated, or removed when assessments change.

Tags provide immediate **context** to individual nodes. In addition, by representing both data (nodes) and assessments (tags) consistently, analysts can use Synapse to query both of these in very powerful ways.

Synapse uses the `syn:tag` form to represent tags, which is simple and straightforward. The appropriate **use** of tags to annotate data is more nuanced. You can think of tags - their structure and application - as an **analytical model** that complements and extends the power of the data model.

The annotations and assessments that are "useful" for analysis may vary widely based on the analytical discipline in question, or even the needs of individual organizations within the same discipline. For this reason, Synapse does not include any "built in" tags. Organizations are free to design and use tags and tag trees that are most useful and relevant to them.

Tip

We encourage the design and use of tags that:

- annotate assessments and conclusions that are relevant to **your** analysis.
- allow you to ask the analytical questions that are most important to **your organization.**

While many disciplines will have similar tagging needs, tags are not necessarily "one size fits all". For an example of tags/tag trees used by The Vertex Project, see our Vertex Tag Tree Overview blog.

This section discusses tags, their unique features, and their uses in more detail.

3.3.1 Tags as Nodes

Tags in Synapse are nodes (`syn:tag` nodes) in their own right. As nodes, they can be viewed directly within Synapse, making them "self-documenting" (see *Storm Reference - Model Introspection* or Optic's Tag Explorer for details on viewing and working with tags).

A tag's primary property is the name of the tag; so the tag `foo.bar` has the primary property `syn:tag = foo.bar`. The dotted notation can be used to construct tag hierarchies / tag trees to organize tags and represent varying levels of specificity. Other `syn:tag` properties allow you to record a definition for the tag and support navigation tag nodes.

This example shows the **node** for the tag `syn:tag = rep.mandiant.apt1`:

```
storm> syn:tag=rep.mandiant.apt1
syn:tag=rep.mandiant.apt1
        :base = apt1
        :depth = 2
        :doc = Indicator or activity Mandiant calls (or associates with) APT1.
        :title = APT1 (Mandiant)
        :up = rep.mandiant
        .created = 2025/07/03 18:39:21.309
```

The `syn:tag` node has the following properties:

- `.created`, which is a universal property showing when the node was added to a Cortex.
- `:title` and `:doc`, which store concise and more detailed definitions for the tag. Definitions on tag nodes help to ensure the tags are applied (and interpreted) correctly by Synapse analysts and other users.

The `:depth`, `:up`, and `:base` secondary properties help to lift and pivot across tag nodes:

- `:depth` is the "location" of the tag in a given tag tree, with the count starting from zero. A single-element tag (`syn:tag = rep`) has `:depth = 0`, while a three-element tag (`syn:tag = rep.mandiant.apt1`) has `:depth = 2`.
- `:base` is the final (rightmost) element in the tag tree.
- `:up` is the tag one "level" up in the tag tree.

Tags (`syn:tag` forms) have some specialized behaviors within Synapse with respect to how they are indexed, created, and manipulated via Storm. Most important for practical purposes is that `syn:tag` nodes are created "on the fly" when a tag is applied to another node. You do not need to create the `syn:tag` node before the tag can be used; applying the tag will automatically create the appropriate `syn:tag` node (or nodes).

See the *syn:tag* section within *Storm Reference - Type-Specific Storm Behavior* for additional detail.

3.3.2 Tags as Labels

A tag's value (`syn:tag = <valu>`) is simply a string and can be set to any user-defined alphanumeric value. Tags do not support special characters except for the underscore (_).

Tag strings use a dotted naming convention, with the period (.) used as a separator to delimit individual elements of a tag if necessary. This dotted notation supports the creation of tag hierarchies or tag trees. These trees can be used to "categorize" different types of tags (with each top-level or root tag representing a particular category). The structure can also support increasingly detailed or specific observations.

Within a tag tree, specific terms are used for the tags and their components:

- **Leaf tag:** The full tag.
- **Root tag:** The top / leftmost element in a given tag.
- **Base tag:** The bottom / rightmost element in a given tag.

For the tag rep.microsoft.forest_blizzard:

- rep.microsoft.forest_blizzard is the leaf tag (leaf).
- rep is the root tag (root).
- forest_blizzard is the base tag (base).

When you apply a tag to a node, all of the tags **above** that tag in the tag tree are automatically applied as well (and the appropriate syn:tag nodes are created if they do not exist). That is, when you apply the tag rep.microsoft.forest_blizzard to a node, Synapse automatically applies the tags rep.microsoft and rep as well. This allows you to "ask" about tags at any depth:

- #rep.microsoft.forest_blizzard: all things Microsoft associates with "Forest Blizzard".
- #rep.microsoft: all things reported by Microsoft.
- #rep: all things reported by any third party.

When you delete (remove) a tag from a node, the tag and all tags **below** it in the tag tree are deleted. If a node has the tag rep.microsoft.forest_blizzard:

- if you delete the tag rep.microsoft.forest_blizzard (the base tag), the tags rep.microsoft and rep will remain.
- if you delete the tag rep (the root or full tag) then all three tags are deleted.

Deleting a tag from a node does **not** delete the syn:tag node for the tag itself.

See the *syn:tag* section within *Storm Reference - Type-Specific Storm Behavior* for additional detail on tags and tag behavior.

Tag Timestamps

Synapse supports the use of optional tag **timestamps** to indicate that the assessment represented by a tag was true, relevant, or observed within the specified time window. Tag timestamps are intervals (pairs of date / time values) similar to the .seen universal property.

Like .seen properties, tag timestamps represent a time **range** and not necessarily specific instances (other than the "first known" and "last known" observations). This means that the assessment represented by the tag is not guaranteed to have been true throughout the entire date range (though depending on the meaning of the tag, that may be the case). That said, the use of timestamps allows much greater granularity in recording observations in cases where the timing of an assessment ("when" something was true or applicable) is relevant.

As an example, tag timestamps can be used to indicate when an IPv4 address was used as a TOR exit node. This knowledge can aid with both current and historical analysis of network infrastructure.

```
storm> inet:ipv4 = 185.29.8.215
inet:ipv4=185.29.8.215
        :asn = 60567
        :loc = se.ab.stockholm
        :type = unicast
        .created = 2025/07/03 18:39:21.353
        #cno.infra.anon.tor.exit = (2023/05/08 14:30:51.000, 2023/08/17 19:39:48.000)
```

The tag cno.infra.anon.tor.exit indicates that the IPv4 has been used as a TOR exit; the dates associated with the tag indicate the "first seen" and "last seen" times.

Tag Properties

Synapse supports the creation and use of custom **tag properties** that can provide additional context to a given tag or set of tags. Tag properties must be created programmatically before they can be used.

Once a tag property is created, it can be applied (appended) to **any** tag; they are not restricted to particular tags. Tag properties are best suited for use cases that would be applicable to **all** (or at least most) tags in your environment. A better option in many cases is the creation of **extended model properties** to represent this additional information.

For example, a third-party data vendor might provide a custom "risk" score associated with an indicator such as an FQDN. While this could be added as a custom `:risk` tag property (`#rep.somevendor:risk=80`), the `:risk` property would then be available for use with any / all tags in the environment, which may not be applicable.

Instead, an extended property can be added to the data model and the "risk" score recorded as a property on the FQDN:

`inet:fqdn:_somevendor:risk=80`

This limits the use of the vendor's "risk" score to only those forms / nodes where it is relevant, and also allows you to work with (select/lift, filter, pivot, etc.) the value the same way as any other property in the data model.

A discussion of extended model elements (forms, properties, etc.) is beyond the scope of this document. Storm libraries for working with extended model elements can be found here: *$lib.model.ext*.

3.3.3 Tags Associated with Nodes

Tags can represent observations or assessments. In some cases tags can stand on their own - the tag `cno.infra.anon.tor.exit` used to indicate that a node (such as an IPv4 address) represents anonymous network infrastructure (specifically, a TOR exit node) is straightforward. In other cases, a tag may represent or "say something" about a larger concept. The tag `rep.mandiant.apt1` means that Mandiant associates an indicator (such as a malware binary) with the threat group APT1. This provides context to the malware binary, but may create additional questions. Who or what is APT1? Where are they located? When did Mandiant first observe them?

Where a tag references a "thing" and you want to record additional information about that thing, the tag can be associated with a node (via a `:tag` secondary property). For example `risk:threat` nodes represent reporting of threat activity by a particular organization (such as Mandiant). The node's `risk:threat:tag` property can be set to `rep.mandiant.apt1`. You can then navigate from nodes that have the `rep.mandiant.apt1` tag, to the node `syn:tag=rep.mandiant.apt1`, to the `risk:threat` node with that `:tag` value to learn more about Mandiant's APT1.

> **Tip**
>
> An alternative method (which predates the use of `:tag` properties for certain nodes) is a "tag the tags" approach. If you wanted to record additional information "about" Mandiant's APT1, you could apply additional tags to the `syn:tag=rep.mandiant.apt1` node itself. For example, to indicate "Mandiant states APT1 is based in China", you could apply a tag such as `rep.mandiant.origin.cn` to the node `syn:tag=rep.mandiant.apt1`.
>
> This approach is valid for some use cases and may seem easier to implement than associating tags with nodes. However, "tag the tags" typically provides less power and flexiblity (to record information and navigate associated data) in favor of convenience. The pros and cons of each approach should be weighed when making implementation decisions.

3.3.4 Tag Best Practices

The tags that you use to annotate data represent your **analytical model**. Your ability to conduct meaningful analysis depends in part on whether your analytical model is well-designed to meet your needs. The tags that work best for you may be different from those that work well for another organization.

The following recommendations should be considered when creating, maintaining, and using tags and tag trees.

Tag Trees

Tag trees generally move from "less specific" to "more specific" the deeper you go within a hierarchy. The order of elements in your hierarchy can affect the types of analysis questions you can most easily answer. The structure you create should allow you to increase specificity in a way that is meaningful to the questions you're trying to answer.

For example, let's say you are storing copies of articles from various news feeds within Synapse (i.e., as `media:news` nodes). You want to use tags to annotate the subject matter of the articles. Two possible options would be:

Tag Tree #1

```
<country>.<topic>.<subtopic>.<subtopic>:
  us.economics.trade.gdp
  us.economics.trade.deficit
  us.economics.banking.lending
  us.economics.banking.regulatory
  us.politics.elections.national
  france.politics.elections.national
  france.politics.elections.local
  china.economics.banking.lending
```

Tag Tree #2

```
<topic>.<subtopic>.<subtopic>.<country>:
  economics.trade.gdp.us
  economics.trade.deficit.us
  economics.banking.lending.us
  economics.banking.regulatory.us
  politics.elections.national.us
  politics.elections.national.france
  politics.elections.local.france
  economics.banking.lending.china
```

Neither tag tree is right or wrong; which is more suitable depends on the types of questions you want to answer. If your analysis focuses primarily on news content within a particular region, the first option (which places "country" at the root of the tree) is probably more suitable. If your analysis focuses more on global geopolitical topics, the second option is probably better. As a general rule, the analytical focus that you "care about most" should generally go at the top of the hierarchy in order to make it easier to ask those questions.

Tag Elements

Each positional element within a tag tree should have the same "category" or meaning. This makes it easier to work with portions of the tag tree in a consistent manner. For example, if you are tagging indicators of compromise with assessments related to third-party reporting, you should maintain a consistent structure:

`rep.<reporter>.<thing reported>`

In this example `rep` is a top-level namespace for third party reporting, the second element refers to the reporter, and the third element to what is being reported (threat, malware family, campaign, etc.).

Tag Precision

A tag should represent "one thing" - an atomic assessment. This makes it easier to change that specific assessment without impacting other assessments. For example, let's say you assess that an IPv4 address was used by the Vicious Wombat threat group as a C2 location for Redtree malware. It might be tempting to create a tag such as:

`cno.threat.vicious_wombat.redtree.c2`

By combining three assessments (who used the IPv4, the malware associated with the IPv4, and how the IPv4 was used) you have made it much more difficult to update the context on the IP if any one of those three assessments changes. What if you realize the IPv4 was used by Sparkling Unicorn instead? Or that the IPv4 was used for data exfiltration and not C2? Using three separate tags makes it much easier to revise your assessments if necessary:

- `cno.threat.vicious_wombat.use`
- `cno.mal.redtree`
- `cno.role.c2`

Tag Definitions

You can store both short-form and long-form definitions directly on `syn:tag` nodes using the `:title` and `:doc` properties, respectively. We recommend that you use these properties to clearly define the meaning of the tags you create within Synapse to ensure they are both applied and interpreted consistently.

Tag Depth

Tag trees can be arbitrarily deep (that is, can support an arbitrary number of tag elements). This implies that deep tag trees can potentially represent very fine-grained observations. While more detail is sometimes helpful, tag trees should reflect the level of detail that is **relevant** for your analysis, and no more. Overly-detailed tag trees can actually hamper analysis by providing too many choices for analysts.

Tags that represent analytical assertions mean that **a human analyst** typically needs to evaluate the data, make an assessment, and decide what tag (or tags) to apply to the data. If tags are overly detailed analysts may get bogged down in "analysis paralysis" - worrying about whether tag A or tag B is correct when that distinction really doesn't matter to the analysis at hand.

We recommend that tags have no more than five elements at most. As always, your specific use case may vary but this works well as general guidance.

Tag Rollout

Tagging data may represent a novel approach to analysis for many users. As analysts adjust to new workflows, it may be helpful to implement a subset of tags at first. Getting used to applying some basic tags may be easier than suddenly being asked to annotate data with a broad range of observations. As analysts get comfortable with the process, you can introduce additional tags or tag trees as appropriate.

Tag Flexibility

Tags are meant to be flexible - the ability to easily add, remove, and modify tags is a built-in aspect of Synapse. Synapse also includes tools to help move, migrate, or restructure entire tag trees (e.g., the Storm *movetag* command).

No one designs a complete, perfect tag structure from the start. It is common to design an initial tag tree and then make changes once you have tested it in practice. Your tag trees will grow over time as analysts identify new observations they want to record. Your analytical needs may change, requiring you to reorganize multiple trees.

This is fine (and expected)! **Don't be afraid to try things or change your mind.** In most cases, bulk changes and migrations can be made using Storm.

Tag Management

Any user with the appropriate permissions can create a new tag. The ability to create tags on the fly makes tags extremely flexible and convenient for analysts – they can create annotations to reflect their observations "in the moment" without the need to wait for code changes or approval cycles.

There is also some risk to this approach, particularly with large numbers of analysts, as analysts may create tags in an uncoordinated and haphazard fashion. Creating arbitrary (and potentially duplicative or contradictory) tags can work against effective analysis.

Your approach to tag creation and approval will depend on your needs and your environment. Where possible, we recommend a middle ground between "tag free-for-all" and "tightly-enforced change management". It is useful for an analyst to create a tag on demand; if they have to wait for review and approval, their observation is likely to be lost as they move on to other tasks. That said, it is also helpful to have some type of regular review process to ensure the tags are being used in a consistent manner, fit appropriately into your analytical model, and have been given clear definitions.

Official vs. "Scratch" Tags

Not all tags and tag trees need to be formally defined and approved. Many organizations define an official set of tag trees that are approved for "production" use and also define (or allow) analysts to use unofficial, personal, or "scratch" tags as needed to help with ongoing research. "Unofficial" tags should use their own namespace (for example, "int" for internal, "temp" for temporary, or "thesilence" for users' personal trees) to clearly separate them from official tags / trees but are otherwise encouraged (and highly useful).

Tag Consistency

No matter how well-designed a tag tree is, it is ineffective if the tags aren't used consistently – that is, by a majority of analysts across a majority of relevant data. It's true that 100% visibility into a given data set and 100% analyst review and annotation of that data is an unrealistic goal. However, for data and annotations that represent your **most pressing** analytical questions, you should strive for as much completeness as possible.

Looked at another way, inconsistent use of tags can result in gaps that can skew your assessment of the data. At best, this can lead to the inability to draw meaningful conclusions; at worst, to faulty analysis.

Inconsistency often occurs as both the number of analysts and the number of tags increase. The larger the team of analysts, the more difficult it is for that team to work closely and consistently together. Similarly, the more tags available to represent different assessments, the fewer tags an analyst can reasonably work with. In both cases, analysts may tend to drift towards analytical tasks that are most immediately relevant to their work or most interesting to them – thus losing sight of the collective analytical goals of the entire team.

Consider an example of tracking Internet domains that masquerade as legitimate companies for malicious purposes. If some analysts are annotating this data but others are not, your ability to answer questions about this data is skewed. Let's say Threat Cluster 12 is associated with 200 domains, and 173 of them imitate real companies, but only 42 have been annotated with "masquerade" tags (e.g., `cno.ttp.se.masq`).

If you try to use the data to answer the question "does Threat Cluster 12 consistently register domains that imitate valid companies?", your assessment is likely to be "no" (only 42 out of 200 domains have the associated tag) based on the incompletely annotated data. There are gaps in your analysis because the information to answer this question has only been partially recorded.

As the scope of analysis within Synapse increases, it is essential to recognize these gaps as a potential shortcoming that may need to be addressed. Options include:

- Establish policy around which assessments and observations (and associated tags) are essential or "required", and which are secondary ("optional" or "as time allows").
- Designate individual analysts or teams to be responsible for particular tasks and associated tags - often matching their area of expertise, such as "malware analysis".
- Leverage Synapse's tools such as triggers, cron jobs, or macros to apply tags in cases where this can be automated. Automation also helps to ensure tags are applied consistently. (See *Storm Reference - Automation* for a more detailed discussion of Synapse's automation tools.)

3.4 Views and Layers

Synapse's architecture supports the separation of data into different storage areas known as **layers.** Layers can be "stacked" to give users visibility into various combinations of data using **views.**

Views and layers are closely related to Synapse's *Fork and Merge* workflow. This section provides some high-level background on these concepts. For additional discussion of views and layers (incuding examples), see our blog on Best Practices for Views & Layers.

> **Tip**
>
> Views and layers are also closely tied to Synapse's **permissions** system, used to manage which users (or roles) can see (read) and edit (create, modify, delete) data. We touch on some high-level permissions concepts here, but for a full discussion see the *Synapse Admin Guide*.

3.4.1 Layers

A *Layer* is where nodes and node data are stored, where changes to Synapse's data store are made, and where **write permissions** are enforced. By default, a Synapse Cortex consists of a single layer (the **default** layer).

Layers can be used to segregate different types of data. For example:

- **Sensitive vs. non-sensitive data.** Organizations may work with data that has varying levels of sensitivity. This may include data at different "classification" levels (such as CISA's Traffic Light Protocol) or data that is subject to legal, regulatory, or business restrictions (customer data, personally identifiable information) vs. data that is considered public knowledge.
- **Vetted vs. non-vetted data.** Some organizations may publish reporting or otherwise make data in Synapse available to customers, partners, or other internal teams. This shared data is typically closely reviewed for accuracy and reliability, which may differ from "internal" data that represents ongoing research or work-in-progress.

Layers are where data is **written** in Synapse; you create nodes, modify properties, and add or remove tags in a specific layer. Changes are typically made to the **top** layer of your current **view.**

Layers are typically configured and managed by Synapse Admins. The Storm *layer* commands are used to work with layers, as are the *layer* type and its methods, and the *$lib.layer* libraries. The Optic UI provides additional GUI-based tools to view and work with layers.

3.4.2 Views

A *View* defines the data (specifically, the layer or layers) that users can see; views are where **read permissions** are enforced. In Synapse, a view consists of an ordered ("stacked") set of layers and provides visibility into the combined data from those layers. The topmost layer in the view is writeable and where any changes are made.

A default installation of Synapse consists of a single view (the **default** view) which contains the default layer; this setup may be sufficient for many use cases.

In more complex environments, you can define different views (composed of different layers) to provide different groups of analysts or other users with varying access to Synapse's data. For example:

- the SOC analyst team's view may consist of a layer with a subset of vetted data;
- the threat intel team's view may include the vetted layer and a layer for their ongoing analysis; and
- the incident response team's view may include the vetted data, the analysis data (so they can leverage it for their IR activity), and a separate layer for potentially sensitive customer data related to their investigation.

> **Tip**
>
> A view contains the layer(s) users can see. Visibility into a view's data is all or nothing; it is not possible to let users see "only certain nodes" or "only nodes with this tag" within a given view.

The Storm *view* commands are used to work with views, along with the *view* type and its methods and the *$lib.view* libraries. The Optic UI provides additional GUI-based tools for working with views.

3.4.3 Fork and Merge

Fork a View

Synapse includes the ability to *Fork* an existing view. When you fork a view, you create a new view with a new, empty, writeable layer on top of the layer(s) from the original (parent) view. The original layer(s) and associated data become read-only; any changes that you make in the new view (creating nodes, modifying properties, adding tags, etc.) are made to the new topmost layer.

Forked views are used for:

- Easily creating a new view that contains all of the existing layers from the original (parent) view (that is, you do not need to fully construct the new view from scratch).
- Creating a "scratch space" on top of an existing "production" view.

Forking a view allows you to make changes without affecting the underlying data. Any changes can be reviewed and either committed (**merged**) into the underlying (original) view or discarded. This makes forked views ideal for a number of purposes:

- analysts can perform exploratory research, testing an approach or hypothesis without affecting "production" data.
- junior analysts undergoing training can do their work in a space where it can be reviewed by a senior analyst for feedback before committing their work to production.
- developers can test new code or automation without affecting live data.

The Storm *view.fork* command is used to fork a view. The Optic UI includes additional GUI-based tools to work with (and fork) views, including the View Selector and View Task Bar as well as the Admin Tool.

> **Tip**
>
> The user who forks a view has **admin** privileges for that view (and its topmost, writeable layer). This means that users who fork a view can "do anything" within that view. However, they may be prevented from **merging** some or all of those changes, based on the write permissions associated with the underlying layer. See the *Synapse Admin Guide* for a detailed discussion of permissions, including the example provided for *Case 4 - Place guardrails around writing (creating or merging) data*.
>
> In addition, the user who forks a view is the only one with access to the view by default. To collaborate with others within the view or to have someone review your work, you need to grant permissions to individual users (or a role or roles). See the *Synapse Admin Guide* for details on assigning permissions, or the Optic User Guide for information on granting permissions in the Optic UI.

Merge a View

Changes made in a forked view can be merged into the underlying view (in whole or in part). Alternatively, the forked view can be deleted, discarding all unmerged changes. This gives you the flexibility to:

- incrementally merge subsets of data while you continue your research;

- review and merge some (or all) of your changes when your work in the view is complete;
- optionally delete the view after merging some or all of your data;
- completely delete and discard views (and data) used for testing or that contain errors (such as if you accidentally tag 100,000 nodes or retrieve passive DNS data for IPv4 127.0.0.1).

Reviewing Changes

The Storm *diff* command can be used in both the Synapse CLI and the Optic Storm Query Bar and provides a flexible way to review some or all changes using the command's options. The **diff icon** in the Optic View Task Bar provides an alternative way to view changes.

Merging Changes

The Storm *view.merge* command can be used to merge **all** changes and optionally delete the view. In Optic, the **merge icon** in the View Task Bar will merge **all** changes and automatically delete the view.

The Storm *merge* command provides greater flexibility to view and merge data, including:

- show what **would** be merged without actually merging;
- merge all data;
- merge a subset of data based on a range of filters and selection criteria (in conjunction with the *diff* command).

The *merge* command does not delete the forked view.

Deleting a Forked View

Some merge methods in the Optic UI can automatically or optionally delete the associated view after merging (see above). This only applies to forked views. Views constructed from an arbitrary list of layers (i.e., without a parent view) do not support merging from the UI.

The **delete icon** in the Optic View Task Bar will delete a forked view and, if possible, also delete the associated layer limited to the forked view. The Optic Admin Tool can also be used to manage views.

The Storm *view.del* command can be used to delete a forked view. However, this command does not delete the associated topmost layer; if you want to remove the layer as well, you must run the *layer.del* command separately.

> **Note**
>
> Deleting a layer will delete all unmerged changes stored in that layer.

3.4.4 Best Practices

- Use dedicated layers to segregate any data that should be visible to some users but not others.
- Use views to compose the sets of data (layers) that should be visible to particular users or groups.
- We **strongly encourage** forking views for all research, analysis, and testing, no matter how trivial or incidental. This applies equally to simple (one layer / one view) Cortexes as well as those with more complex view and layer architectures. In short, **do not work directly in your production data.** It is much easier to delete a forked view (or selectively merge "good" data and discard mistakes) than it is to undo errors in production.
- Consider your organization's strategy for reviewing and merging data. Depending on how you are using forked views (training, research, testing) determine what level of review, if any, is desired (or required) before merging data. Consider whether any procedures will be enforced by agreement/consensus or the use of permissions.

- Forked views provide "scratch space" for ongoing analysis, but can also create silos of data and analysis that are inaccessible to other analysts or groups. We encourage you to develop guidance around "what" should be merged and how often in order to balance the need to more fully develop research with the desire to share data that is beneficial to other users.

  For example, analysts may enrich IOCs by pulling data from third party sources into Synapse. They may then review existing and new data to identify malware families or TTPs, or to cluster threat activity. Tags representing their assessments may be preliminary; in the meantime, the nodes created from third party data could be useful to others on their team. The *merge* command could be used to merge new or updated nodes without merging any tags while analysis continues.

3.5 Tools

3.5.1 storm

The Synapse Storm tool (commonly referred to as the **Storm CLI**) is a text-based interpreter that leverages the Storm query language (see *Storm Reference - Introduction*).

- *Connecting to a Cortex with the Storm CLI*
- *Storm CLI Basics*
- *Accessing External Commands*

Connecting to a Cortex with the Storm CLI

To access the Storm CLI you must use the `storm` module to connect to a local or remote Synapse Cortex.

> **Note**
>
> If you're just getting started with Synapse, you can use the Synapse Quickstart to quickly set up and connect to a local Cortex using the Storm CLI.

To connect to a local or remote Synapse Cortex using the Storm CLI, simply run the Synapse `storm` module by executing the following Python command from a terminal window, where the *<url>* parameter is the URL path to the Synapse Cortex.

```
python -m synapse.tools.storm <url>
```

The URL has the following format:

```
<scheme>://<server>:<port>/<cortex>
```

or

```
<scheme>://<user>:<password>@<server>:<port>/<cortex>
```

if authentication is used.

Example URL paths:

- `cell://vertex/storage` (default if using Synapse Quickstart)
- `tcp://synapse.woot.com:1234/cortex01`
- `ssl://synapse.woot.com:1234/cortex01`

Once connected, you will be presented with the following Storm CLI command prompt:

```
storm>
```

Storm CLI Basics

Once connected to a Synapse Cortex with the Storm CLI, you can execute any Storm queries or Storm commands directly. Detailed information on using the Storm query language to interact with data in a Synapse Cortex can be found in the *Storm Reference*.

To view a list of available **Storm commands,** type `help` from the Storm CLI prompt:

```
storm> help
```

- Detailed help for any command can be viewed by entering `-h` or `--help` after the individual command.
- For additional detail on Storm commands, see *Storm Reference - Storm Commands*.

To exit the Storm CLI, enter `!quit`:

```
storm> !quit
```

- The `!quit` command is technically an "external" (to Storm) command, so must be preceded by the bang (exclamation point) symbol.

Accessing External Commands

You can access a subset of external Synapse tools and commands from within the Storm CLI. External commands differ from native Storm commands in that they are preceded by a bang / exclamation point (`!`) symbol.

You can view the available **external commands** by typing `!help` from the Storm CLI prompt:

```
storm> !help
!export   - Export the results of a storm query into a nodes file.
!help     - List interpreter extended commands and display help output.
!pullfile - Download a file by sha256 and store it locally.
!pushfile - Upload a file and create a file:bytes node.
!quit     - Quit the current command line interpreter.
!runfile  - Run a local storm file.
```

Notably, the Synapse `pushfile` and `pullfile` tools (used to upload and download files from a Synapse storage *Axon*) are accessible from the Storm CLI:

```
storm> !pushfile
```

```
storm> !pullfile
```

See *pushfile* and *pullfile* for additional detail on these tools.

Help for any external command can be viewed by entering `-h` or `--help` after the command:

```
storm> !export -h
```

```
storm> !export --help
```

3.5.2 pushfile

The Synapse `pushfile` command can be used to upload files to a storage Axon (see Axon in the *Synapse Devops Guide*) and optionally create an associated *file:bytes* node in a Cortex.

Large-scale file ingest / upload is best performed using an automated feed / module / API. However, `pushfile` can be useful for uploading one-off files.

Syntax

`pushfile` is executed from an operating system command shell. The command usage is as follows:

```
usage: synapse.tools.pushfile [-h] -a AXON [-c CORTEX] [-r] [-t TAGS] filenames␣
↪[filenames ...]
```

Where:

- `AXON` is the telepath URL to a storage Axon.
- `CORTEX` is the optional path to a Cortex where a corresponding `file:bytes` node should be created.
  - **Note:** while this is an optional parameter, it doesn't make much sense to store a file in an Axon that can't be referenced from within a Cortex.
- `TAGS` is an optional list of tags to be applied to the `file:bytes` node created in the Cortex.
  - `-t` takes a comma separated list of tags.
  - The tag should be specified by name only (i.e., without the `#` character).
- `-r` recursively finds all files when a glob pattern is used for a file name.
- `filenames` is one or more names (with optional paths), or glob patterns, to the local file(s) to be uploaded.
  - If multiple file names are specified, any tag provided with the `-t` option will be added to **each** uploaded file.

Example

Upload the file `myreport.pdf` to the specified Axon, create a `file:bytes` node in the specified Cortex, and tag the `file:bytes` node with the tag `#sometag` (replace the Axon and Cortex path below with the path to your Cortex. Note that the command is wrapped for readability):

```
python -m synapse.tools.pushfile -a aha://axon... -c aha://cortex... -t sometag /home/
↪user/reports/myreport.pdf
```

Executing the command will result in various status messages (lines are wrapped for readability):

```
2019-07-03 11:46:30,567 [INFO] log level set to DEBUG
  [common.py:setlogging:MainThread:MainProcess]
2019-07-03 11:46:30,568 [DEBUG] Using selector: EpollSelector
  [selector_events.py:__init__:MainThread:MainProcess]

adding tags: ['sometag']
Uploaded [myreport.pdf] to axon
file: myreport.pdf (2606351) added to core
  (sha256:229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0) as myreport.
↪pdf
```

- `adding tags: ['sometag']` indicates the tag `#sometag` was applied to the `file:bytes` node.
- `Uploaded [myreport.pdf] to axon` indicates the file was successfully uploaded to the storage Axon.
- `file: myreport.pdf (2606351) added to core (sha256:229cdde4...5cd40ab0) as myreport.pdf` indicates the `file:bytes` node was created in the Cortex.
  - The message gives the new node's primary property value (`sha256:229cdde419ba9549023de39c6a0ca8af74b45fade2d7`) and also notes the `:name` secondary property value assigned to the node (`myreport.pdf`).
  - `pushfile` sets the `file:bytes:name` property to the base name of the local file being uploaded.

If a given file already exists in the Axon (deconflicted based on the file's SHA256 hash), `pushfile` will not re-upload the file. However, the command will still process any other options, including:

- creating the `file:bytes` node in the Cortex if it does not already exist.
- applying any specified tag.
- setting (or overwriting) the `:name` property on any existing `file:bytes` node with the base name of the local file specified.

For example (lines wrapped for readability):

```
python -m synapse.tools.pushfile -a aha://axon...
  -c aha://cortex... -t anothertag,athirdtag
    /home/user/reports/anotherreport.pdf

2019-07-03 11:59:03,366 [INFO] log level set to DEBUG
  [common.py:setlogging:MainThread:MainProcess]
2019-07-03 11:59:03,367 [DEBUG] Using selector: EpollSelector
  [selector_events.py:__init__:MainThread:MainProcess]

adding tags: ['anothertag'. 'athirdtag']
Axon already had [anotherreport.pdf]
file: anotherreport.pdf (2606351) added to core
  (sha256:229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0)
    as anotherreport.pdf
```

Note the status indicating the Axon already had the specified file. Similarly, the status noting the `file:bytes` node was added to the Cortex lists the same SHA256 hash as our first upload (i.e., `anotherreport.pdf` has the same SHA256 hash as `myreport.pdf`) and indicates the `:name` property has been updated (as `anotherreport.pdf`).

The `file:bytes` node for the uploaded report can now be viewed in the specified Cortex by lifting (see *Storm Reference - Lifting*) the file using the SHA256 / primary property value from the `pushfile` status output:

```
file:bytes=sha256:229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0

file:bytes=sha256:229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0
    .created = 2019/07/03 18:46:40.542
    :md5 = 23a14d3a4508628e7e09a4c4868dfb17
    :mime = ??
    :name = anotherrepport.pdf
    :sha1 = 99b6b984988581cae681f65b92198ed77609bd11
    :sha256 = 229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0
    :size = 2606351
    #anothertag
    #athirdtag
    #sometag
complete. 1 nodes in 3 ms (333/sec).
```

Viewing the node's properties, we see that Synapse has set the `:name` property and has calculated and set the MD5, SHA1, and SHA256 hash secondary property values, as well as the file's size in bytes. Similarly the two tags from our two example `pushfile` commands have been added to the node.

Alternatively, a glob pattern could be used to upload all PDF files in a given directory:

```
python -m synapse.tools.pushfile -a aha://axon...
  -c aha://cortex... -t anothertag,athirdtag
    /home/user/reports/*.pdf
```

3.5.3 pullfile

The Synapse `pullfile` command can be used to retrieve (download) one or more files from a storage Axon (see Axon in the *Synapse Devops Guide*).

Syntax

`pullfile` is executed from an operating system command shell. The command usage is as follows:

```
usage: synapse.tools.pullfile [-h] -a AXON [-o OUTPUT] [-l HASHES]
```

Where:

- `AXON` is the telepath URL to a storage Axon.
- `OUTPUT` is the optional directory path where the downloaded file(s) should be written.
  - If no option is specified, the file(s) will be written to the current working directory.
  - It is not possible to specify multiple `-o` options with a single `pullfile` command (i.e., a different `-o` option with each `-l HASH`, for example). If multiple `-o` options are specified, the last `OUTPUT` path specified will be used.
  - Files saved locally are named using their SHA256 hash value.
- `HASHES` is the SHA256 hash(es) of the file(s) to be retrieved.
  - Multiple hashes can be specified, but each must be listed with its own `-l` option (i.e., `-l HASH_0 -l HASH_1 ... -l HASH_n`).

Example

Download the two files with the specified SHA256 hashes from the specified Axon to the local `/home/user/Documents` directory (replace the Axon path below with the path to your Axon. Note that the command is wrapped for readability):

```
python -m synapse.tools.pullfile -a aha://axon...
  -o /home/user/Documents
  -l 229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0
  -l 52c672f45adacca4878461c1bdd5800af8518e675819a0bdcd5c64a72075a478
```

Executing the command will result in various status messages showing the query and successful retrieval of the file(s):

```
Fetching 229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0 to file
Fetched 229cdde419ba9549023de39c6a0ca8af74b45fade2d7a22cdc4105a75cd40ab0 to file
Fetching 52c672f45adacca4878461c1bdd5800af8518e675819a0bdcd5c64a72075a478 to file
Fetched 52c672f45adacca4878461c1bdd5800af8518e675819a0bdcd5c64a72075a478 to file
```

3.5.4 feed

The Synapse `feed` tool is a way to ingest data exported from one Cortex into another Cortex. Users should be familiar with both the Synapse data model (*Data Model Objects* et al.) as well as Synapse concepts such as packed nodes in order to use and understand the `feed` tool effectively.

Syntax

The `feed` tool is executed from an operating system command shell. The command usage is as follows (line is wrapped for readability):

```
usage: synapse.tools.feed [-h] (--cortex CORTEX | --test) [--debug] [--format FORMAT] [--
↪modules MODULES]
  [--chunksize CHUNKSIZE] [--offset OFFSET] [files ...]
```

Where: - `-h` displays detailed help and these command line options - `CORTEX` specifies the telapth URL to the Cortex where the data should be ingested.

- `--test` means to perform the ingest against a temporary, local Cortex instead of a live cortex, for testing or validation
  - When using a temporary Cortex, you do not need to provide a path.
- `--debug` specifies to drop into an interactive prompt to inspect the state of the Cortex post-ingest.
- `FORMAT` specifies the format of the input files.
  - Currently, only the value "syn.nodes" is supported. This is also the default value.
- `MODULES` specifies a path to a Synapse CoreModule class that will be loaded into the temporary Cortex.
  - This option has no effect if the `--test` option is not specified
- `CHUNKSIZE` specifies how many lines or chunks of data to read at a time from the given files.
  - Defaults to 1000 if not specified
- `OFFSET` specifies how many chunks of data to skip over (starting at the beginning)
- `files` is a series of file paths containing data to load into the Cortex (or temporary Cortex)
  - Every file must be either json-serialized data, msgpack-serialized data, yaml-serialized data, or a json lines file. The files do not have to all be of the same type.

Ingest Examples - Overview

The `feed` tool

Ingest Example 1

This example demonstrates loading a set of nodes via the `feed` tool with the "syn.nodes" format option. The nodes are of a variety of types, and are encoded in a json lines (jsonl) format.

JSONL File:

The jsonl file (`testnodes.jsonl`) contains a list of nodes in their packed form. Each line in the file corresponds to a single node, with all of the properties, tags, and nodedata on the node encoded in a json friendly format.

```
[["it:reveng:function", "9710579930d831abd88acff1f2ecd04f"], {"iden":
↪"508204ebc73709faa161ba8c111aec323f63a78a84495694f317feb067f41802", "tags": {"my":␣
↪[null, null], "my.cool": [null, null], "my.cool.tag": [null, null]}, "props": {".
↪created": 1625069466909, "description": "An example function"},   "tagprops": {},
↪"nodedata": {}, "path": {}}]
[["inet:ipv4", 386412289], {"iden":
↪"d6270ca2dc592cd0e8edf8c73000f80b63df4bcd601c9a631d8c68666fdda5ae", "tags": {"my":␣
↪[null, null], "my.cool": [null, null], "my.cool.tag": [null, null]}, "props": {".
↪created": 1625069584577, "type": "unicast"}, "tagprops": {}, "nodedata": {}, "path": {}
```

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```
↪}]
[["inet:url", "https://synapse.docs.vertex.link/en/latest/synapse/userguide.html
↪#userguide"], {"iden":
↪"dba0a280fc1f8cf317dffa137df0e1761b6f94cacbf56523809d4f17d8263840", "tags": {"my":␣
↪[null, null], "my.cool": [null, null], "my.cool.tag": [null, null]}, "props": {".
↪created": 1625069758843, "proto": "https", "path": "/en/latest/synapse/userguide.html
↪#userguide", "params": "", "fqdn": "synapse.docs.vertex.link", "port": 443, "base":
↪"https://synapse.docs.vertex.link/en/latest/synapse/userguide.html#userguide"},
↪"tagprops": {}, "nodedata": {}, "path": {}}]
[["file:bytes", "sha256:ffd19426d3f020996c482255b92a547a2f63afcfc11b45a98fb3fb5be69dd75c
↪"], {"iden": "137fd16d2caab221e7580be63c149f83a11dd11f10f078d9f582fedef9b57ad5", "tags
↪": {"my": [null, null], "my.cool": [null, null], "my.cool.tag": [null, null]}, "props
↪": {".created": 1625070470041, "sha256":
↪"ffd19426d3f020996c482255b92a547a2f63afcfc11b45a98fb3fb5be69dd75c", "md5":
↪"be1bb5ab2057d69fb6d0a9d0684168fe", "sha1": "57d13f1fa2322058dc80e5d6d768546b47238fcd",
↪ "size": 16}, "tagprops": {}, "nodedata": {}, "path": {}}]
```

Verifying the Data:

Typically, users will want to double check the data they have before loading it into a production Cortex. The `feed` tool allows us to perform an ingest our of nodes file against an empty, ephemeral Cortex, so that we can check what nodes get created before adding them to a production Cortex. To load `testnodes.jsonl` into an ephemeral Cortex and drop into a prompt to explore the ingested nodes, run:

```
python -m synapse.tools.feed --test --debug testnodes.jsonl
```

Assuming the command completed with no errors, we should now have a `cmdr` prompt connected to our test Cortex:

```
cli>
```

From which we can issue Storm commands to interact with and validate the nodes that were just ingested. For example:

```
cli> storm #my.cool.tag

it:reveng:function=9710579930d831abd88acff1f2ecd04f
        .created = 2021/06/30 19:46:31.810
        :description = An example function
        #my.cool.tag
inet:ipv4=23.8.47.1
        .created = 2021/06/30 19:46:31.810
        :type = unicast
        #my.cool.tag
inet:url=https://synapse.docs.vertex.link/en/latest/synapse/userguide.html#userguide
        .created = 2021/06/30 19:46:31.810
        :base = https://synapse.docs.vertex.link/en/latest/synapse/userguide.html
↪#userguide
        :fqdn = synapse.docs.vertex.link
        :params =
        :path = /en/latest/synapse/userguide.html#userguide
        :port = 443
        :proto = https
        #my.cool.tag
file:bytes=sha256:ffd19426d3f020996c482255b92a547a2f63afcfc11b45a98fb3fb5be69dd75c
```

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```
        .created = 2021/06/30 19:46:31.810
        :md5 = be1bb5ab2057d69fb6d0a9d0684168fe
        :sha1 = 57d13f1fa2322058dc80e5d6d768546b47238fcd
        :sha256 = ffd19426d3f020996c482255b92a547a2f63afcfc11b45a98fb3fb5be69dd75c
        :size = 16
        #my.cool.tag
complete. 4 nodes in 16 ms (250/sec).
```

Loading the Data:

Once we've inspected and verified the data is acceptable for loading, we can point the `feed` tool to the Cortex we want to load the nodes into, and the same nodes should be added.

```
python -m synapse.tools.feed --cortex "aha://cortex..." testnodes.jsonl
```

However, once we've inspected the data, let's say that the it:reveng:function and inet:ipv4 nodes are not allowed in the production Cortex, but the inet:url and file:bytes are. We can skip these two nodes by using a combination of the `chunksize` and `offset` parameters:

```
python -m synapse.tools.feed --cortex "aha://cortex..." testnodes.jsonl --chunksize 1 --
↪offset 1
```

With the `chunksize` parameter signifying that the `feed` tool should read two lines at a time from the file and process those before reading the next line, and the `offset` parameter meaning the `feed` tool should skip all lines before and including line 1 (so lines 1 and 0) when attempting to add nodes, and only add nodes once it's read in lines 2 and beyond.

3.5.5 csvtool

The Synapse `csvtool` command can be used to ingest structured data from a comma-separated values (CSV) file to create nodes in a Cortex. `csvtool` is useful for bulk-loading CSV-formatted data without the need to develop custom ingest code. (For other data formats such as JSON, yaml, or msgpack, see *feed*.)

The `--export` option can be used to export a set of data from a Cortex into a CSV file.

Storm queries are used both to ingest and export data using `csvtool`. Users should be familiar with the Storm query language (*Storm Reference - Introduction* et al.) and the Synapse data model (*Data Model Objects* et al.) in order to use `csvtool` effectively.

The Storm syntax used with `csvtool` makes use of a few more advanced Storm concepts such as variables, methods, libraries, and some programming flow control concepts (e.g., for loops and switch statements). However, the examples below should be fairly self-explanatory. In other words, users do **not** need to understand in detail how those concepts work in order to create basic `stormfile` queries and start loading data using `csvtool`.

That said, the set of advanced Storm concepts and features can be fully leveraged within a `stormfile` to perform complex data ingest. Interested users are encouraged to refer to the appropriate sections of the Storm reference documents for a more detailed discussion of those concepts, which may be useful for creating more complex `stormfile` queries (or Storm queries in general).

- *Storm Reference - Subqueries*
- *Storm Reference - Advanced - Variables*
- *Storm Reference - Advanced - Methods*
- *Storm Reference - Advanced - Control Flow*
- *Storm Libraries*

- *Storm Types*

Syntax

`csvtool` is executed from an operating system command shell. The command usage is as follows (line is wrapped for readability):

```
usage: synapse.tools.csvtool [-h] [--logfile LOGFILE] [--csv-header] [--cli] [--debug]
  (--cortex CORTEX | --test) [--export] stormfile csvfiles [csvfiles ...]
```

Where:

- `-h` displays detailed help and examples.
- `LOGFILE` is the optional name / path to log Storm events associated with running the `csvtool` command as a JSONL file. Messages are appended to this file when they are written to them.
- `--csv-header` is an option that indicates the first row in the CSV file is a header row and should be skipped for purposes of parsing and node creation.
- `--cli` opens a `cmdr` command prompt after `csvtool` exits.
  - The command prompt will be connected to the Cortex specified by the `--cortex CORTEX` or `--test` option.
- `--debug` will send verbose output to `stdout` during execution.
- `CORTEX` specifies the telepath URL to the Cortex where the data should be ingested.
- `--test` specifies the data should be loaded into a temporary local Cortex (i.e., for testing / validation).
  - When using a temporary Cortex, you do not need to provide a path.
- `--export` is used to extract data from the specified Cortex into a CSV file.
- `stormfile` is the name / path to a file containing a Storm query that tells Synapse how to ingest the CSV data (or how to lift and export data if the `--export` option is used).
- `csvfiles` is the name / path to one or more CSV files containing the data to be ingested (or the name/path where the CSV output should be written if the `--export` option is used).
  - If multiple `csvfiles` are listed for ingest, they are all processed with the specified `stormfile`.
  - Only a single `csvfile` can be specified for output with `--export`.

Note

The same events are output by both `--logfile` and `--debug`; one is written to file and the other is written to `stdout`.

help

The detailed help (`-h`) output for `csvtool` is shown below (lines are wrapped for readability).

```
python -m synapse.tools.csvtool -h

usage: synapse.tools.csvtool [-h] [--logfile LOGFILE] [--csv-header] [--cli] [--debug]
  (--cortex CORTEX | --test) [--export] stormfile csvfiles [csvfiles ...]

Command line tool for ingesting csv files into a cortex
```

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```
The storm file is run with the CSV rows specified in the variable "rows" so most storm␣
↪files
  will use a variable based for loop to create edit nodes.  For example:

for ($fqdn, $ipv4, $tag) in $rows {
    [ inet:dns:a=($fqdn, $ipv4) +#$tag ]
}

More advanced uses may include switch cases to provide different logic based on a
  column value.

for ($type, $valu, $info) in $rows {

    switch $type {
        fqdn: {
            [ inet:fqdn=$valu ]
        }

        "person name": {
            [ ps:name=$valu ]
        }

        *: {
            // default case...
        }
    }

    switch $info {
        "known malware": { [+#cno.mal] }
    }
}

positional arguments:

stormfile             A STORM script describing how to create nodes
                      from rows.
csvfiles              CSV files to load.

optional arguments:
-h, --help            show this help message and exit
--logfile LOGFILE     Set a log file to get JSON lines from the
                      server events.
--csv-header          Skip the first line from each CSV file.
--cli                 Drop into a cli session after loading data.
--debug               Enable verbose debug output.
--cortex CORTEX, -c CORTEX
                      The telepath URL for the cortex ( or alias
                      from ~/.syn/aliases ).
--test, -t            Perform a local CSV ingest against a temporary
                      cortex.
--export              Export CSV data to file from storm using
```

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```
                    $lib.csv.emit(...) events.
```

Ingest Examples - Overview

The key components for using the `csvtool` command are the CSV file itself (`csvfile`) and the file containing the Storm query (`stormfile`) used to ingest the data.

The `stormfile` contains a Storm query to describe how the data from the CSV file(s) should be used to create nodes in a Cortex, including optionally setting properties and / or adding tags.

Note

When ingesting large sets of CSV-formatted data where the data has not been vetted, it may be useful to use the *"Try" Operator* operator instead of the equivalent (=) operator within the Storm syntax in the `stormfile` used to create nodes. When using the try operator (?=), Storm will process what it can, creating nodes from "well-formatted" data and simply skipping rows that may contain bad data. In contrast, using the equivalent operator (=) will result in Storm throwing an error and halting processing if bad data is encountered.

Ingest Example 1

This example demonstrates loading a structured set of data to create nodes of a single form (in this case, DNS A records) and set secondary properties (in this case, the `.seen` universal property).

CSV File:

A CSV file (`testfile.csv`) contains a list of domains, the IP addresses the domains have resolved to, and the first and last observed times for the resolution, as represented by the example header and row data below:

```
domain,IP,first,last
woot.com,1.2.3.4,2018/04/18 13:12:47,2018/06/23 09:45:12
hurr.net,5.6.7.8,2018/10/03 00:47:29,2018/10/04 18:26:06
derp.org,4.4.4.4,2019/06/09 09:00:18,2019/07/03 15:07:52
```

Note

Because the file contains a header row, we need to use the `--csv-header` option to tell `csvtool` to skip the first row when ingesting data.

We want to load the data in the CSV file into a Cortex as a set of DNS A records (`inet:dns:a` nodes) with the first and last dates represented as the `.seen` universal property.

Stormfile:

Storm references the set of rows in the CSV file by the *$rows* built-in variable. We need to define a set of variables (see *Storm Reference - Advanced - Variables*) to represent each field in a row (i.e., each column in the CSV file) and tell Storm to iterate over each row using a *For Loop*. For example:

```
for ($fqdn, $ipv4, $first, $last) in $rows
```

This assigns the variable `$fqdn` to the first column (i.e., the one containing `woot.com`), `$ipv4` to the second column, and so on, and sets up the "for" loop.

We then need a Storm query that tells the "for" loop what to do with each row - that is, how to create the DNS A records from each row in the CSV file:

```
[ inet:dns:a = ( $fqdn, $ipv4 ) .seen=( $first, $last ) ]
```

We combine these elements to create our `stormfile`, as follows:

```
for ($fqdn, $ipv4, $first, $last) in $rows {

    [ inet:dns:a = ( $fqdn, $ipv4 ) .seen=( $first, $last ) ]

}
```

Testing the Ingest:

Typically, users will want to test that their `stormfile` loads and formats the data correctly by first ingesting the data into a local test cortex (`--test`) before loading the data into a production Cortex. This is typically done using either the `--debug` or `--logfile` option to check for errors and reviewing the loaded data (via `--cli`).

Testing the data will highlight common errors such as:

- Invalid Storm syntax in the `stormfile`.
- Data in the CSV file that does not pass *Type* validation on node creation (i.e., bad or incorrect data, such as an IP address in an FQDN column).

We can attempt to load our data into a test Cortex using the following command (line is wrapped for readability):

```
python -m synapse.tools.csvtool --logfile mylog.json --csv-header --cli --test
  stormfile testfile.csv
```

Assuming the command executed with no errors, we should have a `cmdr` CLI prompt for our local test Cortex:

```
cli>
```

We can now issue Storm commands to interact with and validate the data (i.e., did `csvtool` create the expected number of nodes, were the properties set correctly, etc.)

For example:

```
cli> storm inet:dns:a

inet:dns:a=('hurr.net', '5.6.7.8')
    .created = 2019/07/03 22:25:43.966
    .seen = ('2018/10/03 00:47:29.000', '2018/10/04 18:26:06.000')
    :fqdn = hurr.net
    :ipv4 = 5.6.7.8
inet:dns:a=('derp.org', '4.4.4.4')
    .created = 2019/07/03 22:25:43.968
    .seen = ('2019/06/09 09:00:18.000', '2019/07/03 15:07:52.000')
    :fqdn = derp.org
    :ipv4 = 4.4.4.4
inet:dns:a=('woot.com', '1.2.3.4')
    .created = 2019/07/03 22:25:43.962
    .seen = ('2018/04/18 13:12:47.000', '2018/06/23 09:45:12.000')
    :fqdn = woot.com
    :ipv4 = 1.2.3.4
complete. 3 nodes in 12 ms (250/sec).
```

Loading the Data:

Once we have validated that our data has loaded correctly, we can modify our `csvtool` command to load the data into a live Cortex (replace the Cortex path below with the path to your Cortex; line is wrapped for readability):

```
python -m synapse.tools.csvtool --logfile mylog.json --csv-header
  --cortex aha://cortex... stormfile testfile.csv
```

Ingest Example 2

This example demonstrates loading a more complex set of data to create nodes of multiple types, apply a single tag to all nodes, and apply custom tags to only some nodes based on additional criteria.

CSV File:

A CSV file (`testfile.csv`) contains a set of malicious indicators, listed by type and the indicator value, as represented by the example header and row data below:

```
Indicator type,Indicator,Description
URL,http://search.webstie.net/,
FileHash-SHA256,b214c7a127cb669a523791806353da5c5c04832f123a0a6df118642eee1632a3,
FileHash-SHA256,b20327c03703ebad191c0ba025a3f26494ff12c5908749e33e71589ae1e1f6b3,
FileHash-SHA256,7fd526e1a190c10c060bac21de17d2c90eb2985633c9ab74020a2b78acd8a4c8,
FileHash-SHA256,b4e3b2a1f1e343d14af8d812d4a29440940b99aaf145b5699dfe277b5bfb8405,
hostname,dns.domain-resolve.org,
hostname,search.webstie.net,
```

Note that while the CSV file contains a header field titled "Description", that field in this particular file contains no data.

Let's say that in addition to the raw indicators, we know that the indicators came from a blog post describing the activity of the Vicious Wombat threat group, and that the SHA256 hashes are samples of the UMPTYSCRUNCH malware family. To provide additional context for the data in our Cortex, we want to:

- Tag all of the indicators as associated with Vicious Wombat (`#cno.threat.viciouswombat`).
- Tag all of the SHA256 hashes as associated with UMPTYSCRUNCH malware (`#cno.mal.umptyscrunch`).

Stormfile:

Similar to our first example, we need to define a set of variables to represent each column (field) for each row and set up the "for" loop:

```
for ($type, $value, $desc) in $rows
```

In this case, the rows contain different types of data that will be used to create different nodes (forms). The `Indicator type` column (`$type`) tells us what type of data is available and what type of node we should create. We can use a "switch" statement to tell Storm how to handle each type of data (i.e., each value in the `$type` field). Since we know the SHA256 hashes refer to UMPTYSCRUNCH malware samples, we want to add tags to those nodes:

```
switch $type {

    URL: {
        [ inet:url = $value ]
    }

    FileHash-SHA256: {
        [ hash:sha256 = $value +#cno.mal.umptyscrunch ]
    }
```

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```
    hostname: {
        [ inet:fqdn = $value ]
    }
}
```

Finally, because we know all of the indicators are associated with the Vicious Wombat threat group, we want to add a tag to all of the indicators. We can add that after the "switch" statement:

```
[ +#cno.threat.viciouswombat ]
```

So our full `stormfile` script looks like this:

```
for ($type, $value, $desc) in $rows {

    switch $type {

        URL: {
            [ inet:url = $value ]
        }

        FileHash-SHA256: {
            [ hash:sha256 = $value +#cno.mal.umptyscrunch ]
        }

        hostname: {
            [ inet:fqdn = $value ]
        }
    }

    [ +#cno.threat.viciouswombat ]
}
```

Testing the Ingest:

We can now test our ingest by loading the data into a test Cortex (line is wrapped for readability):

```
python -m synapse.tools.csvtool --logfile mylog.json --csv-header --cli --test
  stormfile testfile.csv
```

From the `cmdr` CLI, we can now query the data to make sure the nodes were created and the tags applied correctly. For example:

Check that two `inet:fqdn` nodes were created and given the `#cno.threat.viciouswombat` tag:

```
cli> storm inet:fqdn#cno

inet:fqdn=search.webstie.net
    .created = 2019/07/05 14:49:20.110
    :domain = webstie.net
    :host = search
    :issuffix = False
    :iszone = False
    :zone = webstie.net
```

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```
    #cno.threat.viciouswombat
inet:fqdn=dns.domain-resolve.org
    .created = 2019/07/05 14:49:20.117
    :domain = domain-resolve.org
    :host = dns
    :issuffix = False
    :iszone = False
    :zone = domain-resolve.org
    #cno.threat.viciouswombat
complete. 2 nodes in 14 ms (142/sec).
```

Check that four `hash:sha256` nodes were created and given both the Vicious Wombat and the UMPTYSCRUNCH tags:

```
cli> storm hash:sha256

hash:sha256=7fd526e1a190c10c060bac21de17d2c90eb2985633c9ab74020a2b78acd8a4c8
    .created = 2019/07/05 14:49:20.115
    #cno.mal.umptyscrunch
    #cno.threat.viciouswombat
hash:sha256=b20327c03703ebad191c0ba025a3f26494ff12c5908749e33e71589ae1e1f6b3
    .created = 2019/07/05 14:49:20.115
    #cno.mal.umptyscrunch
    #cno.threat.viciouswombat
hash:sha256=b214c7a127cb669a523791806353da5c5c04832f123a0a6df118642eee1632a3
    .created = 2019/07/05 14:49:20.113
    #cno.mal.umptyscrunch
    #cno.threat.viciouswombat
hash:sha256=b4e3b2a1f1e343d14af8d812d4a29440940b99aaf145b5699dfe277b5bfb8405
    .created = 2019/07/05 14:49:20.116
    #cno.mal.umptyscrunch
    #cno.threat.viciouswombat
complete. 4 nodes in 3 ms (1333/sec).
```

Loading the Data:

Once the data has been validated, we can load it into our live Cortex (replace the Cortex path below with the path to your Cortex; line is wrapped for readability):

```
python -m synapse.tools.csvtool --logfile mylog.json --csv-header
  --cortex aha://cortex... stormfile testfile.csv
```

Export Examples - Overview

The `--export` option allows you to export a set of data from a Cortex into a CSV file.

When `--export` is used:

- `stormfile` contains:
  - the Storm query that specifies the data to be exported; and
  - a statement telling Storm how to format and generate the rows of the CSV file.
- `csvfile` is the location where the data should be written.

The Storm `$lib.csv` library includes functions for working with CSV files. The `$lib.csv.emit()` function will emit CSV rows; the parameters passed to the function define the data that should be included in each row.

`$lib.csv.emit()` will create one row for each node that it processes (i.e., each node in the Storm "pipeline" that passes through the `$lib.csv.emit()` command), as determined by the preceding Storm query.

Export Example 1

For this example, we will export the data we imported in *Ingest Example 2*. For this simple example, we want to export the set of malicious indicators associated with the Vicious Wombat threat group.

Stormfile:

To lift all the indicators associated with Vicious Wombat, we can use the following Storm query:

```
#cno.threat.viciouswombat
```

We then need to tell `$lib.csv.emit()` how to format our exported data. We want to list the indicator type (its form) and the indicator itself (the node's primary property value).

While this seems pretty straightforward, there are two considerations:

- Given our example above, we have multiple node types to export (`inet:url`, `hash:sha256`, `inet:fqdn`).
- While we can reference any secondary property directly using its relative property name (i.e., `:zone` for `inet:fqdn:zone`), referencing the primary property value is a bit trickier, as is referencing the form of the node.

$node is a built-in Storm variable that represents the **current node** passing through the Storm pipeline. `$node` supports a number of methods (*Storm Reference - Advanced - Methods*) that allow Storm to access various attributes of the current node. In this case:

- The *$node.form()* method will access (return) the current node's form.
- The *$node.value()* method will access (return) the current node's primary property value.

This means we can tell `$lib.csv.emit()` to create a CSV file with a list of indicators as follows:

```
$lib.csv.emit($node.form(), $node.value())
```

So our overall `stormfile` to lift and export all of the Vicious Wombat indicators is relatively simple:

```
#cno.threat.viciouswombat
$lib.csv.emit($node.form(), $node.value())
```

Exporting the Data:

We can now test our export of the data we ingested in *Ingest Example 2* (replace the Cortex path below with the path to your Cortex; line is wrapped for readability):

```
python -m synapse.tools.csvtool --debug --export
  --cortex aha://cortex... stormfile export.csv
```

If we view the contents of `export.csv`, we should see our list of indicators:

```
inet:fqdn,search.webstie.net
hash:sha256,7fd526e1a190c10c060bac21de17d2c90eb2985633c9ab74020a2b78acd8a4c8
inet:fqdn,dns.domain-resolve.org
hash:sha256,b20327c03703ebad191c0ba025a3f26494ff12c5908749e33e71589ae1e1f6b3
hash:sha256,b214c7a127cb669a523791806353da5c5c04832f123a0a6df118642eee1632a3
```

(continues on next page)

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```
hash:sha256,b4e3b2a1f1e343d14af8d812d4a29440940b99aaf145b5699dfe277b5bfb8405
inet:url,http://search.webstie.net/
```

Export Example 2

For this example, we will export the DNS A records we imported in *Ingest Example 1*. We will create a CSV file that matches the format of our original ingest file, with columns for domain, IP, and first / last resolution times.

Stormfile:

To lift the DNS A records for the domains `woot.com`, `hurr.net`, and `derp.org`, we can use the following Storm query:

```
inet:dns:a:fqdn=woot.com inet:dns:a:fqdn=hurr.net inet:dns:a:fqdn=derp.org
```

In this case we want `$lib.csv.emit()` to include:

- the domain (`:fqdn` property of the `inet:dns:a` node).
- the IP (`:ipv4` property of the `inet:dns:a` node).
- the first observed resolution (the first half of the `.seen` property).
- the most recently observed resolution (the second half of the `.seen` property).

As a first attempt, we could specify our output format as follows to export those properties:

```
$lib.csv.emit(:fqdn, :ipv4, .seen)
```

This exports the data from the relevant nodes as expected, but does so in the following format:

```
woot.com,16909060,"(1524057167000, 1529747112000)"
```

We have a few potential issues with our current output:

- The IP address is exported using its raw integer value instead of in human-friendly dotted-decimal format.
- The `.seen` value is exported into a single field as a combined `"(<min>, <max>)"` pair, not as individual comma-separated timestamps.
- The `.seen` values are exported using their raw Epoch millis format instead of in human-friendly datetime strings.

We need to do some additional formatting to get the output we want in the CSV file.

IP Address

Synapse stores IP addresses as integers, so specifying `:ipv4` for our output definition gives us the raw integer value for that property. If we want the human-readable value, we need to use the human-friendly representation (*Repr*) of the value. We can do this using the *$node.repr()* method to tell Storm to obtain and use the repr value of a node instead of its raw value (*$node.value()*).

`$node.repr()` by itself (e.g., with no parameters passed to the method) returns the repr of the primary property value of the node passing through the runtime. Our original Storm query, above, lifts DNS A records - so the nodes passing through the runtime are `inet:dns:a` nodes, not IPv4 nodes. This means that using `$node.repr()` by itself will return the repr of the `inet:dns:a` node, not the `:ipv4` property.

We can tell `$node.repr()` to return the repr of a specific secondary property of the node by passing the **string** of the property name to the method:

```
$node.repr(ipv4)
```

.seen times

`.seen` is an *ival* (interval) type whose property value is a paired set of minimum and maximum timestamps. To export the minimum and maximum as separate fields in our CSV file, we need to split the `.seen` value into two parts by assigning each timestamp to its own variable. We can do this as follows:

```
($first, $last) = .seen
```

However, simply splitting the value will result in the variables `$first` and `$last` storing (and emitting) the raw Epoch millis value of the time, not the human-readable repr value. Similar to the way in which we obtained the repr value for the `:ipv4` property, we need to assign the human-readable repr values of the `.seen` property to `$first` and `$last`:

```
($first, $last) = $node.repr(".seen")
```

Stormfile

We can now combine all of these elements into a Storm query that:

- Lifts the `inet:dns:a` nodes we want to export.
- Splits the human-readable version of the `.seen` property into two time values and assigns them to variables.
- Generates `$lib.csv.emit()` messages to create the CSV rows.

Our full stormfile query looks like this:

```
inet:dns:a:fqdn=woot.com inet:dns:a:fqdn=hurr.net inet:dns:a:fqdn=derp.org

($first, $last) = $node.repr(".seen")

$lib.csv.emit(:fqdn, $node.repr(ipv4), $first, $last)
```

Warning

The data submitted to `$lib.csv.emit()` to create the CSV rows **must** exist for every node processed by the function. For example, if one of the `inet:dns:a` nodes lifted by the Storm query and submitted to `$lib.csv.emit()` does not have a `.seen` property, Storm will generate an error and halt further processing, which may result in a partial export of the desired data.

Subqueries (*Storm Reference - Subqueries*) or various flow control processes (*Storm Reference - Advanced - Control Flow*) can be used to conditionally account for the presence or absence of data for a given node.

Exporting the Data:

We can now test our export of the data we ingested in *Ingest Example 1* (replace the Cortex path below with the path to your Cortex; line is wrapped for readability):

```
python -m synapse.tools.csvtool --debug --export
  --cortex aha://cortex... stormfile export.csv
```

If we view the contents of `export.csv`, we should see the following:

```
woot.com,1.2.3.4,2018/04/18 13:12:47.000,2018/06/23 09:45:12.000
hurr.net,5.6.7.8,2018/10/03 00:47:29.000,2018/10/04 18:26:06.000
derp.org,4.4.4.4,2019/06/09 09:00:18.000,2019/07/03 15:07:52.000
```

3.5.6 genpkg

The Synapse `genpkg` tool can be used to generate a Storm *Package* containing new Storm commands and Storm modules from a YAML definition and optionally push it to a Cortex or PkgRepo.

For additional details on using the `genpkg` tool see *Building / Loading* a Rapid Power-Up.

3.5.7 easycert

The Synapse `easycert` tool can be used to manage CA, host, and user certificates.

Syntax

`easycert` is executed using `python -m synapse.tools.easycert`. The command usage is as follows:

```
usage: easycert [-h] [--certdir CERTDIR] [--importfile {cas,hosts,users}] [--ca] [--p12]␣
↪[--server] [--server-sans SERVER_SANS] [--csr] [--sign-csr] [--signas SIGNAS]
                name

Command line tool to generate simple x509 certs

positional arguments:
  name                  common name for the certificate (or filename for CSR signing)

optional arguments:
  -h, --help            show this help message and exit
  --certdir CERTDIR     Directory for certs/keys
  --importfile {cas,hosts,users}
                        import certs and/or keys into local certdir
  --ca                  mark the certificate as a CA/CRL signer
  --p12                 mark the certificate as a p12 archive
  --server              mark the certificate as a server
  --server-sans SERVER_SANS
                        server cert subject alternate names
  --csr                 generate a cert signing request
  --sign-csr            sign a cert signing request
  --signas SIGNAS       sign the new cert with the given cert name
```

3.6 Storm Reference

Synapse uses the Storm Query language to do lifting and modification of data in the graph. Basic Storm usage is documented in the following sections.

3.6.1 Storm Reference - Introduction

Storm is the query language used to interact with data in Synapse. Storm allows you to ask about, retrieve, annotate, add, modify, and delete data within a Synapse Cortex. If you are using the open source or Quickstart versions of Synapse, you will access Synapse via the Storm command-line interface (**Storm CLI**) (see *storm*):

```
storm> <query>
```

If you are a Synapse Enterprise customer or have requested a Synapse Enterprise demo instance you will access Synapse via the Synapse UI (also known as Optic) and use Storm from the Storm query bar.

> **Tip**
>
> If you're not sure which version of Synapse to start with, check out our Getting Started guide.

Storm Background

In designing Storm, we needed it to be flexible and powerful enough to allow interaction with large amounts of data and a wide range of disparate data types. However, we also needed Storm to be intuitive and efficient so it would be accessible to a wide range of users. We wrote Storm specifically to be used by analysts and other users from a variety of knowledge domains who are not necessarily programmers and who would not want to use what felt like a "programming language".

Wherever possible, we masked Storm's underlying programmatic complexity. The intent is for Storm to act more like a "data language", allowing users to:

- **Reference data and query operations in an intuitive form.** We took a "do what I mean" approach for how users interact with and use Storm so that users can focus on the **data** and the relationships among the data, not the query language. Once you get the gist of it, Storm "just works"! This is because Storm and Synapse make use of a number of features "under the hood" such as property normalization, type enforcement / type awareness, and syntax and query optimization, to make Storm easier for you to use. Synapse and Storm do the work in the background so you can focus on analysis.
- **Use a simple yet powerful syntax to run Storm queries.** Storm uses intuitive keyboard symbols (such as an "arrow" (->) for pivot operations) for efficient querying, as well as a natural language-like syntax. This makes using Storm feel more like "asking a question" than "constructing a data query". In fact, one method we use to teach Storm to new users is to practice "translating" questions into queries (you'll be surprised how straightforward it is!).

Analysts still need to learn the Storm "language" - forms (*Form*) and tags (*Tag*) are Storm's "words", and Storm operators allows you to construct "sentences". That said, the intent is for Storm to function more like "how do I ask this question about the data?" and not "how do I write a program to get the data I need?"

Finally – and most importantly – **giving analysts direct access to Storm allows them to create arbitrary queries and provides them with an extraordinarily powerful analytical tool.** Analysts are not constrained to a set of "canned" queries provided through a GUI or an API. Instead, they can follow their analysis wherever it takes them, creating queries as needed and working with the data in whatever manner is most appropriate to their research.

Basic Storm Operations

Storm allows users to perform all of the common operations used to interact with data in Synapse:

- Lift: retrieve data based on specified criteria.
- Filter: refine your results by including or excluding a subset of nodes based on specified criteria.
- Pivot: take a set of nodes and identify other nodes that share one or more property values with the lifted set.
- Traverse light edges.
- Modify data: create, modify, annotate (tag), and delete nodes from Synapse.
- Run commands: Storm supports an extensible set of commands. Many commands provide specific functionality to extend the analytical power of Storm. Other Storm commands allow management of permissions for users

and roles, Synapse views and layers, and Synapse's automation features. You can display available commands by running `help` from the Storm CLI.

Many Storm queries - even "complex" ones - can be constructed from this simple set of "building blocks". For users who want to expand their Storm capabilities, there are additional *Advanced Storm Operations* that provide even greater power and flexibility.

Lift, Filter, and Pivot Criteria

The main operations carried out with Storm are lifting, filtering, and pivoting (we include traversing light edges as part of "pivoting"). When conducting these operations, you need to be able to clearly specify the data you are interested in – your selection criteria. In most cases, the criteria you specify will be based on one or more of the following:

- A **property** (primary or secondary) on a node.
- A specific **value** for a property (<*form*> = <*valu*> or <*prop*> = <*pval*>) on a node.
- A **tag** on a node.
- The existence of a **light edge** linking nodes.
- The name ("verb") of a specific **light edge** linking nodes.

All of the above elements – nodes, properties, values, and tags – are the fundamental building blocks of the Synapse data model (see *Data Model Objects*). **As such, an understanding of the Synapse data model is essential to effective use of Storm.**

Whitespace and Literals in Storm

The Storm query language allows (and in some cases requires) whitespace in order to separate syntax elements such as commands and command arguments.

When using **literals** in Storm, quotation marks are used to **preserve** whitespace characters and other special characters within the literal.

Using Whitespace Characters

Whitespace characters (i.e., spaces) are used within Storm to separate command line arguments. Specifically, whitespace characters are used to separate commands, command arguments, command operators, variables and literals.

When entering a query/command in Storm, one or more whitespace characters are **required** between the following command line arguments:

- A command (such as `max`) and command line parameters (in this case, the property `:asof`):

```
storm> inet:whois:rec:fqdn=vertex.link | max :asof
```

- An unquoted literal and any subsequent argument or operator:

```
storm> inet:email=support@vertex.link | count

storm> inet:email=support@vertex.link -> *
```

Whitespace characters can **optionally** be used when performing the following operations:

- Assigning values using the equals sign assignment operator:

```
storm> [inet:ipv4=192.168.0.1]

storm> [inet:ipv4 = 192.168.0.1]
```

- Comparison operations:

```
storm> file:bytes:size>65536

storm> file:bytes:size > 65536
```

- Pivot operations:

```
storm> inet:ipv4->*

storm> inet:ipv4 -> *
```

- Specifying the content of edit brackets or edit parentheses:

```
storm> [inet:fqdn=vertex.link]

storm> [ inet:fqdn=vertex.link ]

storm> [ inet:fqdn=vertx.link (inet:ipv4=1.2.3.4 :asn=5678) ]

storm> [ inet:fqdn=vertex.link ( inet:ipv4=1.2.3.4 :asn=5678 ) ]
```

Whitespace characters **cannot** be used between reserved characters when performing the following CLI operations:

- Add and remove tag operations. The plus (+) and minus (-) sign characters are used to add and remove tags to and from nodes in Synapse respectively. When performing tag operations using these characters, a whitespace character cannot be used between the actual character and the tag name (e.g., +#<tag>).

```
storm> inet:ipv4 = 192.168.0.1 [ -#oldtag +#newtag ]
```

Entering Literals

Storm uses quotation marks (single and double) to preserve whitespace and other special characters that represent literals. If values with these characters are not quoted, Synapse may misinterpret them and throw a syntax error.

Single (' ') or double (" ") quotation marks can be used when specifying a literal in Storm during an assignment or comparison operation. Enclosing a literal in quotation marks is **required** when the literal:

- begins with a non-alphanumeric character,
- contains a space (\s), tab (\t) or newline(\n) character, or
- contains a reserved Synapse character (for example, \ ) , =] } |).

Enclosing a literal in **single** quotation marks will preserve the literal meaning of **each character.** That is, each character in the literal is interpreted exactly as entered.

- Note that if a literal (such as a string) **includes** a single quotation mark / tick mark, it must be enclosed in double quotes.
- Wrong: 'Storm's intuitive syntax makes it easy to learn and use.'
- Right: "Storm's intuitive syntax makes it easy to learn and use."

Enclosing a literal in **double** quotation marks will preserve the literal meaning of all characters **except for** the backslash (\ ) character, which is interpreted as an 'escape' character. The backslash can be used to include special characters such as tab (\t) or newline (\n) within a literal.

- If you need to include a literal backslash within a double-quoted literal, you must enter it as a "double backslash" (the first backslash "escapes" the following backslash character):

- Wrong: `"C:\Program Files\Mozilla Firefox\firefox.exe"`
- Right: `"C:\\Program Files\\Mozilla Firefox\\firefox.exe"`

Note that because the above example does not include a single quote / tick mark as part of the literal, you can simply enclose the file path in single quotes:

- Also right: `'C:\Program Files\Mozilla Firefox\firefox.exe'`

The Storm queries below demonstrate assignment and comparison operations that **do not require** quotation marks:

- Lifting the domain `vtx.lk`:

```
storm> inet:fqdn = vtx.lk
```

- Lifting the file name `windowsupdate.exe`:

```
storm> file:base = windowsupdate.exe
```

The commands below demonstrate assignment and comparison operations that **require** the use of quotation marks. Failing to enclose the literals below in quotation marks will result in a syntax error.

- Lift the file name `windows update.exe` which contains a whitespace character:

```
storm> file:base = 'windows update.exe'
```

- Lift the organization name `The Vertex Project, LLC` which contains both whitespace and the comma special character:

```
storm> ou:name = 'The Vertex Project, LLC'
```

Backtick Format Strings

Backticks (` `) can be used to specify a format string in Storm, with curly braces used to specify expressions which will be substituted into the string at runtime. Any valid Storm expression may be used in a format string, such as variables, node properties, tags, or function calls.

- Use a variable in a string:

```
storm> $ip = "1.2.3.4" $str = `The IP is {$ip}`
```

- Use node properties in a string:

```
storm> inet:ipv4=1.2.3.4 $lib.print(`IP {$node.repr()}: asn={:asn} .seen={.seen} foo={
↪#foo}`)
```

- Lift a node using a format string:

```
storm> $ip=1.2.3.4 $port=22 inet:client=`{$ip}:{$port}`
```

Backtick format strings may also span multiple lines, which will include the newlines when displayed:

```
storm> inet:ipv4=1.2.3.4 $lib.print(`
IP {$node.repr()}:
asn={:asn}
.seen={.seen}
foo={#foo}`)
```

Like double quotes, backticks will preserve the literal meaning of all characters **except for** the backslash (\ ) character, which is interpreted as an 'escape' character. The backslash can be used to include special characters such as tab (`\t`) or newline (`\n`), or to include a backtick (`) or curly brace ({) in the string.

Storm Operating Concepts

Storm has several notable features in the way it interacts with and operates on data. These concepts are important but also pretty intuitive; it's good to be familiar with them, but most users don't need to worry about them too much for standard Storm queries and operations (day-to-day interaction with Synapse data).

These concepts are much more important if you're using more advanced Storm constructs such as variables, control flow, or functions. If you're writing advanced Storm queries, automation, or custom Power-Ups, you should be comfortable with these terms and behaviors.

Working Set

Most objects in Synapse are **nodes**. Most Storm operations start by **lifting** (selecting) a node or set of nodes from Synapse's data store.

- The set of nodes that you start with is called your **initial working set**.
- The set of nodes at any given point in your Storm query is called your **current working set**.

Operation Chaining

Users commonly interact with data (nodes) in Synapse using operations such as lift, filter, and pivot. Storm allows multiple operations to be **chained** together to form increasingly complex queries:

```
storm> inet:fqdn=vertex.link

storm> inet:fqdn=vertex.link -> inet:dns:a

storm> inet:fqdn=vertex.link -> inet:dns:a -> inet:ipv4

storm> inet:fqdn=vertex.link -> inet:dns:a -> inet:ipv4 +:type=unicast
```

The above example demonstrates chaining a lift (`inet:fqdn=vetex.link`) with two pivots (`-> inet:dns:a`, `-> inet:ipv4`) and a filter (`+:type=unicast`).

When Storm operations are concatenated in this manner, they are processed **in order from left to right** with each operation (lift, filter, or pivot) acting on the output of the previous operation. A Storm query is not evaluated as a single whole; Storm evaluates your working set of nodes against each operation in order before moving to the next operation.

> **Note**
>
> Technically, any query you construct is first evaluated as a whole **to ensure it is a syntactically valid query** - Synapse will complain if your Storm syntax is incorrect. But once Synapse has checked your Storm syntax, nodes are processed by each Storm operation in order.

You do not have to write (or execute) Storm queries "one operation at a time" - this example is meant to illustrate how you can chain individual Storm operations together to form longer queries. If you know that the question you want Storm to answer is "show me the unicast IPv4 addresses that the FQDN vertex.link has resolved to", you can simply run the final query in its entirety. But you can also "build" queries one operation at a time if you're exploring the data or aren't sure yet where your analysis will take you.

The ability to build queries operation by operation means that a Storm query can parallel an analyst's natural thought process: you perform one Storm operation and then consider the "next step" you want to take in your analysis!

Node Consumption

Storm operations typically **transform** your working set in some way. That is, the nodes that "go into" (are inbound) to a given Storm operation are not necessarily the nodes that "come out" of that operation.

Take our operation chaining example above:

- Our **initial working set** consists of the single node `inet:fqdn=vertex.link`, which we selected with a lift operation.
- When we pivot to the DNS A records for that FQDN, we navigate away from (drop) our initial `inet:fqdn` node, and navigate to (add) the DNS A nodes. Our **current working set** now consists of the DNS A records (`inet:dns:a` nodes) for vertex.link.
- Similarly, when we pivot to the IPv4 addresses, we navigate away from (drop) the DNS A nodes and navigate to (add) the IPv4 nodes. Our current working set is made up of the `inet:ipv4` nodes.
- Finally, when we perform our filter operation, we may discard (drop) any IPv4 nodes representing non-unicast IPs (such as `inet:ipv4=127.0.0.1`) if present.

We refer to this transformation (in particular, dropping) of some or all nodes by a given Storm operation as **consuming** nodes. Most Storm operations consume nodes (that is, change your working set in some way - what comes out of the operation is not the same set of nodes that goes in).

For standard Storm queries this process should be fairly intuitive ("now that you point that out... of course that is what's happening"). However, the idea of **node consumption** and the transformation of your current working set is important to keep in mind for more advanced Storm.

Tip

Storm commands (built-in commands, or commands added by Power-Ups) that operate on nodes generally do **not** consume nodes - the nodes that "go into" the command are the same nodes that "come out" by default. This allows you to chain multiple commands together that all operate on the same inbound nodes. Commands may include a `--yield` option to modify this behavior and drop (consume) the inbound nodes and return the node(s) (or primary node(s)) produced by the command.

Storm as a Pipeline

Just as each Storm **operation** in the chain is processed individually from left to right, **each node** in your working set is evaluated **individually** against a given Storm operation in a query. You can think of your Storm query as a **pipeline** of operations, with each node "fired" one at a time through the pipeline. Whether you start with one node or 10,000 nodes, they are evaluated against your Storm query one by one.

Processing nodes one by one significantly reduces Synapse's latency and memory use: this is a big part of what makes Synapse so fast and responsive. Synapse can immediately provide you with results for the initial nodes while it continues processing the remaining nodes. In other words, you don't have to wait for your **entire** query to complete before starting to see results.

For everyday Storm, this behavior is transparent - you run a Storm query, you get a response. However, understanding this pipeline behavior is critical when working with (or troubleshooting) Storm queries that leverage features such as subqueries, variables, control flow operations, or functions.

Advanced Storm Operations

In our experience, the more analysts use Storm, the more they want even greater power and flexibility from the language to support their analytical workflow! To meet these demands, Storm evolved a number of advanced features, including:

- Variables
- Methods
- Control Flow
- Functions
- *Storm Libraries*
- *Storm Types*

Analysts do not need to use or understand these more advanced concepts in order to use Storm or Synapse. Basic Storm functions are sufficient for a wide range of analytical needs and workflows. However, these additional features are available to both "power users" and developers as needed:

- For analysts, once they are comfortable with Storm basics, many of them want to expand their Storm skills **specifically because it facilitates their analysis.**
- For developers, writing extensions to Synapse in Storm has the advantage that the extension **can be deployed or updated on the fly.** Contrast this with extensions written in Python, for example, which would require restarting the system during a maintenance window in order to deploy or update the code.

Note

Synapse's Rapid Power-Ups are written entirely in Storm and exposed to Synapse users as Storm commands!

3.6.2 Storm Reference - Document Syntax Conventions

This section covers the following important conventions used within the Storm Reference Documents:

- *Storm and Layers*
- *Storm Syntax Conventions*
- *Usage Statements vs. Specific Storm Queries*
- *Type-Specific Behavior*
- *Whitespace*

Storm and Layers

The Storm Reference documentation provides basic syntax examples that assume a simple Storm environment - that is, a Cortex with a single Layer. For multi-Layer Cortexes, the effects of specific Storm commands - particularly data modification commands - may vary based on the specific arrangement of read / write Layers, the Layer in which the command is executed, and the permissions of the user.

Storm Syntax Conventions

The Storm Reference documentation provides numerous examples of both abstract Storm syntax (usage statements) and specific Storm queries. The following conventions are used for Storm **usage statements:**

- Items that must be entered literally on the command line are in **bold.** These items include command names and literal characters.

- Items that represent "variables" that must be replaced with a name or value are placed within angle brackets (< >) in *italics*. Most "variables" are self-explanatory, however a few commonly used variable terms are defined here for convenience:
  - <*form*> refers to a form / node primary property, such as `inet:fqdn`.
  - <*valu*> refers to the value of a primary property, such as `woot.com` in `inet:fqdn=woot.com`.
  - <*prop*> refers to a node secondary property (including universal properties) such as `inet:ipv4:asn` or `inet:ipv4.created`.
  - <*pval*> refers to the value of a secondary property, such as `4808` in `inet:ipv4:asn=4808`.
  - <*query*> refers to a Storm query.
  - <*inet:fqdn*> refers to a Storm query whose results contain the specified form(s)
  - <*tag*> refers to a tag (`#sometag` as opposed to a `syn:tag` form).
- **Bold brackets** are literal characters. Parameters enclosed in non-bolded brackets are optional.
- Parameters **not** enclosed in brackets are required.
- A vertical bar signifies that you choose only one parameter. For example:
  - `a | b` indicates that you must choose a or b.
  - `[ a | b ]` indicates that you can choose a, b, or nothing (the non-bolded brackets indicate the parameter is optional).
- Ellipses (…) signify the parameter can be repeated on the command line.
- The `storm` command that must precede a Storm query is assumed and is omitted from examples.

Example:

[<*form*> **=** <*valu*> [**:** <*prop*> **=** <*pval*> …] **]**

The Storm query above adds a new node.

- The outer brackets are in **bold** and are required literal characters to specify a data modification (add) operation. Similarly, the equals signs are in **bold** to indicate literal characters.
- <*form*> and <*valu*> would need to be replaced by the specific form (such as `inet:ipv4`) and primary property value (such as `1.2.3.4`) for the node being created.
- The inner brackets are not bolded and indicate that one or more secondary properties can **optionally** be specified.
- <*prop*> and <*pval*> would need to be replaced by the specific secondary property and value to add to the node, such as `:loc = us`.
- The ellipsis (`...`) indicate that additional secondary properties can optionally be specified.

Usage Statements vs. Specific Storm Queries

Examples of specific queries represent fully literal input, but are not shown in bold for readability. For example:

Usage statement:

[<*form*> **=** <*valu*> [**:** <*prop*> **=** <*pval*> …] **]**

Example query:

[inet:ipv4 = 1.2.3.4 :loc = us]

Type-Specific Behavior

Some data types within the Synapse data model have been optimized in ways that impact their behavior within Storm queries (e.g., how types can be input, lifted, filtered, etc.) See *Storm Reference - Type-Specific Storm Behavior* for details.

Whitespace

Whitespace may be used in the examples for formatting and readability.

3.6.3 Storm Reference - Lifting

Lift operations retrieve a set of nodes based on the specified criteria. While all lift operations are retrieval operations, they can be broken down into "types" of lifts based on the criteria, comparison operator, or special handler used:

- *Lift by Form*
- *Lift by Property*
- *Lift by Property Value - Standard Comparison Operators*
- *Lift by Property Value - Extended Comparison Operators*
- *Tag Lifts*

In addition, the specialized "reverse" keyword and the "try" operator can each be used with lift operations to modify their behavior:

- *"reverse" Keyword*
- *"Try" Operator*

> **Tip**
>
> When performing lift operations, you can specify the name of an *Interface* to represent all forms that inherit that interface. See the sections below for details and examples.

See *Storm Reference - Document Syntax Conventions* for an explanation of the syntax format used below.

See *Storm Reference - Type-Specific Storm Behavior* for details on special syntax or handling for specific data types.

Lift by Form

"Lift by form" operations return **all** nodes of that form in Synapse. The wildcard (asterisk) character (*) can be used to lift all nodes of all forms that match a partial form name / namespace.

If a form inherits an *Interface*, you can specify the interface name to lift all nodes of all forms that inherit the interface.

> **Tip**
>
> In a production instance of Synapse, lifting **all** nodes of a commonly used form (e.g., `inet:fqdn` or `inet:ipv4`) or lifting by an interface that is inherited by numerous forms (e.g. `it:host:activity`) may return thousands or tens of thousands of nodes. Lifting by form or interface can be used with the Storm *limit* command to return only a specified number of nodes (for example, to view a sample of available data).

Lift by Form Name

A "lift by form name" operation returns all nodes for the specified *Form*. This type of lift requires the name of the form whose nodes you want to lift.

Syntax:

<form>

Examples:

Lift all FQDN (inet:fqdn) nodes:

```
inet:fqdn
```

Lift all nodes representing articles (media:news nodes):

```
media:news
```

Lift by Form Name - Wildcard

You can use the wildcard (asterisk) character (*) to specify all forms that match a partial form name. Use of the wildcard is not limited to form namespace boundaries.

Note

The wildcard can only be used at the end of the partial match. It cannot be used at the beginning or in the middle of the form name. For example, both of the following are **invalid**:

`*:header`

`it:exec:*:del`

In addition, use of the wildcard does not extetnd to partial matching of property names. For example, the following is **invalid**:

`file:bytes:mime:pe:*`

Syntax:

<partial_form_name> *

Examples:

Lift all nodes in the MITRE ATT&CK form namespace (e.g., it:mitre:attack:group, it:mitre:attack:technique, etc.):

```
it:mitre:attack:*
```

Lift all DNS A (inet:dns:a) and DNS AAAA (inet:dns:aaaa) nodes:

```
inet:dns:a*
```

Lift Form by Interface

You can use the name of an *Interface* to lift all forms that inherit that interface.

> **Note**
>
> When lifting by interface, you cannot use the wildcard (*) character to match multiple interface names. Synapse will interpret use of the wildcard as an attempt to match multiple form names.

Syntax:

<interface>

Examples:

Lift all host activity nodes (all nodes of all forms that inherit it:host:activity interface):

```
it:host:activity
```

Lift all taxonomy nodes (all nodes of all forms that inherit the meta:taxonomy interface):

```
meta:taxonomy
```

Lift by Property

A "lift by property" operation returns all nodes that **have** the specified *Property* set, regardless of the property value. In most cases, this type of lift requires the full name (i.e., the combined form and property name) of the property you want to use to lift the nodes. When lifting by universal property, the form name is only needed if you want to lift nodes of a specific form that have the universal property.

Lift by Secondary Property

Syntax:

<form> **:** *<prop>*

Examples:

Lift all IPv4 (inet:ipv4) nodes that have a location (:loc property):

```
inet:ipv4:loc
```

Lift all file (file:bytes) nodes that have a PDB path (:mime:pe:pdbpath property):

```
file:bytes:mime:pe:pdbpath
```

Lift by Interface Property

If a form inherits an *Interface*, you can lift all nodes of all forms that have an interface-derived property by specifying the full name of the interface and its property.

Syntax:

<interface> **:** *<prop>*

Examples:

Lift all host activity nodes (all nodes of all forms that inherit the it:host:activity interface) that have a :time property:

```
it:host:activity:time
```

Lift all protocol request nodes (all nodes of all forms that inherit the inet:proto:request interface) that have an associated network flow (i.e., that have a :flow property):

```
inet:proto:request:flow
```

Lift by Universal Property

Syntax:

[*<form>*] **.** *<prop>*

A *Universal Property* applies to and can be used by any node. Synapse uses two universal properties:

- `.created`, a time (date/time) value representing when a node was created in Synapse.
- `.seen`, an interval (pair of date/time values) that can be used optionally to represent "when" the object represented by a node existed or was observed.

Examples:

Lift all email (inet:email) nodes with a .seen property:

```
inet:email.seen
```

Lift all nodes with a .seen property:

```
.seen
```

Lift all nodes in Synapse:

```
.created
```

Tip

Because the `.created` property is automatically set for every node when it is first added to Synapse, lifting by the `.created` property effectively lifts every node in Synapse (technically, every node in the current *View*).

Lift by Extended Property

Syntax:

<form> **:_** *<prop>*

An *Extended Property* is a custom property that has been added to the Synapse data model to capture specialized data for a given form. To avoid potential namespace collisions with standard properties, extended property names must begin with an underscore. In addition, we recommend using the name of the source or vendor of the property data as the first property namespace element.

Examples:

Lift all of the files (file:bytes) nodes that have a VirusTotal "reputation" extended property (:_virustotal:reputation property):

```
file:bytes:_virustotal:reputation
```

Note

The `:_virustotal:reputation` extended property is added to the Synapse data model by the Synapse-VirusTotal Power-Up.

Lift by Property Value - Standard Comparison Operators

A "lift by property value" operation returns the node(s) whose property matches the specified value. This type of lift requires:

- the form name or full property name (i.e., the combined form and property name) that you will use to lift the node(s);
- a *Comparison Operator* to specify how the property value should be evaluated; and
- the property value.

A "lift by property value" can be performed using primary, secondary, universal, or extended properties.

Tip

When lifting by a secondary property value, you can specify either a form name or an *Interface* name.

In Synapse, we define **standard comparison operators** as the following set of operators:

- equal to (=)
- less than (<)
- greater than (>)
- less than or equal to (<=)
- greater than or equal to (>=)

The *"Try" Operator* (?=) can optionally be used in place of the standard equal to operator (=). Use of the try operator is generally not required for interactive Storm queries, but may be useful for more complex Storm queries (such as automation or Storm-based ingest queries).

The most commonly used standard comparison operator is the equal to (=) operator. Comparison operators that expect a **quantity** (i.e., the inequality symbools <, >, <=, and >=) can only be used with properties whose type supports the comparison (e.g., integers, dates/times, etc.)

Tip

IPv4 addresses (`inet:ipv4` nodes) are stored as their decimal integer equivalents (even though they are displayed in familiar "dotted decimal" format), and can be used with the various inequality operators:

```
inet:ipv4 < 192.168.0.0
```

IPv6 addresses (`inet:ipv6` nodes) are stored as strings due to limitations with msgpack, but can be used with the various inequality operators if enclosed in single or double quotes:

```
inet:ipv6 >= '::0'
```

Lift by Primary Property Value

Syntax:

<form> <operator> <valu>

Examples:

Lift the FQDN vertex.link:

```
inet:fqdn = vertex.link
```

Lift the DNS A record showing that domain woot.com resolved to IP 1.2.3.4:

```
inet:dns:a = (woot.com, 1.2.3.4)
```

Lift the organization node whose primary property is the specified guid (globally unique identifier):

```
ou:org = 4b0c2c5671874922ce001d69215d032f
```

Lift the Autonomous System (inet:asn) nodes whose AS number is less than 50:

```
inet:asn < 50
```

Lift by Secondary Property Value

Syntax:

<form> **:** *<prop> <operator> <pval>*

Examples:

Lift the organization node with "vertex" in the names property:

```
ou:org:names *[ = vertex ]
```

Lift all DNS A records for the FQDN "hugesoft.org":

```
inet:dns:a:fqdn = hugesoft.org
```

Lift all the files with a PE compiled time of 1992-06-19 22:22:17:

```
file:bytes:mime:pe:compiled = '1992/06/19 22:22:17'
```

Lift all the files with a PE compiled time that falls within the year 2019:

```
file:bytes:mime:pe:compiled = 2019*
```

Lift files whose size is less than 1MB:

```
file:bytes:size < 1000000
```

Lift domain WHOIS records for FQDNs registered (created) after January 1, 2023:

```
inet:whois:rec:created > 2023/01/01
```

Lift PE files that were compiled during the year 2012 or earlier:

```
file:bytes:mime:pe:compiled <= 2012*
```

Lift contact data (ps:contact nodes) for individuals where the date of birth (:dob property) is January 1, 1990 or later:

```
ps:contact:dob >= 1990/01/01
```

Usage Notes:

- When lifting nodes by secondary property value where the value is a time (date / time), you do not need to use full `YYYY/MM/DD hh:mm:ss.mmm` syntax. Synapse allows the use of both lower resolution values (e.g., `YYYY/MM/DD`) and wildcard values (e.g., `YYYY/MM*`). In particular, wildcard syntax can be used to specify any values that match the wildcard expression. See the type-specific documentation for *time* types for a detailed discussion of these behaviors.

Lift by Interface Property Value

If a form inherits an *Interface*, you can lift all nodes of all forms with a specific interface-derived property value by using the name of the interface.

> **Tip**
>
> Synapse returns results in lexical order (sorted, ascending to descending) based on the way the queried property is indexed. When using an interface to lift by secondary property, Synapse performs the lifts for each form in parallel, and yields the results in order. See the *"reverse" Keyword* section for additional discussion of this concept.

Syntax:

<interface> **:** *<prop>* *<operator>* *<pval>*

Examples:

Lift all host activity nodes (all nodes of all forms that inherit the it:host:activity interface) associated with the host name "ron-pc":

```
it:host:activity:host = { it:host:name=ron-pc }
```

> **Tip**
>
> The `:host` property is a guid value (the guid of an `it:host` node). The example above uses a *Subquery* to specify the host guid value using another Storm query (i.e., "The guid of the it:host node whose :name is ron-pc") insetad of specifying the guid value directly. Subqueries are a useful way to work with guid forms by referencing nodes using more human-friendly secondary property values. See *Using Subqueries to Reference Nodes* for a more detailed discussion.

Lift all host activity nodes (all nodes of all forms that inherit the it:host:activity interface) that were observed on or after February 1, 2024:

```
it:host:activity:time >= 2024/02/01
```

Lift by Universal Property Value

Synapse has two built-in universal properties:

- `.created` (a time) which represents the date and time a node was created in Synapse; and
- `.seen` (an interval), a pair of date / time values that can optionally be used to represent when a node existed or was observed.

Times (date / time values) are stored as integers (epoch milliseconds) in Synapse and can be lifted using any standard comparison operator.

Because intervals are a pair of date / time values, they can only be lifted using the equal to (=) standard comparison operator to specify an **exact** match for the interval values.

The *Lift by Time or Interval (@=)* and *Lift by Range (*range=)* extended comparison operators provide additional flexibility when lifting by times and intervals.

See also the *time* and *ival* sections of the *Storm Reference - Type-Specific Storm Behavior* guide for additional details on working with times and intervals in Synapse.

Syntax:

[*<form>*] `.` *<prop> <operator> <pval>*

Examples:

Lift all nodes created after January 1, 2024:

```
.created >= 2024/01/01
```

Lift all DNS A records (inet:dns:a nodes) whose .seen property exactly matches the specified interval:

```
inet:dns:a.seen = ('2023/11/19 12:11:42.041', '2023/12/27 08:05:47.776')
```

Lift by Extended Property Value

When lifting by extended property value, you can use any standard comparison operator supported by the property's type. For example, if the extended property is a string, only the equal to (=) standard operator is supported. If the extended property is an integer, any of the standard operators can be used.

Syntax:

<form> `:_` *<prop> <operator> <pval>*

Example:

Lift all files with a VirusTotal "reputation" score less than -50:

```
file:bytes:_virustotal:reputation < -50
```

Lift by Property Value - Extended Comparison Operators

Storm supports a set of extended comparison operators (comparators) for specialized lift operations.

- *Lift by Regular Expression (~=)*
- *Lift by Prefix (^=)*
- *Lift by Time or Interval (@=)*
- *Lift by Range (*range=)*
- *Lift by Set Membership (*in=)*

- *Lift by Proximity (*near=)*
- *Lift by (Arrays) (*[ ])*

Just as with standard comparison operators, lifting by property value with extended comparison operators requires:

- the form name or full property name (i.e., the combined form and property name) that you will use to lift the node(s);
- a *Comparison Operator* to specify how the property value should be evaluated; and
- the property value.

Each extended comparison operator can be used with any kind of property (primary, secondary, universal, or extended) whose *Type* is appropriate for the comparison used.

Tip

When lifting by a secondary property value, you can specify either a form name or an *Interface* name.

Synapse returns results in lexical order (sorted, ascending to descending) based on the way the queried property is indexed. When using an interface to lift by secondary property, Synapse performs the lifts for each form in parallel, and yields the results in order. See the *"reverse" Keyword* section for additional discussion of this concept.

Lift by Regular Expression (~=)

The extended comparator ~= is used to lift nodes based on PCRE-compatible regular expressions.

Tip

Lift by Prefix (^=) can be used to match the beginning of string-based properties. It is much faster than lifting by regex for start-of-string matches and should be used instead of a regular expression lift where possible.

Syntax:

<form> [**:** | **.** | **:_** *<prop>*] **~=** *<regex>*

<interface> **:** *<prop>* **~=** *<regex>*

Examples:

Lift all files with PDB paths containing the string "rouji":

```
file:bytes:mime:pe:pdbpath ~= rouji
```

Lift all organizations whose name contains a string that starts with "v", followed by 0 or more characters, followed by "x":

```
ou:org:name ~= '^v.*x'
```

Lift by Prefix (^=)

Synapse performs prefix indexing on string and string-derived types, which optimizes lifting nodes whose *<valu>* or *<pval>* starts with a given prefix (substring). The extended comparator ^= is used to lift nodes by prefix.

Note

Extended string types that support dotted notation (such as the *loc* or *syn:tag* types) have custom behaviors with respect to lifting and filtering by prefix.

inet:fqdn nodes are indexed in reverse string order so cannot be lifted using the prefix extended operator. However, reverse indexing allows wildcard (*) matching of the beginning of any FQDN string.

See the relevant sections in the *Storm Reference - Type-Specific Storm Behavior* guide for details.

Syntax:

<form> [**:** | **.** | **:_** *<prop>*] **^=** *<prefix>*

<interface> **:** *<prop>* **^=** *<prefix>*

Examples:

Lift all email addresses that start with "abuse":

```
inet:email ^= abuse
```

Lift all organizations whose name starts with "ministry":

```
ou:org:name ^= ministry
```

Lift all Microsoft Office metadata nodes (all nodes of all forms that inherit the file:mime:msoffice interface) whose :author name starts with "DESKTOP":

```
file:mime:msoffice:author ^= DESKTOP
```

Lift all tags (syn:tag) nodes in the "rep.alienvault" tree where the third tag element starts with the numeral "0":

```
syn:tag ^= rep.alienvault.0
```

Tip

Even though tag elements are dot-separated, when lifting `syn:tag` nodes by prefix the prefix string is not constrained to dot boundaries. In other words, a prefix lift used with tags can match a partial tag element. The query above will match all of the following tags:

- syn:tag=rep.alienvault.0_day
- syn:tag=rep.alienvault.0_days
- syn:tag=rep.alienvault.0day
- syn:tag=rep.alienvault.0days
- syn:tag=rep.alienvault.0ktapus

Lift by Time or Interval (@=)

Many forms include properties that are date / time values (*<ptype>* = *<time>*) or time windows / intervals (*<ptype>* = *<ival>*). The time/interval extended comparator `@=` is used to lift nodes based on comparisons among various combinations of times and intervals.

> **Tip**
>
> See *Storm Reference - Type-Specific Storm Behavior* for additional detail on the use and behavior of *time* and *ival* data types.

Syntax:

<form> **:** | **.** | **:_** *<prop>* **@=(** *<ival_min>* **,** *<ival_max>* **)**

<form> **:** | **.** | **:_** *<prop>* **@=** *<time>*

<interface> **:** *<prop>* **@=(** *<ival_min>* **,** *<ival_max>* **)**

<interface> **:** *<prop>* **@=** *<time>*

Examples:

Lift all DNS A records whose .seen values fall between July 1, 2022 and August 1, 2022:

```
inet:dns:a.seen @= ( 2022/07/01, 2022/08/01 )
```

Lift all DNS requests that occurred on May 3, 2023 (between 05/03/2023 00:00:00 and 05/03/2023 23:59:59):

```
inet:dns:request:time @= ( '2023/05/03 00:00:00', '2023/05/04 00:00:00' )
```

Lift the WHOIS email nodes that were observed between July 1, 2023 and the present:

```
inet:whois:email.seen @= ( 2023/07/01, now )
```

Lift the network flows that occurred within the past day:

```
inet:flow:time @= ( now, '-1 day' )
```

Lift all host activity nodes (all nodes of all forms that inherit the it:host:activity interface) that occurred within the past three hours:

```
it:host:activity:time @= (now, '-3 hours')
```

Usage Notes:

- When specifying an interval with the `@=` operator, the minimum value is included in the interval for comparison purposes but the maximum value is **not**. This is equivalent to "greater than or equal to *<min>* and less than *<max>*". This behavior differs from that of the `*range=` operator, which includes **both** the minimum and maximum.
- **Comparing intervals to intervals:** when using an interval with the `@=` operator to lift nodes based on an interval property, Synapse returns nodes whose interval value has **any** overlap with the specified interval. For example:
  - A lift interval of September 1, 2018 to October 1, 2018 (2018/09/01, 2018/10/01) will match nodes with any of the following intervals:
    - August 12, 2018 to September 6, 2018 (2018/08/12, 2018/09/06).
    - September 13, 2018 to September 17, 2018 (2018/09/13, 2018/09/17).
    - September 30, 2018 to November 5, 2018 (2018/09/30, 2018/11/05).
- **Comparing intervals to times:** When using an interval with the `@=` operator to lift nodes based on a time property, Synapse returns nodes whose time value falls within the specified interval.

- **Comparing times to times:** When using a time with the `@=` operator to lift nodes based on a time property, Synapse returns nodes whose timestamp is an **exact match** of the specified time. In other words, in this case the interval comparator (`@=`) behaves like the equal to comparator (=).
- When specifying date / time and interval values, Synapse allows the use of both lower resolution values (e.g., `YYYY/MM/DD`), and wildcard values (e.g., `YYYY/MM*`). Wildcard time syntax may provide a simpler and more intuitive means to specify some intervals. For example `inet:whois:rec:asof=2018*` is equivalent to `inet:whois:rec:asof@=('2018/01/01', '2019/01/01')`.
- Time-based keywords (such as `now`) and relative time syntax (expressions such as `+-1 hour` or `-7 days`) can be used for interval values.

  See the type-specific documentation for *time* and *ival* types for a detailed discussion of these behaviors.

Lift by Range (*range=)

The range extended comparator (`*range=`) supports lifting nodes whose <*form*> = <*valu*> or <*prop*> = <*pval*> fall within a specified range of values. The comparator can be used with types such as integers and times.

Note

The `*range=` operator can be used to lift both `inet:ipv4` and `inet:ipv6` values (which are stored as decimal integers and strings, respectively). However, ranges of *inet:ipv4* and `inet:ipv6` nodes can also be lifted directly by specifying the lower and upper addresses in the range using `<min>-<max>` format. For example:

```
inet:ipv4 = 192.168.0.0-192.168.0.10
```

Because IPv6 nodes are stored as strings, the range must be enclosed in quotes:

```
inet:ipv6 = "::0-ff::ff"
```

The `*range=` operator cannot be used to compare a time range with a property value that is an interval (`ival` type). The interval (`@=`) operator should be used instead.

Syntax:

<*form*> [**:** | **.** | **:_** <*prop*>] ***range =** (<*range_min*> **,** <*range_max*> **)**

<*interface*> **:** <*prop*> ***range =** (<*range_min*> **,** <*range_max*> **)**

Examples:

Lift all files whose size is between 1000 and 100000 bytes:

```
file:bytes:size *range= ( 1000, 100000 )
```

Lift all files whose VirusTotal "reputation" score is between -20 and 20:

```
file:bytes:_virustotal:reputation *range= ( -20, 20 )
```

Lift all domain WHOIS records that were captured / retrieved between November 29, 2013 and June 14, 2016:

```
inet:whois:rec:asof *range= ( 2013/11/29, 2016/06/14 )
```

Lift all DNS requests made within one day of December 1, 2021:

```
inet:dns:request:time *range= ( 2021/12/01, '+-1 day' )
```

Usage Notes:

- When specifying a range, **both** the minimum and maximum values are included in the range. This is the equivalent of "greater than or equal to <*min*> and less than or equal to <*max*>").
- When specifying a range of time values, Synapse allows the use of both lower resolution values (e.g., `YYYY/MM/DD`) and wildcard values (e.g., `YYYY/MM*`) for the minimum and/or maximum range values. In some cases, wildcard time syntax may provide a simpler and more intuitive means to specify some time ranges. For example `inet:whois:rec:asof=2018*` is equivalent to `inet:whois:rec:asof*range=('2018/01/01', '2018/12/31 23:59:59.999')`. See the type-specific documentation for *time* types for a detailed discussion of these behaviors.
- When using keywords (such as `now`) or relative values (such as `-1 hour`) to specify a range of times, the first value in the range is calculated relative to the current time and the second value is calculated relative to the first value.
- If you specify a range value that is nonsencical or exclusionary (such as `( 47, 16 )`), Synapse will **not** generate an error and will simply fail to return results. (The expression is syntacticaly correct, but no value is both greater than 47 and less than 16).

Lift by Set Membership (*in=)

The set membership extended comparator (`*in=`) supports lifting nodes whose <*form*> = <*valu*> or <*prop*> = <*pval*> matches any of a set of specified values. The comparator can be used with any type.

Syntax:

<*form*> [**:** | **.** | **:_** <*prop*>] ***in =** (<*set_1*> **,** <*set_2*> **,** …)

<*interface*> **:** <*prop*> ***in =** (<*set_1*> **,** <*set_2*> **,** …)

Examples:

Lift organization names matching any of the specified values:

```
ou:name *in= ( fsb, gru, svr )
```

Lift all IPv4 addresses associated with any of the specified Autonomous System (AS) numbers:

```
inet:ipv4:asn *in= ( 9009, 20473, 44477 )
```

Lift all tags (syn:tag nodes) whose final tag element matches any of the specified string values:

```
syn:tag:base *in= ( plugx, korplug, sogu, kaba )
```

Lift by Proximity (*near=)

The proximity extended comparator (`*near=`) supports lifting nodes by "nearness" to another node. Currently, `*near=` supports proximity based on geospatial location (i.e., nodes within a given radius of a specified latitude / longitude).

Syntax:

<*form*> **:** | **.** | **:_** <*prop*> ***near =** ((<*lat*> **,** <*long*> **),** <*radius*> **)**

Examples:

Lift all locations (geo:place nodes) within 500 meters of the Russian Cryptographic Museum (where the coordinates 55.83069,37.59781 represent the Museum's location):

```
geo:place:latlong *near= ( (55.83069, 37.59781), 500m )
```

Usage Notes:

- Radius can be specified in the following units. The terms recognized by Storm are listed in parentheses. For example, radius can be specified as 2km or '2 km' or '0.5 meters' or '6 feet' (distance expressions that contain spaces need to be enclosed in single or double quotes):
  - Kilometers (km / kilometer / kilometers)
  - Meters (m / meter / meters)
  - Centimeters (cm / centimeter / centimeters)
  - Millimeters (mm / millimeter / millimeters)
  - Miles (mile / miles)
  - Yards (yard / yards)
  - Feet (foot / feet)
- Radius values of less than 1 must be specified with a leading zero (e.g., 0.5km).
- The `*near=` comparator works for geospatial data by lifting nodes within a square bounding box centered at *<lat>,<long>*, then filters the nodes returned by ensuring that they are within the great-circle distance given by the *<radius>* argument.

Lift by (Arrays) (*[ ])

Storm uses a special syntax to lift (or filter) by comparison with one or more elements of an *array* type. The syntax consists of an asterisk (`*`) preceding a set of square brackets (`[ ]`), where the square brackets contain a comparison operator and a value that can match one or more elements in the array. This allows users to match values in the array list without needing to know the exact order or values of the array itself.

Syntax:

<form> **:** | **.** | **:_** *<prop>* **[** *<operator>* *<pval>* **]**

Examples:

Lift the x509 certificates (crypto:x509:cert nodes) that reference FQDNs ending with ".xyz":

```
crypto:x509:cert:identities:fqdns *[ = '*.xyz' ]
```

Lift the MITRE ATT&CK groups whose names include the string 'bear':

```
it:mitre:attack:group:names *[ ~= bear ]
```

Usage Notes:

- The comparison operator used must be valid for lift operations for the type used in the array. For example, *inet:fqdn* suffix matching (i.e., `crypto:x509:cert:identities:fqdns *[ = '*.com' ]`), can be used when lifting arrays consisting of domains, but the prefix operator (`^=`), which is only valid when **filtering** `inet:fqdns`, cannot.
- The standard equals (=) operator can be used to filter nodes based on array properties, but the value specified must **exactly match** the **full** property value in question. For example:

  `ou:org:names=( "the vertex project", "the vertex project llc", vertex )`
- See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* document for additional details.

Tag Lifts

Tags in Synapse can represent observations or assessments. They are used to provide context to nodes (in the form of "labels" applied to nodes) and to group related nodes.

Storm supports lifting nodes based on the tag(s) applied to the node, as well lifting based on tag timestamps, tag properties, or tag property values.

The "hashtag" symbol (#) is used to specify a tag name when lifting by tag.

Lift by Tag

A "lift by tag" operation lifts **all** nodes that have the specified tag.

Syntax:

*<tag>*

Examples:

Lift all nodes that ESET associates with Sednit:

```
#rep.eset.sednit
```

Lift all nodes associated with anonymized infrastructure:

```
#cno.infra.anon
```

Tip

Tags are hierarchical, and each tag element is its own tag; the tag `#cno.infra.anon` consists of the tags `#cno`, `#cno.infra`, and `#cno.infra.anon`. Lifting nodes using a tag "higher up" in the tag hierarchy will lift all nodes with specified tag or any tag "lower down" in the hierarchy. In other words, lifting by `#cno.infra.anon` will lift "anonymized" infrastructure, whether the infrastructure is a VPN (`#cno.infra.anon.vpn`), a TOR node (`#cno.infra.anon.tor`), or an anonymous proxy (`#cno.infra.anon.proxy`).

Lift Form by Tag

Lift form by tag lifts only those nodes of the specified form that have a particular tag.

Syntax:

<form> **#** *<tag>*

Examples:

Lift the FQDN nodes that ESET associates with Sednit:

```
inet:fqdn#rep.eset.sednit
```

Lift the inet:ipv4 nodes associated with DNS sinkhole infrastructure:

```
inet:ipv4#cno.infra.dns.sink.hole
```

Tip

A "lift form by tag" operation is equivalent to a "lift and filter" operation that first lifts **all** nodes of the specified form, and then filters the results to **only** those nodes with the specified tag. This set of operations is potentially resource-intensive and inefficient (why lift **all** nodes only to discard most of them?). Instead, Synapse specifically optimizes "lift form by tag" operations to **only** lift nodes that have the tag.

In fact, if you specify a Storm query such as `inet:fqdn +#rep.mandiant.apt1`, Synapse will execute the query as if you had specified the "lift form by tag" query `inet:fqdn#rep.mandiant.apt1`. In other words, in some cases Synapse knows to "do what you mean" in order to process your queries more efficiently.

Lift Using Tag Timestamps

A tag timestamp can be thought of as a specialized "property" of a tag that happens to be a date / time range (interval). You can lift nodes based on tag timestamp values using any comparison operator supported by interval (*ival* types). The time / interval extended operator (`@=`) is used most often, but equal to (=) can also be used to **exact** match the values in the interval.

See *Lift by Time or Interval (@=)* for additional detail on the use of the `@=` operator.

Syntax:

[*<form>*] **#** *<tag>* **@=** *<time>* | **(** *<min_time>* **,** *<max_time>* **)**

Lift any nodes that were associated with anonymous VPN infrastructure between December 1, 2023 and January 1, 2024:

```
#cno.infra.anon.vpn @= ( 2023/12/01, 2024/01/01 )
```

Lift the FQDNs that were owned / controlled by Threat Cluster 15 as of October 30, 2021:

```
inet:fqdn#cno.threat.t15.own @= 2021/10/30
```

Lift the IP addresses that were TOR exit nodes between April 1, 2023 and July 1, 2023:

```
inet:ipv4#cno.infra.anon.tor.exit @= ( 2023/04/01, 2023/07/01 )
```

Lift Using Tag Properties

Tag Properties can be used to provide additional context to tags. Storm supports lifting nodes whose tags have a specific tag property (regardless of the value of the property).

Note

In many cases, information previously recorded using a tag property is better suited to the use of an *Extended Property*.

Syntax:

[*<form>*] **#** *<tag>* **:** *<tagprop>*

Lift any nodes with a ":risk" property reported by Symantec:

```
#rep.symantec:risk
```

Lift all FQDNs with a ":risk" property reported by Symantec:

```
inet:fqdn#rep.symantec:risk
```

> **Note**
>
> You must specify a tag associated with the tag property. It is not possible to lift nodes based on a particular tag property being present on **any** tag (e.g., Storm queries such as `#:risk` or `inet:fqdn#:risk` will generate `BadSyntax` errors).

Lift Using Tag Property Values

Storm supports lifting nodes based on the value of a tag property (similar to lifting by the value of a node property).

You can lift nodes based on tag property values using any comparison operator supported by the property's *Type*. For example, if the tag property is defined as an integer (`int`) type, you can use any comparison operator supported by integers.

The *"Try" Operator* (`?=`) can optionally be used in place of the standard equal to operator (`=`) for tag property values. Use of the try operator is generally not required for interactive Storm queries, but may be useful for more complex Storm queries (such as automation or Storm-based ingest queries).

Syntax:

[*<form>*] **#** *<tag>* **:** *<tagprop>* *<operator>* *<pval>*

Lift any nodes with a ":risk" property value of 100 as reported by ESET:

```
#rep.eset:risk = 100
```

Lift all FQDNs with a ":risk" property value greater than 90 as reported by domaintools:

```
inet:fqdn#rep.domaintools:risk > 90
```

Lift all FQDNs with a ":risk" property with a value between 45 and 70 as reported by Symantec:

```
inet:fqdn#rep.symantec:risk *range= ( 45, 70 )
```

Recursive Tag Lift (##)

Tags can be applied to `syn:tag` nodes to record additional information about the the observation represented by the `syn:tag` node itself. In other words, tags (labels) can be used to provide additional context about tags (`syn:tag` nodes).

The ability to "tag the tags" can be used to represent certain types of analytical relationships. For example:

- `syn:tag` nodes representing threat groups can be tagged to indicate their assessed country of origin.
- `syn:tag` nodes representing malware or tools can be tagged with their assessed availability (e.g., public, private, private but shared, etc.)

A recursive tag lift retrieves all nodes with the specified tag. If the results include any `syn:tag` nodes, the recursive lift will also lift any nodes with those tags. The process continues until no more `syn:tag` nodes are returned.

The final result set returned by a recursive tag lift includes all of the nodes that were lifted recursively, but will **not** include any lifted `syn:tag` nodes themselves.

The "double hashtag" symbol (`##`) is used to specify a recursive tag lift.

Syntax:

<*tag*>

Example:

You are using "availability" tags to show the general availability of malware or tools reported by Mandiant. You add the appropriate "availability" tag to the `syn:tag` node that represents the associated malware. For example, you apply the tag `#rep.mandiant.avail.public` to the node `syn:tag=rep.mandiant.gh0st` because Mandiant reported that the source code for the Gh0st backdoor is publicly available.

Lift all the nodes (e.g., indicators of compromise) associated with any malware family or tool that Mandiant reports is publicly available:

```
##rep.mandiant.avail.public
```

The query above will:

- Lift all nodes tagged `#rep.mandiant.avail.public`, such as `syn:tag` nodes for tools or malware families that Mandiant assesses are publicly available (e.g., `syn:tag=rep.mandiant.gh0st` or `syn:tag=rep.mandiant.beacon`).
- Lift any nodes tagged with those tags (e.g., `#rep.mandiant.gh0st` or `#rep.mandiant.beacon`). This would typically include IOCs such as hashes, FQDNs, IPv4s, URLs, etc.
- If any nodes tagged with the additional tags (`#rep.mandiant.gh0st`, etc.) are `syn:tag` nodes, repeat the process, continuing until no more `syn:tag` nodes are lifted.
- Return the recursively lifted set of nodes (excluding any `syn:tag` nodes).

Note

"Tag the tags" is one approach to provide context to things that tags represent and may be suitable for some use cases. However, the Synapse data model now includes **forms** to represent objects or concepts that are commonly associated with tags, and that can be linked to their associated tag via a `:tag` secondary property. For example, a `risk:tool:software` node can represent Mandiant's reporting on Gh0st malware, with a `:tag` property that could be set to `rep.mandiant.gh0st`. The node can be used to record additional context about Mandiant's Gh0st, including things like availability, alternate names used in reporting, and so on. In short, using a form with secondary properties to provide "context" (that is still linked to an associated tag) gives you greater flexibility to record that context and simplifies lifting, filtering, and pivoting across similar nodes.

See *Tags Associated with Nodes* for a brief discussion of this concept, or the User Guide for the Vertex-Threat-Intel Power-Up (in particular, the Threat Intel Model section) for additional examples.

"reverse" Keyword

Synapse indexes property values so that data (nodes) can be lifted (retrieved) and returned quickly. By default, lift results are returned in lexical order (i.e., sorted in ascending order), based on the property specified in the lift (primary, secondary, universal, or extended) and the way the property is indexed.

The `reverse` keyword can be used to return the specified nodes in reverse lexical order (i.e., sorted in descending order). To perform a "reverse" lift, specify the `reverse` keyword and enclose the lift operation in parentheses.

A "reverse" lift can be followed by additional Storm operations (pivots, filters, commands) just like a "normal" lift.

Tip

When using the `reverse` keyword to lift by secondary property value using an *Interface* name, Synapse performs the lifts for each form in parallel, and yields the results in descending order. For example, the following query will

return all nodes of all forms that inherit the `it:host:activity` interface that have a `:time` value greater than or equal to 2024/02/01, sorted in descending order (most recent first):

```
reverse (it:host:activity:time >= 2024/02/01)
```

Syntax:

reverse (<*lift*>)

Examples:

Lift inet:ipv4 nodes with a :loc property (sorted descending based on the :loc property value):

```
storm> reverse ( inet:ipv4:loc )
inet:ipv4=197.155.229.194
        :loc = zw.ha.harare
        :type = unicast
        .created = 2025/07/03 18:39:02.268
inet:ipv4=41.221.147.14
        :loc = zw
        :type = unicast
        .created = 2025/07/03 18:39:02.268
inet:ipv4=41.164.23.42
        :loc = za.wc.worcester
        :type = unicast
        .created = 2025/07/03 18:39:01.810
inet:ipv4=155.254.9.3
        :loc = us.mt.three forks
        :type = unicast
        .created = 2025/07/03 18:39:01.811
inet:ipv4=102.64.66.222
        :loc = tz.02.dar es salaam
        :type = unicast
        .created = 2025/07/03 18:39:01.812
```

Lift five inet:ipv4 nodes (sorted descending based on the integer value of the inet:ipv4 primary property):

```
storm> reverse ( inet:ipv4 ) | limit 5
inet:ipv4=255.255.255.255
        :type = private
        .created = 2025/07/03 18:39:02.277
inet:ipv4=223.159.33.195
        :type = unicast
        .created = 2025/07/03 18:39:02.278
inet:ipv4=198.42.76.23
        :type = unicast
        .created = 2025/07/03 18:39:02.278
inet:ipv4=197.155.229.194
        :loc = zw.ha.harare
        :type = unicast
        .created = 2025/07/03 18:39:02.268
inet:ipv4=185.29.8.215
        :type = unicast
        .created = 2025/07/03 18:39:02.123
```

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```
        #cno.infra.anon.tor.exit = (2023/05/08 14:30:51.000, 2024/01/04 22:05:03.000)
```

Lift the five most recently-created inet:email nodes (sorted descending by the .created property value):

```
storm> reverse ( inet:email.created ) | limit 5
inet:email=illia.volochii@gmail.com
        :fqdn = gmail.com
        :user = illia.volochii
        .created = 2025/07/03 18:39:02.306
inet:email=dholth@fastmail.fm
        :fqdn = fastmail.fm
        :user = dholth
        .created = 2025/07/03 18:39:02.304
inet:email=alex.gronholm@nextday.fi
        :fqdn = nextday.fi
        :user = alex.gronholm
        .created = 2025/07/03 18:39:02.303
inet:email=support@hammer-software.com
        :fqdn = hammer-software.com
        :user = support
        .created = 2025/07/03 18:39:02.302
inet:email=20231128124623.11d85d83ed11a341@adnoc.ae
        :fqdn = adnoc.ae
        :user = 20231128124623.11d85d83ed11a341
        .created = 2025/07/03 18:39:02.301
```

Note

In some cases, Synapse uses specialized indexing to optimize specific Storm operations (such as the ability to lift forms by tag) or to make it easier to work with certain types of data (type-specific behavior). For example, FQDN strings (`inet:fqdn` types) are reversed before being indexed.

Where specialized indexing is used, both "normal" and "reverse" lifts still return nodes in lexical or reverse lexical order, respectively. However, the "sort order" of the results may not be apparent, based on the custom criteria used to index the nodes.

See the *Storm Reference - Type-Specific Storm Behavior* section for details on some type-specific behaviors, including any custom indexing for the listed types.

"Try" Operator

The Storm "try" operator (?=) can be used in lift operations as an alternative to the equal to (=) comparison operator.

Properties in Synapse are subject to *Type Enforcement*. Type enforcement makes a reasonable attempt to ensure that a value "makes sense" for the property in question - that the value you specify for an `inet:ipv4` node looks reasonably like an IPv4 address (and not an FQDN or URL). If you try to lift a set of nodes using a property value that does not pass Synapse's type enforcement validation, Synapse will generate an error. The error will cause the currently executing Storm query to halt and stop processing. For example, the following query halts based on the bad value (`evil.com`) provided for an `inet:ipv4` node:

```
storm> inet:ipv4 = evil.com inet:ipv4 = 8.8.8.8
ERROR: illegal IP address string passed to inet_aton
```

When using the try operator (?=), Synapse will to attempt (try) to lift the node(s) using the specified property value. However, instead of halting in the event of an error, Synapse will ignore the error (silently fail on that specific lift operation) but continue processing the rest of the Storm query. Using the try operator below, Synapse ignores the bad value for the first IPv4 address but returns the second one:

```
storm> inet:ipv4 ?= evil.com inet:ipv4 ?= 8.8.8.8
inet:ipv4=8.8.8.8
        :type = unicast
        .created = 2025/07/03 18:39:02.131
        #rep.domaintools:risk = 42
```

The try operator is generally not necessary for interactive Storm queries. However, it can be very useful for more complex Storm queries or Storm-based automation (see *Storm Reference - Automation*), where a single badly-formatted lift operation (potentially relying on input or data from a third-party data source) could cause the query to fail during execution.

Tip

The try operator can also be used when lifting using an *Interface*.

Syntax:

<form> **?=** *<valu>*

<form> **:** *<prop>* **?=** *<pval>*

<interface> **:** *<prop>* **?=** *<pval>*

Tip

See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* for specialized "try" syntax when working with array properties.

Examples:

Try to lift the MD5 node 174cc541c8d9e1accef73025293923a6:

```
storm> hash:md5 ?= 174cc541c8d9e1accef73025293923a6
hash:md5=174cc541c8d9e1accef73025293923a6
        .created = 2025/07/03 18:39:02.318
```

Try to lift the DNS A nodes whose :ipv4 property is 192.168.0.100:

```
storm> inet:dns:a:ipv4 ?= 192.168.0.100
inet:dns:a=('woot.com', '192.168.0.100')
        :fqdn = woot.com
        :ipv4 = 192.168.0.100
        .created = 2025/07/03 18:39:02.322
```

Try to lift the email address nodes for ron@vertex.link and ozzie@vertex.link:

Notice that despite the first email address being entered incorrectly, the error message is suppressed, and the query executes to completion.

```
storm> inet:email ?= 'ron[at]vertex.link' inet:email ?= 'ozzie@vertex.link'
inet:email=ozzie@vertex.link
        :fqdn = vertex.link
        :user = ozzie
        .created = 2025/07/03 18:39:02.327
```

Try to lift any Microsoft Office document metadata nodes (all nodes of all forms that inherit the file:mime:msoffice interface) whose author (:author property) is 'Rafael Moon':

```
file:mime:msoffice:author ?= 'Rafael Moon'
```

3.6.4 Storm Reference - Filtering

Filter operations are performed on the output of a previous Storm operation such as a lift or pivot. A filter operation downselects from the working set of nodes by either including or excluding a subset of nodes based on specified criteria.

- + specifies an **inclusion** filter. The filter downselects the working set to **only** those nodes that match the specified criteria.
- - specifies an **exclusion** filter. The filter downselects the working set to all nodes **except** those that match the specified criteria.

Similar to lift operations (*Storm Reference - Lifting*), filter operations can be broken down into "types" of filters based on the criteria, comparison operator, or special handler used:

- *Filter by Form*
- *Filter by Property*
- *Filter by Property Value - Standard Comparison Operators*
- *Filter by Property Value - Extended Comparison Operators*
- *Tag Filters*

Tip

In general, you can filter using the same criteria and comparison operators used for lift operations. This includes using a wildcard (*) to partially match form names and using *Interface* names to filter by all forms that inherit an interface.

Because filter operations act on a pre-selected **subset** of nodes, some additional methods are available for filtering that would be less efficient for initial lift operations. For example, you can filter FQDNs (`inet:fqdn` nodes) by prefix (^=), although you cannot lift FQDNs using that operator. Similarly, you can *Filter by Tag Globs* but you cannot lift using that syntax.

Storm also supports specialized filters and filter operations:

- *Compound Filters*
- *Subquery Filters*
- *Expression Filters*
- *Embedded Property Syntax*

See *Storm Reference - Document Syntax Conventions* for an explanation of the syntax format used below.

See *Storm Reference - Type-Specific Storm Behavior* for details on special syntax or handling for specific data types.

Filter by Form

A "filter by form" operation modifies your working set to include (or exclude) all nodes of the specified form. The wildcard (asterisk) character (*) can be used to filter based on forms that match a partial form name / namespace.

If the form inherits an *Interface*, you can specify the interface name to filter based on all forms that inherit the interface.

Filter by Form Name

Syntax:

<query> **+ | -** *<form>*

Examples:

Filter the current working set to only include domains (inet:fqdn nodes):

```
<query> +inet:fqdn
```

Filter the current working set to exclude URLs (inet:url nodes):

```
<query> -inet:url
```

Filter by Form Name - Wildcard

You can use the wildcard (asterisk) character (*) to specify all forms that match a partial form name. Use of the wildcard is not limited to form namespace boundaries.

> **Note**
>
> The wildcard can only be used at the end of the partial match. It cannot be used at the beginning or in the middle of the form name. For example, both of the following are **invalid**:
>
> `+*:header`
>
> `-it:exec:*:del`
>
> In addition, use of the wildcard does not extend to partial matching of property names. For example, the following is **invalid**:
>
> `+file:bytes:mime:pe:*`

Syntax:

<query> **+ | -** *<partial_form_name>* *****

Examples:

Filter the current working set to exclude PE metadata nodes (e.g., file:mime:pe:resource, file:mime:pe:section, etc.):

```
<query> -file:mime:pe:*
```

Filter the current working set to only include antivirus / scan-related nodes (e.g., it:av:scan:result, it:av:signame):

```
<query> +it:av:s*
```

Filter Form by Interface

You can use the name of an interface to filter all forms that inherit that interface.

Note

When filtering by interface, you cannot use the wildcard (*) character to match multiple interface names. Synapse will interpret use of the wildcard as an attempt to match multiple form names.

Syntax:

<query> **+** | **-** *<interface>*

Examples:

Filter the current working set to only include host activity nodes (all nodes of all forms that inherit the it:host:activity interface):

```
<query> +it:host:activity
```

Filter the current working set to exclude taxonomy nodes (all nodes of all forms that inherit the meta:taxonomy interface):

```
<query> -meta:taxonomy
```

Filter by Property

A "filter by property" operation modifies your working set to include (or exclude) all forms that **have** the specified property (secondary, universal, or extended), regardless of the property value.

Tip

When filtering by property, you can specify the property using either the **full** property name (i.e., the combined form and property, such as `inet:dns:a:ipv4`) or the **relative** property name (i.e., the property name alone, including its separator character, such as `:ipv4`).

Using the relative property name allows for simplified syntax and more efficient data entry ("less typing"). Full property names can be used for clarity (i.e., specifying **exactly** what you want to filter on).

Full property names are **required** when filtering on a property using an interface. They may also be required in cases where multiple nodes in the inbound working set have the same relative property name (e.g., `inet:dns:a:ipv4` and `inet:url:ipv4`) and you only wish to filter based on the property of one of the forms.

Each example below is shown using both the full property name (*<form>:<prop>*) and the relative property name (*:<prop>*) where applicable.

Filter by Secondary Property

Syntax:

<query> **+** | **-** [*<form>*] **:** *<prop>*

Examples:

Filter the current working set to only include threats (risk:threat nodes) that have an assessed country of origin (:country:code property):

```
<query> +risk:threat:country:code
```

```
<query> +:country:code
```

Filter the current working set to exclude articles (media:news nodes) that have a publisher name (:publisher:name property):

```
<query> -media:news:publisher:name
```

```
<query> -:publisher:name
```

Filter by Interface Property

If a form inherits an *Interface*, you can filter all nodes of all forms that have an interface-derived property by specifying the full name of the interface and its property.

Syntax:

<query> **+** | **-** *<interface>* **:** *<prop>*

Example:

Filter the current working set to only include those host activity nodes (all nodes of all forms that inherit the it:host:activity interface) that have a :time property:

```
<query> +it:host:activity:time
```

> **Tip**
>
> When filtering using an interface property, you must use full property syntax (i.e., the combined interface and property name).

Filter by Universal Property

Syntax:

<query> **+** | **-** [*<form>*] **.** *<prop>*

Example:

Filter the current working set to only include DNS A records (inet:dns:a nodes) that have a .seen property:

```
<query> +inet:dns:a.seen
```

```
<query> +.seen
```

Filter by Extended Property

Syntax:

<query> **+** | **-** [*<form>*] **:_** *<prop>*

Example:

Filter the current working set to exclude those organizations (ou:org nodes) that have an "isthreat" extended property:

```
<query> -ou:org:_vertex:threatintel:isthreat
```

```
<query> -:_vertex:threatintel:isthreat
```

Tip

The `:_vertex:threatintel:isthreat` extended property is a Boolean property added by the Vertex-Threat-Intel Power-Up. It can be used to indicate whether an organization is tracked as a threat group.

Filter by Property Value - Standard Comparison Operators

A "filter by property value" operation modifies the current working set to include (or exclude) the node(s) whose property matches the specified value. This type of filter requires:

- the filter operator (+ or -);
- the property name (full or relative) to use for the filter;
- a *Comparison Operator* to specify how the property value should be evaluated; and
- the property value.

A "filter by property value" can be performed using primary, secondary, universal, or extended properties.

In Synapse, we define **standard comparison operators** as the following set of operators:

- equal to (=)
- less than (<)
- greater than (>)
- less than or equal to (<=)
- greater than or equal to (>=)

For filter operations, the not equal (`!=`) operator is also supported.

When filtering by secondary or extended property value, you can specify the property using either the **full** property name (i.e., the combined form and property, such as `inet:dns:a:ipv4`) or the **relative** property name (i.e., the property name alone, including its separator character, such as `:ipv4`).

When filtering by universal property value, only the relative property name is required.

Using the relative property name allows for simplified syntax and more efficient data entry ("less typing"). Full property names can be used for clarity (i.e., specifying **exactly** what you want to filter on).

Full property names are **required**:

- when filtering based on an interface property value.
- in cases where multiple nodes in the inbound working set have the same relative property name (e.g., `inet:dns:a:ipv4` and `inet:url:ipv4`, or a universal property such as `.seen`) and you only wish to filter based on the property of one of the forms.

Each example below is shown using both the full property name (*<form>:<prop>*) and the relative property name (*:<prop>*) where applicable.

> **Tip**
>
> When filtering nodes by a property value where the value is a time (date / time), you do not need to use full `YYYY/MM/DD hh:mm:ss.mmm` syntax. Synapse allows you to use either lower resolution values (e.g., `YYYY/MM/DD`) or wildcard values (e.g., `YYYY/MM*`). In particular, wildcard syntax can be used to specify any values that match the wildcard expression. See the type-specific documentation for *time* types for a detailed discussion of these behaviors.

Filter by Primary Property Value

Syntax:

<query> **+** | **-** *<form>* *<operator>* *<valu>*

Filter the current working set to exclude the loopback IPv4 address (127.0.0.1):

```
<query> -inet:ipv4 = 127.0.0.1
```

```
<query> +inet:ipv4 != 127.0.0.1
```

Filter by Secondary Property Value

Syntax:

<query> **+** | **-** [*<form>*] **:** *<prop>* *<operator>* *<pval>*

Filter the current working set to include only those domains (inet:fqdn nodes) that are also logical zones:

```
<query> +inet:fqdn:iszone = 1
```

```
<query> +:iszone  = 1
```

Filter the current working set to exclude any files (file:bytes nodes) with a PE compiled time of 1992-06-19 22:22:17:

```
<query> -file:bytes:mime:pe:compiled = '1992/06/19 22:22:17'
```

```
<query> -:mime:pe:compiled = '1992/06/19 22:22:17'
```

Filter the current working set to include only those files (file:bytes nodes) compiled in 2019:

```
<query> +file:bytes:mime:pe:compiled = 2019*
```

```
<query> +:mime:pe:compiled = 2019*
```

Filter thet current working set to exclude those files (file:bytes nodes) whose size is greater than or equal to 1MB:

```
<query> -file:bytes:size >= 1000000
```

```
<query> -:size >= 1000000
```

Filter by Interface Property Value

If a form inherits an *Interface*, you can filter all nodes of all forms with a specific interface-derived property value by using the name of the interface.

Syntax:

<query> **+** | **-** *<interface>* **:** *<prop>* *<operator>* *<pval>*

Examples:

Filter the current working set to only include those Microsoft Office metadata nodes (all nodes of all forms that inherit the file:mime:msoffice interface) whose :author property is 'admin':

```
<query> +file:mime:msoffice:author = admin
```

Filter the current working set to exclude any host activity nodes (all nodes of all forms that inherit the it:host:activity interface) observed earlier than January 1, 2024:

```
<query> -it:host:activity:time < 2024/01/01
```

Filter by Universal Property Value

Synapse has two built-in universal properties:

- `.created` (a time) which represents the date and time a node was created in Synapse; and
- `.seen` (an interval), a pair of date / time values that can optionally be used to represent when the object represented by a node existed or was observed.

Times (date / time values) are stored as integers (epoch milliseconds) in Synapse and can be filtered using any standard comparison operator.

Because intervals are a pair of date / time values, they can only be filtered using the equal to (=) standard comparison operator to specify an **exact** match for the interval values.

The *Filter by Time or Interval (@=)* and *Filter by Range (*range=)* extended comparison operators provide additional flexibility when filtering by times and intervals.

See the *time* and *ival* sections of the *Storm Reference - Type-Specific Storm Behavior* guide for additional details on working with times and intervals in Synapse.

Syntax:

+ | **-** [*<form>*] **.** *<prop>* *<operator>* *<pval>*

Filter the current working set to include only those nodes created on January 1, 2024 or later:

```
<query> +.created >= 2024/01/01
```

Filter the current working set to include only those FQDNs (inet:fqdn nodes) created on January 1, 2024 or later:

```
<query> +inet:fqdn.created >= 2024/01/01
```

Filter the current working set to include only the DNS A records (inet:dns:a nodes) whose .seen property exactly matches the specified interval:

```
<query> +inet:dns:a.seen = ('2016/06/01 12:22:47.234', '2017/06/10 02:44:55.437')
```

```
<query> +.seen = ('2016/06/01 12:22:47.234', '2017/06/10 02:44:55.437')
```

Filter by Extended Property Value

When filtering by extended property value, you can use any standard comparison operator supported by the property's type. For example, if the extended property is a string, only the equal to (=) standard operator is supported. If the extended property is an integer, any of the standard operators can be used.

Syntax:

+ | **-** [*<form>*] **:_** *<prop>* *<operator>* *<pval>*

Filter the current working set to include only those organizations (ou:org nodes) which are categorized as threats:

```
<query> +ou:org:_vertex:threatintel:isthreat = true
```

```
<query> +:_vertex:threatintel:isthreat = true
```

Tip

Boolean values can be specified using either `true` / `false` or `1` / `0`.

Filter the current working set to incldue only those files whose VirusTotal "reputation" score is less than -100:

```
<query> +file:bytes:_virustotal:reputation < -100
```

```
<query> +:_virustotal:reputation < -100
```

Filter by Property Value - Extended Comparison Operators

Storm supports a set of extended comparison operators (comparators) for specialized filter operations. In most cases, the same extended comparators are available for both lifting and filtering:

- *Filter by Regular Expression (~=)*
- *Filter by Prefix (^=)*
- *Filter by Time or Interval (@=)*
- *Filter by Range (*range=)*
- *Filter by Set Membership (*in=)*
- *Filter by Proximity (*near=)*
- *Filter by (Arrays) (*[ ])*

Each extended comparision operator can be used with any kind of property (primary, secondary, universal, or extended) whose *Type* is appropriate for the comparison used. When filtering by secondary property value, you can optionally specify an *Interface* name and property to filter based on all forms that inherit that interface.

Filter by Regular Expression (~=)

The extended comparator ~= is used to filter nodes based on PCRE-compatible regular expressions.

Tip

Filter by Prefix (^=) can be used to filter based on the beginning of string-based properties, and is more efficient for beginning-of-string filter operations. It should be used instead of a regular expression filter where possible.

Syntax:

<query> **+ | -** *<form>* **~=** *<regex>*

<query> **+ | -** [*<form>*] **: | . | :_** *<prop>* **~=** *<regex>*

<query> **+ | -** *<interface>* **:** *<prop>* **~=** *<regex>*

Examples:

Filter the current working set to include only files (file:bytes nodes) with a PDB path containing the string 'tekide':

```
<query> +file:bytes:mime:pe:pdbpath ~= tekide
```

```
<query> +:mime:pe:pdbpath ~= tekide
```

Filter the current working set to exclude organizations (ou:org nodes) whose name contains a string that starts with "v", followed by 0 or more characters, followed by "x":

```
<query> -ou:org:name ~= '^v.*x'
```

```
<query> -:name ~= '^v.*x'
```

Filter the current working set to only include taxonomy nodes (all nodes of all forms that inherit the meta:taxonomy interface) whose description (:desc property) includes the string 'credential':

```
<query> +meta:taxonxomy:desc ~= credential
```

Filter by Prefix (^=)

Synapse performs prefix indexing on strings and string-derived types, which optimizes filtering nodes whose *<valu>* or *<pval>* starts with a given prefix (substring). The extended comparator **^=** is used to filter nodes by prefix.

Note

Extended string types that support dotted notation (such as the *loc* or *syn:tag* types) have custom behaviors with respect to lifting and filtering by prefix.

inet:fqdn nodes are indexed in reverse string order so cannot be **lifted** using the prefix extended operator. However, they can be **filtered** by prefix.

See the relevant sections in the *Storm Reference - Type-Specific Storm Behavior* guide for details.

Syntax:

<query> **+ | -** *<form>* **^=** *<prefix>*

<query> **+ | -** [*<form>*] **: | . | :_** *<prop>* **^=** *<prefix>*

<query> **+ | -** *<interface>* **:** *<prop>* **^=** *<prefix>*

Examples:

Filter the current working set to exclude email addresses (inet:email nodes) that start with "abuse":

```
<query> -inet:email ^= abuse
```

Filter the current working set to only include organizations (ou:org nodes) whose name starts with "ministry":

```
<query> +ou:org:name ^= ministry
```

```
<query> +:name ^= ministry
```

Filter the current working set to only include Microsoft Office metadata nodes (all nodes of all forms that inherit the file:mime:msoffice interface) whose :author property starts with 'Admin':

```
<query> +file:mime:msoffice:author ^= Admin
```

Filter by Time or Interval (@=)

The time extended comparator (@=) is used to filter nodes based on comparisons among various combinations of times and intervals.

> **Tip**
>
> See *Storm Reference - Type-Specific Storm Behavior* for additional detail on the use and behavior of *time* and *ival* data types.

Syntax:

<query> **+** | **-** [*<form>*] **:** | **.** | **:_** *<prop>* **@=(** *<ival_min>* **,** *<ival_max>* **)**

<query> **+** | **-** [*<form>*] **:** | **.** | **:_** *<prop>* **@=** *<time>*

<query> **+** | **-** *<interface>* **:** *<prop>* **@=(** *<ival_min>* **,** *<ival_max>* **)**

<query> **+** | **-** *<interface>* **:** *<prop>* **@=** *<time>*

Examples:

Filter the current working set to include only those DNS A records (inet:dns:a nodes) whose .seen values fall between July 1, 2022 and and August 1, 2022:

```
+inet:dns:a.seen @= ( 2022/07/01, 2022/08/01 )
```

```
+.seen @= ( 2022/07/01, 2022/08/01 )
```

Filter the current working set to only include DNS requests (inet:dns:request nodes) that occurred on May 3, 2023 (between 05/03/2023 00:00:00 and 05/03/2023 23:59:59):

```
+inet:dns:request:time @= ( '2023/05/03 00:00:00', '2023/05/04 00:00:00' )
```

```
+:time @= ( '2023/05/03 00:00:00', '2023/05/04 00:00:00' )
```

> **Tip**
>
> Because the `inet:dns:request:time` property is a single date / time value, the following filters would also work:
>
> - `+inet:dns:request:time = 2023/05/03*`
> - `+:time = 2023/05/03*`

Filter the current working set to only include DNS A records (inet:dns:a nodes) whose resolution time window includes the date December 1, 2023:

```
<query> +inet:dns:a.seen @= 2023/12/01
```

```
<query> +.seen @= 2023/12/01
```

Filter results to include only those domain WHOIS records (inet:whois:rec nodes) where the domain was registered (created) exactly on March 19, 2019 at 5:00 UTC:

```
<query> +inet:whois:rec:created @= '2019/03/19 05:00:00'
```

```
<query> +:created @= '2019/03/19 05:00:00'
```

Note

When comparing a single time value to a time property, the `@=` comparator behaves just like the equal to (=) operator.

Filter the current working set to only include WHOIS email nodes (inet:whois:email) that were observed between July 1, 2023 and the present:

```
<query> +inet:whois:email.seen @= ( 2023/07/01, now )
```

```
<query> +.seen @= ( 2023/07/01, now )
```

Filter the current working set to only include the network flows (inet:flow nodes) that occurred within the past day:

```
<query> +inet:flow:time @= ( now, '-1 day' )
```

```
<query> +:time @= ( now, '-1 day' )
```

Filter the current working set to only include the host activity nodes (all nodes of all forms that inherit the it:host:activity interface) whose :time value is within the past three hours:

```
<query> +it:host:activity:time @= (now, '-3 hours')
```

Usage Notes:

- When specifying an interval with the `@=` operator, the minimum value is included in the interval for comparison purposes but the maximum value is **not**. This is equivalent to "greater than or equal to *<min>* and less than *<max>*". This behavior differs from that of the `*range=` operator, which includes **both** the minimum and maximum.
- **Comparing intervals to intervals:** when using an interval with the `@=` operator to filter nodes based on an interval property, Synapse returns nodes whose interval value has **any** overlap with the specified interval. For example:
  - A lift interval of September 1, 2018 to October 1, 2018 (2018/09/01, 2018/10/01) will match nodes with any of the following intervals:
    - August 12, 2018 to September 6, 2018 (2018/08/12, 2018/09/06).
    - September 13, 2018 to September 17, 2018 (2018/09/13, 2018/09/17).
    - September 30, 2018 to November 5, 2018 (2018/09/30, 2018/11/05).

- **Comparing intervals to times:** When using an interval with the `@=` operator to lift nodes based on a time property, Synapse returns nodes whose time value falls within the specified interval.
- **Comparing times to times:** When using a time with the `@=` operator to filter nodes based on a time property, Synapse returns nodes whose timestamp is an **exact match** of the specified time. In other words, in this case the interval comparator (`@=`) behaves like the equal to comparator (=).
- When specifying date / time and interval values, Synapse allows the use of both lower resolution values (e.g., `YYYY/MM/DD`), and wildcard values (e.g., `YYYY/MM*`). Wildcard time syntax may provide a simpler and more intuitive means to specify some intervals. For example `inet:whois:rec:asof=2018*` is equivalent to `inet:whois:rec:asof@=('2018/01/01', '2019/01/01')`.
- Time-based keywords (such as `now`) and relative time syntax (expressions such as `+-1 hour` or `-7 days`) can be used for interval values.

  See the type-specific documentation for *time* and *ival* types for a detailed discussion of these behaviors.

Filter by Range (*range=)

The range extended comparator (`*range=`) supports filtering nodes whose *<form> = <valu>* or *<prop> = <pval>* fall within a specified range of values. The comparator can be used with types such as integers and times.

Note

The `*range=` operator can be used to filter both `inet:ipv4` and `inet:ipv6` values (which are stored as decimal integers and strings, respectively). However, ranges of *inet:ipv4* and inet:ipv6 nodes can also be filtered directly by specifying the lower and upper addresses in the range using `<min>-<max>` format. For example:

- `+inet:ipv4 = 192.168.0.0-192.168.0.10`
- `+:ipv4 = 192.168.0.0-192.168.0.10`

Because IPv6 nodes are stored as strings, the range must be enclosed in quotes:

- `+inet:ipv6 = "::0-ff::ff"`
- `+:ipv6 = "::0-ff::ff"`

The `*range=` operator cannot be used to compare a time range with a property value that is an interval (`ival` type). The interval (`@=`) operator should be used instead.

Syntax:

<query> **+ | -** *<form>* ***range = (** *<range_min>* **,** *<range_max>* **)**

<query> **+ | -** [*<form>*] **: | . | :_** *<prop>* ***range = (** *<range_min>* **,** *<range_max>* **)**

<query> **+ | -** *<interface>* **:** *<prop>* ***range = (** *<range_min>* **,** *<range_max>* **)**

Examples:

Filter the current working set to exclude files (file:bytes nodes) whose size is between 1000 and 100000 bytes:

```
<query> -file:bytes:size *range= ( 1000, 100000 )
```

```
<query> -:size *range= ( 1000, 100000 )
```

Filter the current working set to only include files (file:bytes nodes) whose VirusTotal "reputation" score is between -20 and 20:

```
<query> +file:bytes:_virustotal:reputation *range= ( -20, 20 )
```

```
<query> +:_virustotal:reputation *range= ( -20, 20 )
```

Filter the current working set to exclude domain WHOIS records (inet:whois:rec nodes) that were captured / retrieved between November 29, 2013 and June 14, 2016:

```
<query> -inet:whois:rec:asof *range= ( 2013/11/29, 2016/06/14 )
```

```
<query> -:asof *range= ( 2013/11/29, 2016/06/14 )
```

Filter the current working set to only include DNS requests (inet:dns:request nodes) made within one day of December 1, 2021:

```
<query> +inet:dns:request:time *range= ( 2021/12/01, '+-1 day' )
```

```
<query> +:time *range= ( 2021/12/01, '+-1 day' )
```

Filter the current working set to only include taxonomy nodes (all nodes of all forms that inherit the meta:taxonomy interface) whose :depth is between 1 and 3 (i.e., between 2 and 4 taxonomy elements):

```
<query> +meta:taxonomy:depth *range= (1, 3)
```

Usage Notes:

- When specifying a range (`*range=`), both the minimum and maximum values are **included** in the range (the equivalent of "greater than or equal to <*min*> and less than or equal to <*max*>"). This behavior is slightly different than that for time interval (`@=`), which includes the minimum but not the maximum.
- When specifying a range of time values, Synapse allows you to use either lower resolution values (e.g., `YYYY/MM/DD`) or wildcard values (e.g., `YYYY/MM*`) for the minimum and/or maximum range values. In some cases, plain wildcard time syntax may provide a simpler and more intuitive means to specify some time ranges. For example `+inet:whois:rec:asof=2018*` (or `+:asof=2018*`) is equivalent to `+inet:whois:rec:asof*range=('2018/01/01', '2018/12/31 23:59:59.999')` (or `+:asof*range=('2018/01/01', '2018/12/31 23:59:59.999')`). See the type-specific documentation for *time* types for a detailed discussion of these behaviors.
- When using keywords (such as `now`) or relative values (such as `-1 hour`) to specify a range of times, the first value in the range is calculated relative to the current time and the second value is calculated relative to the first value.
- If you specify a range value that is nonsencical or exclusionary (such as `( 47, 16 )`), Synapse will **not** generate an error and will simply fail to return results. (The expression is syntacticaly correct, but no value is both greater than 47 and less than 16).

Filter by Set Membership (*in=)

The set membership extended comparator (`*in=`) supports filtering nodes whose <*form*> = <*valu*> or <*prop*> = <*pval*> matches any of a set of specified values. The comparator can be used with any type.

Syntax:

<*query*> **+** | **-** <*form*> ***in =** (<*set_1*> **,** <*set_2*> **,** ...)

<*query*> **+** | **-** [<*form*>] **:** | **.** | **:_** <*prop*> ***in =** (<*set_1*> **,** <*set_2*> **,** ...)

<*query*> **+** | **-** <*interface*> **:** <*prop*> ***in =** (<*set_1*> **,** <*set_2*> **,** ...)

Examples:

Filter the current working set to exclude organization names (ou:name nodes) matching any of the specified values:

```
<query> -ou:name *in= ( fsb, gru, svr )
```

Filter the current working set to only include IPv4 addresses associated with any of the specified Autonomous System (AS) numbers:

```
<query> +inet:ipv4:asn *in= ( 9009, 20473, 44477 )
```

```
<query> +:asn *in= ( 9009, 20473, 44477 )
```

Filter the current working set to only include tags (syn:tag nodes) whose final tag element matches any of the specified string values:

```
<query> +syn:tag:base *in= ( plugx, korplug, sogu, kaba )
```

```
<query> +:base *in= ( plugx, korplug, sogu, kaba )
```

Filter by Proximity (*near=)

The proximity extended comparator (*near=) supports filtering nodes by "nearness" to another node. Currently, *near= supports proximity based on geospatial location (i.e., nodes within a given radius of a specified latitude / longitude).

Syntax:

<*query*> **+** | **-** [<*form*>] **:** | **.** | **:_** <*prop*> ***near =** ((<*lat*> **,** <*long*> **),** <*radius*> **)**

Examples:

Filter the current working set to only include locations (geo:place nodes) within 500 meters of the Russian Cryptographic Museum (where the coordinates 55.83069,37.59781 represent the Museum's location):

```
<query> +geo:place:latlong *near= ( (55.83069, 37.59781), 500m )
```

Usage Notes:

- In the example above, the latitude and longitude of the desired location are explicitly specified as parameters to *near=.
- Radius can be specified in the following units. The values in parentheses are the acceptable terms for specifying a given unit:
  - Kilometers (km / kilometer / kilometers)
  - Meters (m / meter / meters)
  - Centimeters (cm / centimeter / centimeters)
  - Millimeters (mm / millimeter / millimeters)
  - Miles (mile / miles)
  - Yards (yard / yards)
  - Feet (foot / feet)
- Radius values of less than 1 must be specified with a leading zero (e.g., 0.5 km).

- The `*near=` comparator works for geospatial data by lifting nodes within a square bounding box centered at *<lat>,<long>*, then filters the nodes returned by ensuring that they are within the great-circle distance given by the *<radius>* argument.

Filter by (Arrays) (*[ ])

Storm uses a special syntax to filter (or lift) by comparison with one or more elements of an *array* type. The syntax consists of an asterisk (`*`) preceding a set of square brackets (`[ ]`), where the square brackets contain a comparison operator and a value that can match one or more elements in the array. This allows users to match any value in the array list without needing to know the exact order or values of the array itself.

Note

When filtering based on a value in an array property, you must use the relative name of the property. The full property name (i.e., the combined form and property) is not supported for this type of filter.

Syntax:

<query> **+|-:|.|:_** *<prop>* ***[** *<operator>* *<pval>* **]**

Examples:

```
<query> +:identities:fqdns *[ = '*.xyz' ]
```

Filter the current working set to exclude the MITRE ATT&CK groups (it:mitre:attack:group nodes) whose names include the string 'bear':

```
<query> -:names *[ ~= bear ]
```

Usage Notes:

- The comparison operator used must be valid for filter operations for the type used in the array.
- The standard equals (=) operator can be used to filter nodes based on array properties, but the value specified must **exactly match** the **full** property value in question:
  - For example: `ou:org +:names=("the vertex project","the vertex project llc",vertex)` will filter to any `ou:org` nodes whose `:names` property consists of **exactly** those names in **exactly** that order.
- See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* document for additional details on working with arrays.

Tag Filters

Tags in Synapse can represent observations or assessments. They are used to provide context to nodes (in the form of "labels" applied to nodes) and to group related nodes.

Storm supports filtering nodes based on the tags applied to nodes (including the use of tag globs), as well as filtering based on tag timestamps, tag properties, or tag property values.

The "hashtag" symbol (`#`) is used to specify a tag name when filtering by tag.

Filter by Tag (#)

A "filter by tag" operation downselects the current working set to include (or exclude) all nodes with the specified tag.

Syntax:

<query> **+ | - #** *<tag>*

Filter the current working set to exclude all nodes that ESET associates with Sednit:

```
<query> -#rep.eset.sednit
```

Filter the current working set to only include nodes associated with anonymized infrastructure:

```
<query> +#cno.infra.anon
```

Tip

Tags are hierarchical, and each tag element is its own tag; the tag `#cno.infra.anon` consists of the tags `#cno`, `#cno.infra`, and `#cno.infra.anon`. Filtering nodes using a tag "higher up" in the tag hierarchy will include (or exclude) nodes with the specified tag or any tag "lower down" in the hierarchy. In other words, filtering by `#cno.infra.anon` will filter all "anonymized" infrastructure, whether the infrastructure is a VPN (`#cno.infra.anon.vpn`), a TOR node (`#cno.infra.anon.tor`), or an anonymous proxy (`#cno.infra.anon.proxy`).

Filter by Tag Globs

Synapse supports filtering based on the set of tags that match a specified glob expression using single (*) or double (**) asterisks, or a combination of the two.

The single asterisk and double asterisk behave differently:

- The asterisk (*) represents an arbitrary string that matches **within** a single tag element (i.e., one element as bounded by the tag's "dot" (.) separators).
- The double asterisk (**) represents an arbitrary string match anywhere in the tag, including **across** tag elements.

Another way to look at this is that the single asterisk is constrained by the tag's "dot" boundaries, but the double asterisk is not.

Syntax:

<query> **+ | - #** *<string>* **| * | ** [. *<string>* | * | ** ...]**

Examples:

Filter the current working set to exclude any nodes tagged as "seduploader" by any third-party reporting organization:

```
<query> -#rep.*.seduploader
```

To record assessments made by third parties, The Vertex Project uses `rep` ("reported by") as the root tag element, followed by a tag element for the reporting organization (e.g., `rep.eset`), followed by the name of the "thing" reported (in this case, the `seduploader` malware family).

The tag glob filter above uses the single asterisk to match any tag element in the second position, and will match tags such as:

- `rep.eset.seduploader`
- `rep.paloalto.seduploader`

. . . etc.

Filter the current working set to include any nodes tagged as "cobaltstrike" by any third-party reporting organization whose name begins with 'm':

```
<query> +#rep.m*.cobaltstrike
```

The tag glob filter above uses the single asterisk to match any partial tag element in the second position that starts with 'm', and will match tags such as:

- `rep.malwarebazaar.cobaltstrike`
- `rep.mandiant.cobaltstrike`
- `rep.microsoft.cobaltstrike`

Tip

The filter above would **not** match on a tag such as `rep.malwarebazaar.3p.anyrun.cobaltstrike`, because the string `cobaltstrike` is not the third tag element. A double asterisk, which matches across a tag's "dot" boundaries, would match this tag as well as the example tags above:

`rep.m**cobaltstrike`

Filter the current working set to exclude any nodes tagged as "seduploader" either internally or by any third-party reporting organization:

```
<query> -#*.*.seduploader
```

The Vertex Project uses the `cno` root tag to represent our own internal assessments (and distinguish them from third party-assessments), and the `mal` element to represent assessments related to malware. The tag glob filter above uses two single asterisks to match any element in both the first and second positions, and will match all of the following:

- `rep.eset.seduploader`
- `rep.paloalto.seduploader`
- `cno.mal.seduploader`

. . . etc.

Filter the current working set to include any nodes reported by Microsoft whose tags end in "blizzard":

```
<query> +#rep.microsoft.**blizzard
```

The tag glob filter above uses a double asterisk to match any Microsoft tag (tag that begins `rep.microsoft`) that ends in "blizzard", regardless of tag depth. The filter will match all of the following:

- `rep.microsoft.aqua_blizzard`
- `rep.microsoft.cadet_blizzard`
- `rep.microsoft.forest_blizzard`
- `rep.microsoft.very.long.tag.thatendswithblizzard`

. . . etc.

Filter the current working set to exclude any nodes tagged with any tag that starts with "cno" and is followed by any string:

```
<query> -#cno**
```

The tag glob filter above uses a double asterisk to match any string following "cno". The filter will match all of the following:

- `cno.mal`
- `cno.threat.t42`
- `cnoooo.you_get_a_cno.and_you_get_a_cno`

...etc.

Note

The double asterisk must match "something" - the filter above will **not** match a node that simply has the tag `#cno`.

Filter the current working set to include any nodes tagged by any third-party reporting organization where the tag contains the string "2017":

```
<query> +#rep.*.**2017**
```

The tag glob filter above uses both a single and double asterisk. The single asterisk matches any tag element in the second position; the double asterisk matches any string that includes "2017", including across "dot" boundaries. The filter will match all of the following:

- `rep.alienvault.cve20178291`
- `rep.malwarebazaar.3p.reversinglabs.document_ole_exploit_cve_2017_11882`
- `rep.vt.cve_2017_0199`

Note

The double asterisk must match "something" - the filter above matches strings where "2017" appears **between** other arbitrary characters. The filter would not match tags such as `rep.foo.2017` or `rep.bar.baz.cve2017`.

Filter Using Tag Timestamp Values

A tag timestamp can be thought of as a specialized "property" of a tag that happens to be a date / time range (interval). You can filter nodes based on tag timestamp values using any comparison operator supported by interval (*ival* types). The time / interval extended operator (`@=`) is used most often, but equal to (=) can also be used to **exactly** match the values in the interval.

See *Filter by Time or Interval (@=)* for additional detail on the use of the `@=` operator.

Syntax:

<query> **+ | - #** *<tag>* **@=** *<time>* **|** **(** *<min_time>* **,** *<max_time>* **)**

Filter the current result set to only include nodes that were associated with anonymous VPN infrastructure between December 1, 2023 and January 1, 2024:

```
<query> +#cno.infra.anon.vpn @= ( 2023/12/01, 2024/01/01 )
```

Filter the current working set to only include nodes that were owned / controlled by Threat Cluster 15 as of October 30, 2021:

```
<query> +#cno.threat.t15.own @= 2021/10/30
```

Filter Using Tag Properties

Tag Properties can be used to provide additional context to tags. Storm supports filtering nodes whose tags have a specific tag property (regardless of the value of the property).

Note

In many cases, information previously recorded using a tag property is better suited to the use of an *Extended Property*.

Syntax:

<query> **+** | **-** **#** *<tag>* | ***** **:** *<tagprop>*

Filter the current working set to only include nodes with a ":risk" property reported by Symantec:

```
<query> +#rep.symantec:risk
```

Filter the current working set to include nodes with a ":risk" property associated with any tag:

```
<query> +#**:risk
```

Tip

When filtering based on the **existence** of a tag property, you can use tag glob syntax (see *Filter by Tag Globs*) to specify the associated tags. Filters such as `+#rep.*.*:risk` or (per the above example) `+#**:risk` are supported.

When filtering for a specific tag property that appears on **any** tag, either a double asterisk (tag glob, as above) or single asterisk can be used, e.g.: `+#*:risk`. The single asterisk in this instance is not a tag glob, but a special syntax helper for this specific use case. (That is, because entering `+#*:risk` instead of `+#**:risk` is a common user error, Synapse automatically handles this case to "do what you mean".)

Filter Using Tag Property Values

Storm supports filtering nodes based on the value of a tag property (similar to filtering by the value of a node property).

You can filter nodes based on tag property values using any comparison operator supported by the property's *Type*. For example, if the tag property is defined as an integer (`int`) type, you can use any comparison operator supported by integers.

Note

Tag glob syntax (see *Filter by Tag Globs*) is **not** supported when filtering based on a tag property value. For example, a filter such as `+#rep.**:risk>20` will generate a syntax error.

Syntax:

<query> **+** | **-** **#** *<tag>* **:** *<tagprop>* *<operator>* *<pval>*

Filter the current working set to include nodes with a ":risk" property value of 100 as reported by ESET:

```
<query> +#rep.eset:risk = 100
```

Filter the current working set to exclude nodes with a ":risk" property value less than 90 as reported by domaintools:

```
<query> -#rep.domaintools:risk < 90
```

Filter the current working set to include nodes with a ":risk" property with a value between 45 and 70 as reported by Symantec:

```
<query> +#rep.symantec:risk *range= ( 45, 70 )
```

Compound Filters

Storm supports the use of the logical operators **and**, **or**, and **not** (including **and not**) to construct compound filters. You can use parentheses to group portions of the filter statement to indicate order of precedence and clarify logical operations when evaluating the filter.

Note

- Logical operators must be specified in lower case.
- Synapse evalutes compound filters **in order from left to right**. Depending on the filter, left-to-right order may differ from the standard Boolean order of operations (**not** then **and** then **or**).
- Parentheses should be used to logically group portions of the filter statement if necessary to clarify order of operations.

Syntax:

<*query*> **+** | **-** **(** <*filter*> **and** | **or** | **not** | **and not** ... **)**

Examples:

Filter the current working set to exclude files (file:bytes nodes) that are less than or equal to 16384 bytes in size and were compiled prior to January 1, 2014:

```
<query> -(file:bytes:size <= 16384 and file:bytes:mime:pe:compiled < 2014/01/01)
```

```
<query> -(:size <= 16384 and :mime:pe:compiled < 2014/01/01)
```

Filter the current working set to only include files (file:bytes nodes) or domains (inet:fqdn nodes) that ESET associates with Sednit:

```
<query> +( ( file:bytes or inet:fqdn ) and #rep.eset.sednit )
```

*Filter the current working set to include only files (file:bytes nodes) and domains (inet:fqdn nodes) that ESET associates with Sednit that are **not* sinkholed:*

```
<query> +( ( file:bytes or inet:fqdn ) and ( #rep.eset.sednit and not #cno.infra.dns.
↪sinkhole ) )
```

Subquery Filters

You can use Storm's subquery syntax (*Storm Reference - Subqueries*) to create filters. A subquery (enclosed in curly braces ({ })) can be placed within a larger Storm query.

Most filter operations in Storm will modify (reduce) your current set of nodes based on some criteria of the **nodes themselves** (e.g., a node's form, property, or tag).

Subquery filters allow you to filter your **current** set of nodes based on some criteria of **nearby** nodes. You use the subquery filter to effectively "look ahead" at nodes one or more pivots away from your current nodes, and filter your current nodes based on the properties of those "nearby" nodes.

When nodes are passed to a subquery filter, they are evaluated against the filter's criteria:

- Nodes are **excluded** ("consumed", discarded) if they evaluate **false.**
- Nodes are **included** (not "consumed", retained) if they evaluate **true.**

The subquery pivot operation (used to "look ahead" at other nodes) is effectively performed in the background (without navigating away from your current working set), which provides a more powerful and efficent way to filter your data. (The alternative would be to **actually** navigate to the nearby nodes, filter those nodes, and then navigate **back** to the data you are interested in.)

You can optionally use a standard (mathematical) comparison operator with a subquery filter, in order to filter your current set of nodes based on the **number of results** returned by executing the subfilter's Storm query.

Refer to the *Storm Reference - Subqueries* guide for additional information on subqueries and subquery filters.

Syntax:

+ | **-** **{** <*query*> **}** [<*standard operator*> <*value*>]

Examples:

Filter the current working set of FQDNs (inet:fqdn nodes) to only FQDNs that have resolved to an IPv4 address that Trend Micro associates with Pawn Storm (i.e., an IP address tagged #rep.trend.pawnstorm):

```
<inet:fqdn> +{ -> inet:dns:a -> inet:ipv4 +#rep.trend.pawnstorm }
```

The subquery filter above takes the inbound `inet:fqdn` nodes and (within the subquery):

- pivots to the associated DNS A records (`inet:dns:a` nodes);
- pivots to the asssociated IPv4 addresses (`inet:ipv4` nodes);
- checks the IPv4 for the presence of a `#rep.trend.pawnstorm` tag.

The subquery filter returns only those `inet:fqdn` nodes where, if you performed the operations within the subquery, **would** (based on the inclusive filter) result in an `inet:ipv4` node with a `#rep.trend.pawnstorm` tag.

Filter the current working set of IPv4 addresses (inet:ipv4 nodes) to exclude any IPv4 associated with an Autonomous System (AS) whose name starts with "makonix":

```
<inet:ipv4> -{ :asn -> inet:asn +:name ^= makonix }
```

The subquery filter above takes the inbound `inet:ipv4` nodes and (within the subquery):

- pivots to the associated `inet:asn` nodes; and
- checks the `inet:asn` nodes for a `:name` value that starts with "makonix".

The subquery filter returns only those `inet:ipv4` nodes where, if you performed the operations within the subquery, **would not** (based on the exclusive filter) result in an `inet:asn` node with a `:name` value starting with "makonix".

Tip

See *Embedded Property Syntax* for an alternative way to perform this query.

Filter the current working set of files (file:bytes nodes) to include only files that are detected as malicious in (10) or more scans (i.e., files that are associated with 10 or more it:av:scan:result nodes whose :verdict property value is "malicious"):

```
<file:bytes> +{ -> it:av:scan:result +:verdict=malicious }>=10
```

The subquery filter above takes the inbound `file:bytes` nodes and (within the subquery):

- pivots to the associated `it:av:scan:result` nodes; and
- filters the results to include only those nodes whose `it:av:scan:result:verdict` property value is `malicious`; and
- counts the number of resulting `it:av:scan:result` nodes for each file.

The subquery filter returns only those `file:bytes` nodes with 10 or more associated `it:av:scan:result` nodes with a `malicious` verdict.

Tip

This is a simplified example. `it:av:scan:result` nodes represent a scan performed at a given point in time; the filter above does not provide any time constraints so will count any / all "malicious" results, regardless of "when" the scan was performed. Results could include files detected as malicious by ten different vendors during a single scan as well as files detected as malicious by only one vendor during ten different scans.

Filter the current working set of x509 certificates (crypto:x509:cert nodes) to only include certificates linked to more than one FQDN (inet:fqdn) identity:

```
<crypto:x509:cert> +{ :identities:fqdns -> inet:fqdn }>1
```

The subquery filter above takes the inbound `crypto:x509:cert` nodes and (within the subquery):

- uses the `:identities:fqdns` array property to pivot to any associated FQDNs (`inet:fqdn` nodes); and
- counts the number of `inet:fqdn` nodes associated with each certificate.

The subquery filter returns only those `crypto:x509:cert` nodes associated with more than one FQDN.

Tip

See *Expression Filters* below for an alternative way to perform this query.

Expression Filters

An expression filter is used to downselect your current working set based on the evaluation of a particular expression. Expression filters are useful when:

- you need to compute a value that you want to use for the filter, or
- when you want to filter based on a value that may change (e.g., when using Storm queries that assign variables; see *Storm Reference - Advanced - Variables*).

Syntax:

<query> **+ | - $(** *<expression>* **)**

Examples:

Filter the current working set of x509 certificates (crypto:x509:cert nodes) to only include certificates linked to more than one FQDN (inet:fqdn) identity:

```
<crypto:x509:cert> $fqdns=:identities:fqdns +$( $fqdns.size() > 1 )
```

This example assigns the list of domains in the `crypto:x509:cert:identities:fqdns` property to the user-defined variable `$fqdns`, computes the number of domains in the list using *size()*, and checks to see if the result is greater than 1.

(See the *Storm Library Documentation* for additional detail on Storm types and Storm libraries.)

Tip

This certificate example is identical to the final example under *Subquery Filters* above, and shows an alternative way to return the same data.

This expression filter is more efficient than the subquery filter because the expression filter simply evaluates the expression ("what is the size of the `:identities:fqdns` array property?"), where the subquery filter needs to pivot to the adjacent nodes in order to evaluate the results. This difference in performance is negligible for small data sets but more pronounced when working with large numbers of nodes.

Filter the current working set of network flows (inet:flow nodes) to only include flows where the total number of bytes transferred in the flow between the source (inet:flow:src:txbytes) and destination (inet:flow:dst:txbytes) is greater than 100MB (~100,000,000 bytes):

```
<inet:flow> +$( :src:txbytes + :dst:txbytes >=100000000 )
```

Filter the current set of nodes associated with any threat group or threat cluster (e.g., tagged ``#cno.threat.<threat_name>``), to include only those nodes that are attributed to more than one threat (e.g., that have more than one #cno.threat.<threat_name> tag):

```
#cno.threat +$( $node.globtags(cno.threat.*).size() > 1 )
```

This query may identify nodes that are incorrectly attributed to more than one group, or instances where two or more threat clusters overlap (which may indicate that the clusters actually represent a single set of activity).

This example uses the *$node.globtags()* method to select the set of tags on each node that match the specified expression (`cno.threat.*`) and *size()* to count the number of matches.

Filter the current working set of DNS A records (inet:dns:a nodes) to only include those whose .seen interval falls WITHIN the past 30 day window (e.g., where the <min> value of the .seen interval is greater than or equal to the date 30 days in the past:

```
$ival = $lib.cast( ival, ( now, -30 days ) )
( $start, $stop ) = $ival
inet:dns:a.seen @= $ival
( $min, $max ) = .seen
+$( $min >= $start )
```

The interval comparison operator (`@=`) will lift or filter interval properties (such as `.seen`) if the node's interval has **any overlap** with the comparison value. Using current Storm syntax, this means it is not possible to directly lift or

filter for interval values that fall **within** the comparison interval value.

The above query uses **variables** (see *Storm Reference - Advanced - Variables*) to calculate the date/time exactly 30 days prior to the current date/time (`$start` and `$stop`) and uses an expression filter to ensure that the *<min>* value of the node's `.seen` property is more recent than "30 days ago".

The query is repeated here with inline comments to note what each line is doing:

```
$ival = $lib.cast( ival, ( now, -30 days ) )  // Set the variable $ival to a pair of␣
↪date/time values specified
                                              // using the keyword "now" and the␣
↪relative value "-30 days".
( $start, $stop ) = $ival                     // Set the variables $start and $stop to␣
↪the individual date/times
                                              // from $ival.
inet:dns:a.seen @= $ival                      // Lift all inet:dns:a nodes whose .seen␣
↪property has any **overlap**
                                              // with the past 30 days.
( $min, $max ) = .seen                        // Set the variables $min and $max to the␣
↪individual date/times of the
                                              // .seen interval
+$( $min >= $start )                          // Use an expression filter to ensure that␣
↪the $min time of the node's
                                              // .seen value is greater than or equal to␣
↪the $start time of "30 days ago".
```

Embedded Property Syntax

Storm includes a shortened syntax consisting of two colons (`::`) that can be used to reference a secondary property of an **adjacent** node. Because the syntax can be used to "pull in" a property or property value from a nearby node, it is known as "embedded property syntax".

Embedded property syntax expresses something that is similar (in concept, though not in practice) to a secondary-to-secondary property pivot (see *Storm Reference - Pivoting*). The syntax expresses navigation:

- From a **secondary property** of a form (such as `inet:ipv4:asn`), to
- The **form** for that secondary property (i.e., `inet:asn`), to
- A **secondary property** (or property value) of that **target form** (such as `inet:asn:name`).

Tip

This process can be repeated to reference properties of forms more than one pivot away.

Despite its similarity to a pivot operation, embedded property syntax is commonly used for:

- **Filter operations** (specifically, as a more concise alternative to certain *Subquery Filters*)
- **Variable assignment** (see *Storm Reference - Advanced - Variables*)
- Defining an *Embed Column* in the Synapse UI (Optic)

Syntax:

<query> [**+** | **-**] **:** *<prop>* **::** *<prop>* [**::** *<prop>* ...]

<query> [**+** | **-**] **:** *<prop>* [**::** *<prop>* ...] **::** *<prop>* *<operator>* *<pval>*

Note

When using embedded property syntax in Storm, the leading colon (before the name of the initial secondary property) is **required** - e.g., `:asn::name`.

When using this syntax in Optic (the Synapse UI) to create an embed column in Tabular display mode, the initial colon should be **omitted** - e.g, `asn::name`. Optic effectively prepends the initial colon for you.

Filter Examples:

The examples below illustrate the use of embedded property syntax in a filter expresssion.

Filter the current working set of IPv4 addresses (inet:ipv4 nodes) to exclude any IPv4 associated with an Autonomous System (AS) whose name starts with "makonix":

```
<inet:ipv4> -:asn::name ^= makonix
```

Tip

This example is an alternative way to return the same data as the second example under *Subquery Filters* above:

```
<inet:ipv4> -{ :asn -> inet:asn +:name ^= makonix }
```

Filter the current working set of sandbox "file add" operations (it:exec:file:add nodes) to only those "add" operations performed by a file that has a PDB path (:mime:pe:pdbpath property):

```
<it:exec:file:add> +:sandbox:file::mime:pe:pdbpath
```

The `:sandbox:file` property of an `it:exec:file:add` node represents the file (`file:bytes` node) that was executed in the sandbox environment. If this filter were written as a subquery filter, the pivot syntax within the subquery would look like this:

```
<it:exec:file:add> +{ :sandbox:file -> file:bytes +:mime:pe:pdbpath }
```

Instead, embedded property syntax is used to represent the pivot from the `:sandbox:file` property of the `it:exec:file:add` node, to the associated `file:bytes` node, to the file's `:mime:pe:pdbpath` property.

Filter the current working set of sandbox "file add" operations (it:exec:file:add nodes) to only those "add" operations performed by a self-extracting RAR file (i.e., a file with a PDB path whose base file name is sfxrar.pdb):

```
<it:exec:file:add> +:sandbox:file::mime:pe:pdbpath::base = sfxrar.pdb
```

This example expands on the previous example to use two instances of embedded property syntax. If this filter were written as a subquery filter, the pivot syntax within the subquery would look like this:

```
<it:exec:file:add> +{ :sandbox:file -> file:bytes :mime:pe:pdbpath -> file:path +:base =␣
↪sfxrar.pdb }
```

Instead, embedded property syntax is used to represent the pivots from:

- the `:sandbox:file` property of the `it:exec:file:add` node, to the associated `file:bytes` node, to its `:mime:pe:pdbpath` property; and
- the `:mime:pe:pdbpath` property of the `file:bytes` node, to the associated `file:path` node, to its `:base` property.

Variable Assignment Example:

Embedded property syntax can also be used when assigning variables (see *Storm Reference - Advanced - Variables*).

Set the variable $name to the name of the Autonomous System (AS) associated with a given IPv4 address:

```
<inet:ipv4> $name=:asn::name
```

This example uses embedded property syntax to pivot from the inbound `inet:ipv4` node, to the ASN (`inet:asn` node) associated with the IPv4's `:asn` property, and assigns the value of the ASN's `:name` property to the variable `$name`.

3.6.5 Storm Reference - Pivoting

Pivot operations are performed on the output of a previous Storm operation such as a lift or filter. A pivot operation navigates from one set of nodes to another based on some relationship between the nodes. This relationship is commonly one of the following:

- The nodes have properties that share the same value.
- The nodes are joined by a light edge.

While all node-to-node navigation is referred to generically as "pivoting", for clarity we make a distinction with respect to Storm:

- a **pivot** operation navigates between nodes that share a **property value**; and
- a **traversal** operation navigates between nodes that are connected by a **light edge**.

> **Tip**
>
> Traversal is also known as a "walk" operation (i.e., you can *traverse* a light edge or *walk* a light edge).

Pivots and traversals each have their own operator (symbol) used to represent the operation. The operations can also be combined ("pivot and traverse") in various ways using additional operators.

Generically, all variations of pivots and traversals (including combined operations) require:

- a set of source nodes;
- an operator (symbol) for the kind of operation to be performed; and
- the target node(s) for the operation.

Pivot and traversal operations both consume nodes - each operation navigates "away" from the source nodes to the target nodes, which become your new result set / working set. *Join Operations* can be used to retain the source nodes and combine (join) them with the target nodes in your result set.

See *Storm Reference - Document Syntax Conventions* for an explanation of the syntax format used below.

See *Storm Reference - Type-Specific Storm Behavior* for details on special syntax or handling for specific data types.

Navigating the Data Model

To navigate the data in Synapse (pivot between properties or traverse light edges), it helps to understand how forms, properties, and types are related, and to be familiar with common light edge conventions and how they are used to connect various forms.

- The Synapse Data Model *Forms* documentation lists:
  - All forms in Synapse, with their associated properties and types.

  - The edges that can be used to link a given form (whether as the source or target of the edge).

- For *Optic* users, Optic's Data Model Explorer allows you to search, cross-reference, and view data model objects. In addition to the information above, Data Model Explorer also lists all of the forms that a form is **referenced by** (i.e., where that form's type is a secondary property on another form).

Using the Wildcard as a Target

In many cases you can use the wildcard or asterisk (*) as the target of a pivot or traversal to represent "all the things" that can be reached by your operation. One use for the wildcard is to "explore" a subset of connected data - for example, if you are not sure what relationships exist among the data in your instance of Synapse, and you want to see "what's connected".

Keep in mind that individual wildcard pivots or traversals (as described below) **only** show you nodes that are connected to your source nodes by the specific operation performed; this is generally **not** "all the nodes" that are connected. (See the examples below for details on individual operations.)

The following Storm expression can be used to show **all** nodes that are connected to your source nodes by **any** type of property pivot or edge traversal relationship:

```
<source_nodes> tee { --> * } { <-- * }
```

The expression uses the Storm *tee* command to perform two operations on the set of source nodes (a *Pivot Out and Traverse* and a *Pivot In and Traverse*, with the wildcard as the target in each case) and return the combined results.

> **Tip**
>
> This query is equivalent to using the Explore button in the Optic UI to navigate.

There are two minor exceptions to this "show me all the connections" query:

- The query will not return connections to edge nodes where the source node is an *Ndef* of an associated edge node. Edge nodes are not commonly used (in many cases, they have been deprecated in favor of light edges). Pivot operations involving edge nodes are described below.
- The query will not return property connections where nodes may have have a common property **value**, but the properties are of different **types** (use of the wildcard to "find" relationships depends on *Type Awareness*).

Pivot Operations

Pivot operations navigate between sets of nodes that have properties that share a common value. Each pivot operation requires:

- the source node(s) for the pivot;
- a pivot operator (such as `->`); and
- the target of the pivot.

Unless otherwise specified, the target (*<target>*) of a pivot can be:

- a form name (e.g., `hash:md5`);
- a partial form name (wildcard match, e.g., `hash:*`);
- a form and property name (e.g., `file:bytes:md5`);
- an *Interface* name (e.g., `it:host:activity`);
- an interface and property name (e.g., `file:mime:msoffice:application`);

- a list of form names (e.g., `( inet:dns:request, inet:flow )`); or
- a wildcard / asterisk (`*`).

For the specialized use case of *Raw Pivot Syntax*, the target of the pivot is a Storm expression.

Note

You cannot specify property **values** in pivot operations. For example, the following is invalid:

```
inet:fqdn=vertex.link -> inet:dns:a:ipv4=127.0.0.1
```

If you want to pivot to a specific node or subset of nodes, you must navigate to the target forms, and then filter your results based on the property value(s) you are interested in:

```
inet:fqdn=vertex.link -> inet:dns:a +:ipv4=127.0.0.1
```

Depending on the kind of pivot operation, you may need to specify a **source property** for the pivot as well; see the discussion of *Implicit Pivot Syntax* below.

While there are a few specialized use cases (such as pivoting to or from tags), most pivots involve navigating between the following kinds of properties:

- primary to secondary;
- secondary to primary;
- secondary to secondary; or
- primary to primary.

Primary to primary property pivots are a specialized use case that is commonly handled using *Raw Pivot Syntax*.

Tip

In Synapse, these property-to-property relationships are **implicit** relationships. You do not need to explicitly "define" the relationship or "link" the nodes. In fact, if the source and target properties have the same value **and** the same *Type*, Storm can use Synapse's *Type Awareness* to simplify pivot operations and identify relationships among nodes.

Implicit Pivot Syntax

Pivot operations in Storm can always be executed by **explicitly** specifying the source and target properties for the pivot. This is referred to as **explicit pivot syntax** or "explicit syntax" for short.

When researching network infrastructure, a common set of pivots is to navigate from a set of FQDNs (`inet:fqdn` nodes) to their DNS A records (`inet:dns:a` nodes) and then to the IPv4 addresses (`inet:ipv4` nodes) that the A records point to. The following Storm query performs those pivots using **explicit syntax**:

```
inet:fqdn = vertex.link -> inet:dns:a:fqdn :ipv4 -> inet:ipv4
```

The query:

- lifts the FQDN `vertex.link`;
- pivots from the FQDN to any DNS A node with the same FQDN property value (`-> inet:dns:a:fqdn`); and
- pivots from the `:ipv4` property of the `inet:dns:a` nodes to any `inet:ipv4` nodes with the same value (`:ipv4 -> inet:ipv4`).

We explicitly specify `inet:dns:a:fqdn` as the **target** property of our first pivot; and we explicitly specify the `:ipv4` property of the `inet:dns:a` nodes as the **source** property of our second pivot. Explicit syntax tells Storm **exactly** what you want to do; there is no ambiguity in the query or in "how" you want to navigate the data.

Note

When specifying a secondary property as the source of a pivot (such as `:ipv4` above), you must specify the property using relative property syntax (i.e., using the property name alone). If you were to use full property syntax (`inet:dns:a:ipv4`) Synapse would interpret that as a lift operation - i.e., "after you pivot to the DNS A records with an FQDN of vertex.link, then lift all DNS A records that have an IPv4 property, and pivot to ALL of the associated IPv4 nodes".

Explicit syntax is precise, but there is extra work ("more typing") involved to create the query, especially when there is an "obvious" source and / or target for the pivot. In other words, if you are pivoting from an FQDN (`inet:fqdn`) to a DNS A record (`inet:dns:a`), the `:fqdn` property is the only target property that makes sense.

In these cases, you can use **implicit pivot syntax** (implicit syntax) for your Storm query. Implicit syntax takes advantage of Synapse's *Type Awareness* to "know" which properties can be pivoted to (or from), given the source and target forms for the pivot operation. With implicit syntax, you do not need to specify the source or target property in cases where it is self-evident for the forms used.

Using implicit syntax, we can rewrite the above query as follows:

```
inet:fqdn = vertex.link -> inet:dns:a -> inet:ipv4
```

With implicit syntax, we can simply specify the source and target **forms**, and allow Synapse to identify the source and target **properties** using types and type awareness.

Implicit syntax can be used in the following cases where the source and target properties have the **same type** and the **same value**:

- Primary to secondary property pivots.
- Secondary to primary property pivots.

Tip

This includes cases where the secondary property value is the **node definition** (*Ndef*) of the corresponding primary property (these cases are uncommon, but includes forms such as `risk:technique:masquerade`). Note that this does not extend to legacy edge nodes that are composite forms, which have their own optimizations and pivot syntax (see *Edge Node Pivots*, below).

Implicit pivot syntax **cannot** be used in the following cases:

- Primary to primary property pivots (see *Raw Pivot Syntax*).
- Secondary to secondary property pivots.
- Pivots between primary and secondary properties involving tags (i.e., where the type is `syn:tag`). See *Tag Pivots* below.
- Pivots between primary and secondary properties with the same value but of different **types**.
- Pivots between primary and secondary properties where the source or target is ambiguous (e.g., where a form has more than one property of the same type, and you only want to pivot to (or from) one of them).

> **Tip**
>
> The examples below use implicit syntax where possible and may include explicit syntax for completeness. Where implicit syntax cannot be used, only explicit syntax is shown.

Pivot Out

Most pivots are "pivot out" operations (or variations). "Pivot out" refers to the "direction" of the pivot operator symbol: an "arrow" (->) that points "out" from left to right. "Pivot out" operations are so common that they are generally just referred to as "pivots" or "pivot operations".

Pivot out operations require:

- the source node(s) for the pivot;
- the pivot operator (->); and
- the target of the pivot.

The target(s) that are appropriate for a particular pivot out operation depend on the source and target properties and the specific navigation you want to perform.

Primary to Secondary Property Pivot

When pivoting from the primary property of a set of source nodes to target nodes with the same secondary property value (e.g., from a set of FQDNs to their associated DNS A nodes), the target can be:

- a form name or interface name;
- a form or interface name with a property name; or
- a partial form name (wildcard form match).

Implicit syntax can be used for these pivots if the target property is self-evident / unambiguous.

Syntax:

<query> **->** *<form>* [**:** | **.** | **._** *<prop>*]

<query> **->** *<interface>* [**:** *<prop>*]

<query> **->** *<partial_form_name>* *****

Examples:

Pivot from a set of FQDNs (inet:fqdn nodes) to their associated DNS requests (inet:dns:request nodes):

```
<inet:fqdn nodes> -> inet:dns:request
```

The query above uses implicit syntax; Synapse recognizes that the logical target property (given source nodes that are FQDNs) is `:query:name:fqdn`. You could optionally use explicit syntax instead:

```
<inet:fqdn nodes> -> inet:dns:request:query:name:fqdn
```

Pivot from a set of IPv4 addresses (inet:ipv4 nodes) to any network flows (inet:flow nodes) associated with the IPs:

```
<inet:ipv4 nodes> -> inet:flow
```

The query above uses implicit syntax. Note that because `inet:flow` nodes have two target properties of type `inet:ipv4` (`:src:ipv4` and `:dst:ipv4`), the result of this query will be all `inet:flow` nodes where the inbound

IPv4s are either the source **or** destination IP. If you only want to see flows where the inbound IPv4s are the destination IP (for example), you must use explicit syntax to clarify this:

```
<inet:ipv4 nodes> -> inet:flow:dst:ipv4
```

Pivot from a set of tags (syn:tag nodes) to the threat clusters (risk:threat nodes) represented by those tags:

```
<syn:tag nodes> -> risk:threat:tag
```

The query above uses explicit syntax. Even though the `:tag` property is of type `syn:tag`, `syn:tag` nodes have specialized handling with respect to pivoting in Storm (see *Pivot from Tags* and *Pivot to Tags* below). Because pivots involving `syn:tag` nodes are handled differently by default, you must use explicit syntax when pivoting between tags (`syn:tag` nodes) and properties whose type is `syn:tag`.

Pivot from a set of FQDNs (inet:fqdn nodes) to any associated DNS records (e.g., inet:dns:a, inet:dns:cname, inet:dns:ns, inet:dns:request, etc.):

```
<inet:fqdn nodes> -> inet:dns:*
```

The query above uses the wildcard (*) as a partial match for any form name that starts with `inet:dns:`.

Pivot from a set of FQDNs (inet:fqdn nodes) to any associated DNS A or DNS AAAA records:

```
<inet:fqdn nodes> -> inet:dns:a*
```

The query above uses the wildcard (*) as a partial match for any form name that starts with `inet:dns:a` followed by zero or more characters.

Pivot from a set of files to all host execution nodes (all nodes of all forms that inherit the it:host:activity interface - e.g., it:exec:file:add, it:exec:url, etc.) associated with those files:

```
<file:bytes nodes> -> it:host:activity
```

The query above uses implicit syntax. The `it:host:activity` interface defines two properties of type `file:bytes` for host activity nodes - `:exe` and `:sandbox:file`. The query above will return all activity nodes where the inbound files appear in either property. If you only want to see activity nodes whose `:exe` property (for example) matches the inbound files, you need to use explicit syntax:

```
<file:bytes nodes> -> it:host:activity:exe
```

Pivot from a set of usernames (inet:user nodes) to any file paths (file:path nodes) where the username is an element of the path (a :base value - for example, where a username might appear in a PDB path):

```
<inet:user nodes> -> file:path:base
```

The query above uses explicit syntax. The `inet:user` form has a type of `inet:user`, but the `:base` property of the `file:path` form has a type of `file:base`. Because the properties are two different types, you must use explicit syntax.

Tip

The query above will return the (partial) `file:path` whose final element is the user name (e.g., if your source node is `inet:user=evilhacker`, the query will return `c:\users\evilhacker`). You can use the Storm *tree* command to recursively pivot through the remaining `file:path` elements to obtain the full path containing the username:

```
<inet:user nodes> -> file:path:base tree { -> file:path:dir }
```

Pivot from a set of FQDNs (inet:fqdn nodes) to the "masquerade" technique nodes (risk:technique:masquerade nodes) associated with those FQDNs:

```
<inet:fqdn nodes> -> risk:technique:masquerade
```

The above query uses implicit pivot syntax.

A `risk:technique:masquerade` node represents an object that is purposely crafted to imitate (masquerade as) another object, typically for malicious purposes. The node records the relationship between the "original" object being imitated (`risk:technique:masquerade:target`) and the object that is imitating it (`risk:technique:masquerade:node`). (Both properties are of type "ndef" (node definition), and consist of `( <form>, <valu> )` pairs.)

Because the query above uses implicit syntax, it will return any `risk:technique:masquerade` nodes where the inbound FQDNs are either the `:target` or `:node` value. If (for example) the inbound FQDNs were a set of suspicious FQDNs and you wanted to return only those "masquerade" nodes where the inbound FQDNs were the `:node` masquerading as a valid FQDN, you would need to use explicit syntax:

```
<inet:fqdn nodes> -> risk:technique:masquerade:node
```

Secondary to Primary Property Pivot

When pivoting from a secondary property of a set of source nodes to target nodes with the same primary property (e.g., from a set of DNS A nodes to their associated FQDNs), the target can be:

- a form name;
- a list of form names;
- a wildcard.

Implicit syntax can be used for these pivots if the source property is self-evident / unambiguous.

Tip

Use of the the wildcard (asterisk) character (*) is known as a "wildcard pivot out". This pivot navigates from any/all secondary properties on the source nodes to the nodes corresponding to those property values. Contrast this operation with the "wildcard pivot in", described under *Pivot In*.

Syntax:

<query> [**:** | **.** | **:_** *<prop>*] **->** *<form>*

<query> [**:** | **.** | **:_** *<prop>*] **->** (*<form_1>* **,** *<form_2>* ...)

<query> **->** ***

Note

If you specify a source property for the pivot, you must use the relative property name (i.e., the property name alone, preceded by its separator character).

Examples:

Pivot from a set of DNS A records (inet:dns:a nodes) to their associated FQDNs (inet:fqdn nodes):

```
<inet:dns:a nodes> -> inet:fqdn
```

The query above uses implicit syntax. Synapse recognizes that, given a target form of `inet:fqdn`, the logical source property is the `:fqdn` property of the `inet:dns:a` nodes. You could optionally use explicit syntax:

```
<inet:dns:a nodes> :fqdn -> inet:fqdn
```

Pivot from a set of DNS NS records (inet:dns:ns nodes) to their associated FQDNs (inet:fqdn nodes):

```
<inet:dns:ns nodes> -> inet:fqdn
```

The query above uses implicit syntax. Because `inet:dns:ns` nodes have two properties of type `inet:fqdn` (`:zone` and `:ns`), Synapse will pivot to the FQDNs associated with both values. If you only want to pivot to the FQDNs associated with the name server (NS) FQDNs (for example), you must use explicit syntax:

```
<inet:dns:ns nodes> :ns -> inet:fqdn
```

Pivot from a set of X509 certificate metadata nodes (crypto:x509:cert nodes) to the associated SHA1 fingerprints (hash:sha1 nodes) and to any FQDNs (inet:fqdn nodes) associated with the certificates:

```
<crypto:x509:cert nodes> -> ( hash:sha1, inet:fqdn )
```

Tip

Specifying a list of target forms allows you to perform a more focused pivot (in contrast to pivoting to any / all target forms using a wildcard). The elements of the list must be enclosed in parentheses and separated by commas.

Pivot from a set of X509 certificate metadata nodes (crypto:x509:cert nodes) to any/all nodes associated with any of the certificates' secondary properties:

```
<crypto:x509:cert nodes> -> *
```

The query above is an example of a **wildcard pivot out**. For any secondary properties on the source nodes, the query will return the associated nodes. For example, if the `crypto:x509:cert:identities:ipv4s` property is set, the query will return the associated `inet:ipv4` nodes. A wildcard pivot out is also known as a "refs out" pivot (for "references") because it pivots to the nodes "referenced by" the source nodes' secondary properties.

Secondary to Secondary Property Pivot

When pivoting from a secondary property of a set of source nodes to target nodes with the same secondary property (e.g., from the `:ipv4` property of a set of DNS A nodes to a set of network flow nodes with the same IPv4 as a `:dst:ipv4` property), the target can be:

- a form name and property name;
- a list of form and property names; or
- an interface name and property name.

You must use explicit syntax to specify both the source and target properties.

Syntax:

<query> **:** | **.** | **:_** *<prop>* **->** *<form>* **:** | **.** | **:_** *<prop>*

<query> **:** | **.** | **:_** *<prop>* **->** *<interface>* **:** *<prop>*

Examples:

Pivot from the WHOIS records (inet:whois:rec nodes) for a set of domains to the DNS A records (inet:dns:a nodes) for the same domains:

```
<inet:whois:rec nodes> :fqdn -> inet:dns:a:fqdn
```

Tip

In many cases, secondary to secondary property pivots are a "shortcut" for two pivot operations (secondary to primary and primary to secondary) that perform the equivalent navigation. For example:

```
<inet:whois:rec nodes> -> inet:fqdn -> inet:dns:a
```

Pivot from a set of DNS requests (inet:dns:request nodes) to all host activity nodes (all nodes of all forms that inherit the it:host:activity interface) that share the same file as their :exe property:

```
<inet:dns:request nodes> :exe -> it:host:activity:exe
```

Pivot from a set of DNS A records (inet:dns:a nodes) to any network flows (inet:flow) or service banners (inet:banner) associated with the IPs:

```
<inet:dns:a nodes> -> ( inet:flow:dst:ipv4, inet:banner:server:ipv4 )
```

Pivot In

The pivot in operator is an "arrow" (<-) that points "in" from right to left.

Pivot operations navigate between sets of nodes that share a common property value. There is no "direction" to this relationship; logically, pivot operations are functionally equivalent whether the pivot "arrow" points out (left to right) or in (right to left):

- Pivot from a set of FQDNs to their associated DNS A records:

  ```
  <inet:fqdn nodes> -> inet:dns:a
  ```

- Pivot from a set of FQDNs to the DNS A records that reference them:

  ```
  <inet:fqdn nodes> <- inet:dns:a
  ```

Because Storm evaluates operations from left to right, the "pivot out" arrow is generally more intuitive and has been used to implement nearly all pivot operations in Storm (the second example, above, is not supported and will generate a `StormRuntimeError`).

The pivot in operation is a specialized operation that can only be used with the wildcard (*) as a target. This **wildcard pivot in** operation navigates from the primary property of the source node(s) to any nodes where that value is a secondary property. A wildcard pivot in is also known as a "refs in" pivot (for "references") because it pivots out to the nodes that "reference" the source nodes' primary property. Contrast this operation with the "wildcard pivot out", described under *Secondary to Primary Property Pivot*.

Syntax:

<query> **<-** ***

Example:

Pivot from a set of FQDNs (inet:fqdn nodes) to all nodes with a secondary property that references a source FQDN:

```
<inet:fqdn nodes> <- *
```

A wildcard pivot in will return any node with a secondary property value that matches any of the source FQDNs. For example, the above query could return various DNS records (`inet:dns:a`, `inet:dns:mx`), URLs (`inet:url`), email addresses (`inet:email`), articles (`media:news`), and so on.

Raw Pivot Syntax

Raw pivot syntax is a pivot operation where the target of the pivot is expressed as a **Storm query**. The use of raw pivot syntax is uncommon for interactive Storm queries, but is useful when you need greater flexibility in specifying the pivot target vs. using standard property-to-property pivot syntax.

Raw pivot syntax requires:

- the source node(s) for the pivot;
- a pivot operator; and
- the target of the pivot (specified as a Storm query enclosed in curly braces).

Both pivot (`->`) and pivot and join (`-+>`) operators can be used with raw pivot syntax. Pivot in (`<-`) and pivot in and join (`<+-`) are not supported.

Use cases for raw pivot syntax include primary-to-primary property pivots and pivots where the value of the target property (primary or secondary) is computed from the input node(s) (e.g., using a variable derived from the inbound nodes. See *Storm Reference - Advanced - Variables* for a discussion of using variables in Storm).

Syntax:

<query> *<pivot operator>* **{** *<query>* **}**

Examples:

The following is a simple example to illustrate the concept.

Pivot from a set of strings (it:dev:str nodes) representing domains to the associated FQDNs (inet:fqdn nodes):

```
<it:dev:str nodes> $fqdn = $node.value() -> { inet:fqdn ?= $fqdn }
```

The query above is a primary-to-primary property pivot between forms of different types. The query lifts the `it:dev:str` nodes, defines the variable `$fqdn` as the value of the node, then pivots to the `inet:fqdn` nodes with the same value. The FQDN nodes are lifted using the Storm query; the *"Try" Operator* is used in the event that any of the inbound `it:dev:str` nodes are invalid as FQDNs.

Note that you could create an equivalent Storm query using only lift and filter operations:

```
<it:dev:str nodes> $fqdn = $node.value() inet:fqdn ?= $fqdn -it:dev:str
```

This second query still lifts the `it:dev:str` nodes and sets the `$fqdn` variable, but then lifts the `inet:fqdn` nodes directly and drops (filters out) the original `it:dev:str` nodes.

While both queries return the same result (the `inet:fqdn` nodes), using raw pivot syntax is slightly more efficient because the pivot operation drops the `it:dev:str` nodes for you (pivots consume nodes); there is no need to filter them out at the end, as in the second example. As always, these efficiencies may be trivial for smaller queries but can be significant for larger queries.

Pivot from a set of HTTP referer headers (inet:http:request:header nodes) to any URLs (inet:url nodes) specified as the header value:

```
inet:http:request:header:name = referer $url = :value -> { inet:url ?= $url }
```

The query above illustrates using raw pivot syntax to pivot from a secondary to a primary property where the properties are of different types. The query lifts all `inet:http:request:header` nodes where the `:name` value is `referer`, sets the associated `:value` property (a `str` type) as the variable `$url`, then pivots to any `inet:url` nodes (an `inet:url` type) that have the same value. The *"Try" Operator* operator is used in the event any of the referer values contain bad or malformed data.

Tag Pivots

Tags in Synapse are unique in that they are both nodes and labels that are applied to other nodes. (See the *Analytical Model* document for additional discussion of tags as both nodes and labels.)

Because of tags' unique role, pivot syntax used with tags navigates between **tags as nodes** (`syn:tag` nodes) and **tags as labels** (i.e., nodes that have the tags applied), as opposed to performing standard property-to-property pivots.

Both the pivot out (`->`) and pivot out and join (`-+>`) operator are supported for tag pivots. Pivot in (`<-`) and pivot in and join (`<+-`) are not supported.

Tip

The custom behavior used with tag pivots may lead to counterintuitive results when attempting to pivot between tags (`syn:tag` nodes) and properties that are `syn:tag` types (such as `risk:threat:tag` or `ou:technique:tag`).

For example, if you attempt to pivot from a `syn:tag` node used to associate nodes with a threat cluster to the `risk:threat` node representing the cluster, the following Storm query will fail to return the expected results:

```
syn:tag=rep.talos.lazarus -> risk:threat
```

The query looks as though it should return the appropriate `risk:threat` node using implicit syntax to navigate to the `risk:threat:tag` property, using type awareness. However, because the default Storm behavior when pivoting from a `syn:tag` node is to pivot to **nodes that have the tag**, the above query is actualy attempting to pivot to any `risk:threat` nodes that are tagged `#rep.talos.lazarus`. The query is syntactically correct, so will not generate an error; but it will not return the expected nodes (and likely will not return any nodes at all).

Explicitly specifying the `:tag` property will return the `risk:threat` node as expected:

```
syn:tag=rep.talos.lazarus -> risk:threat:tag
```

Pivot to Tags

Pivot to tags syntax allows you to pivot from a set of nodes with tags to the set of `syn:tag` nodes representing those tags. Pivot to tag operations require:

- the source node(s) for the pivot;
- a pivot operator; and
- the set of tags (`syn:tag` nodes) that is the target of the pivot.

Pivot to tags uses the "hashtag" symbol (`#`) to indicate that the target of the pivot is a set of `syn:tag` nodes (by default, the set of all leaf tags on the source nodes). The target expression can be modified to refer to:

- all tag nodes,
- all tag nodes matching a specified pattern, or
- the tag node matching a specific tag.

Pivot to Leaf Tags

The hashtag symbol (#) used by itself as a target refers to the syn:tag nodes for all **leaf** tags applied to the source nodes. A leaf tag is the longest / final tag in a tag tree. For example, if a node has the tag #rep.eset.sednit (which is comprised of the three tags #rep, #rep.eset, and #rep.eset.sednit), the leaf tag is #rep.eset.sednit.

Syntax:

<query> *<pivot_operator>* **#**

Examples:

Pivot from a set of nodes to the tags (syn:tag nodes) for all leaf tags applied to those nodes:

```
<query> -> #
```

Pivot to All Tags

The hashtag symbol can be used with the wildcard (#*) to pivot to all syn:tag nodes applied to the source nodes, not just the leaf tags. For example, if a node has the tag #rep.eset.sednit (which is comprised of the three tags #rep, #rep.eset, and #rep.eset.sednit), all three tags will be returned.

Syntax:

<query> *<pivot_operator>* **#***

Pivot from a set of nodes to the tags (syn:tag nodes) for all tags applied to those nodes:

```
<query> -> #*
```

Pivot to Tags Matching a Pattern

The single (*) or double (**) asterisk can be used to specify a set of target tags that match the specified tag glob expression. The single asterisk is used to match **within** a single tag element. The double asterisk is used to match **across** tag elements.

Syntax:

<query> *<pivot_operator>* **#** *<string>* | * | ** [**.** *<string>* | * | ** ...]

Pivot from a set of nodes to the tags (syn:tag nodes) associated with any third-party reporting where the third tag element is "bisonal":

```
<query> -> #rep.*.bisonal
```

Vertex uses the rep tag tree to indicate third-party reporting / assertions. The query above will match syn:tag nodes from the source nodes where the tag has rep as the first tag element, has any value as the second element, and has bisonal as the third element. This would include tags such as:

- rep.alienvault.bisonal
- rep.malwarebazaar.bisonal

Pivot from a set of nodes to the tags (syn:tag nodes) representing any third party reporting where the tag ends in the string "bisonal":

```
<query> -> #rep.**bisonal
```

The query above will match any tag that has rep as the first element, followed by any number of elements that end in the string "bisonal". This would include the tags noted above, as well as tags such as:

- `rep.malwarebazaar.3p.intezer.bisonal`

Pivot to Specific Tag

Pivot to the `syn:tag` node for a specific tag by specifying the exact tag as the target.

Syntax:

<query> *<pivot operator>* # *<tag>*

Pivot from a set of nodes to the syn:tag node for the tag "cno.ttp.phish.attach":

```
<query> -> #cno.ttp.phish.attach
```

Pivot from Tags

Pivot from tags syntax allows you to pivot from a set of `syn:tag` nodes to the nodes that have those tags.

Pivot from tag operations require:

- the source node(s) for the pivot (`syn:tag` nodes);
- a pivot operator; and
- the target forms for the pivot.

The target for a pivot from tags operation can be:

- a form name;
- a partial form name (wildcard match);
- an interface name;
- a list of form names; or
- a wildcard.

Pivot from tags pivots to nodes that have the exact source tag(s) applied. For example, pivoting from the tag `syn:tag=rep.eset.sednit` will **not** return nodes with only `#rep` or `#rep.eset`. Conversely, pivoting from `syn:tag=rep` will return nodes with **any** tag in the `rep` tag tree (because the `rep` tag is included in all of those trees).

Tip

A pivot from tags operation is similar to a *Lift by Tag* or *Lift Form by Tag* operation. The following Storm queries are equivalent:

```
syn:tag=rep.microsoft.forest_blizzard -> *
```

```
#rep.microsoft.forest_blizzard
```

As are these:

```
syn:tag=rep.microsoft.forest_blizzard -> ( inet:fqdn, inet:ipv4 )
```

```
inet:fqdn#rep.microsoft.forest_blizzard inet:ipv4#rep.microsoft.forest_blizzard
```

Pivot from tags can be useful when used with *Pivot to Tags*. For example, you can take a set of inbound tagged nodes, use pivot to tags to navigate to some or all of the associated `syn:tag` nodes, and then use pivot from tags to navigate to other nodes that have the same tags.

Syntax:

<syn:tag node(s)> <pivot operator> <form>

<syn:tag node(s)> <pivot operator> <partial_form_name> *****

<syn:tag node(s)> <pivot operator> <interface>

<syn:tag node(s)> <pivot operator> **(** *<form_1>* **,** *<form_2>* ... **)**

<syn:tag node(s)> <pivot operator> *****

Examples:

Pivot from a set of syn:tag nodes to any files (file:bytes nodes) with those tags applied:

```
<syn:tag nodes> -> file:bytes
```

Pivot from a set of syn:tag nodes to any DNS nodes with those tags applied:

```
<syn:tag nodes> -> inet:dns:*
```

The query above would return (for example) `inet:dns:a` nodes, `inet:dns:request` nodes, etc.

Pivot from a set of syn:tag nodes to any host activity nodes (all nodes of all forms that inherit the it:host:activity interface) with those tags applied:

```
<syn:tag nodes> -> it:host:activity
```

Pivot from a set of syn:tag nodes to any IPv4 (inet:ipv4), IPv6 (inet:ipv6), server (inet:server), or network flow (inet:flow) nodes with those tags applied and retain the syn:tag nodes in the results (pivot and join):

```
<syn:tag nodes> -+> ( inet:ipv4, inet:ipv6, inet:server, inet:flow )
```

Pivot from a set of syn:tag nodes to all nodes that have any of the tags applied:

```
<syn:tag nodes> -> *
```

Edge Node Pivots

Edge nodes (also called digraph nodes) are specialized nodes whose purpose is to link two arbitrary nodes in a specific relationship. Edge nodes are composite forms but are unique in that, because the node(s) in the relationship may be arbitrary, the edge node's primary property consists of at least one value that is a *Node Definition* or **ndef** - that is, a `(<form>, <valu>)` pair vs. a standard `<valu>`. (Some edge nodes include a time value as a third element of the primary property if the arbitrary relationship occurred at a specific time.)

This means that pivots to or from edge nodes must account for having a form **and** property value in common between the source and target, not just a property value.

Both the pivot (`->`) and pivot and join (`-+>`) operators are supported for edge pivots. The pivot in operator (`<-`) is supported for specialized cases. The pivot in and join operator (`<+-`) is not supported.

Note

Composite edge nodes are largely legacy elements in the Synapse data model. In many cases, the use of lightweight (light) edges is now preferred over edge nodes. For example, `edge:has` nodes have largely been replaced by `-(has)>` light edges; and the use of `meta:seen` nodes is discouraged in favor of `-(seen)>` light edges.

Edge nodes may be preferred when you need to record additional information about the relationship (edge nodes have properties, and you can apply tags to edge nodes). We recommend choosing one option (edge nodes or light edges) for a given relationship for consistency (i.e., so analysts do not have to query for the same type of relationship in two different ways).

In addition, where there is a need to:

- link two arbitrary nodes in some type of relationship, and
- record additional information about the relationships (i.e., where use of a light edge is not appropriate)

…the current preference is to create a guid form whose secondary properties include one or more ndefs instead of a composite edge node (an example of this kind of form is the `risk:technique:masquerade` form). In particular, use of a guid form with ndef secondary properties greatly simplifies pivoting to or from nodes that use ndefs, eliminating the need for analysts to use or be aware of specialized *Edge Node Pivots*.

By using guid forms, the ndef value(s) are no longer tied to the node's primary property the way they are in a legacy composite edge node. This allows Synapse and Storm to treat pivots between nodes and ndef properties as "standard" primary-to-secondary or secondary-to-primary property pivots (using an optimization similar to that used for type awareness and implicit pivot syntax).

Pivot to Edge Nodes

Pivoting to edge nodes requires:

- the source node(s) for the pivot;
- the pivot operator;
- the target of the pivot.

When pivoting to edge nodes, the target can be:

- a form name (edge form);
- a partial edge form name (wildcard match) - supported for pivot out / pivot out and join only;
- an interface (in cases where an edge form inherits an interface); or
- a form (edge form) and property name.

Tip

Storm uses some optimizations to simplify working with edge nodes.

When pivoting out (`->` or `-+>`) to a set of edge nodes, the target of the pivot is assumed to be the edge nodes whose `n1` value matches the `(<form>, <valu>)` of the inbound nodes. This means that you do not need to specify the target property for an edge pivot **unless** the target is the edge nodes' `n2` property.

As an alternative, the pivot in operator (`<-`) can be used specifically to pivot from the source nodes to the `n2` property of the target edge nodes.

Note that the use of the pivot in operator (`<-`) to pivot to edge nodes' `n1` property is not supported, even if you specify it as the target property. In addition, the target of a pivot in operation cannot be a partial edge form name (wildcard match).

Syntax:

<query> *<pivot operator>* *<target>* [**:n2**]

<query> **<-** *<edge_form>*

Examples:

> **Note**
>
> The examples below are for illustrative purposes to show the Storm syntax used to navigate edge nodes. Based on current modeling best practices, the relationships shown here using edge nodes would typically be represented using light edges or guid forms.

Pivot from a set of articles (media:news nodes) to the edge nodes (edge:refs nodes) showing things that the articles reference (e.g., such as indicators like hashes or FQDNs):

```
<media:news nodes> -> edge:refs
```

Pivot from a set of vulnerabilities (risk:vuln nodes) to the edge nodes (edge:has nodes) showing which nodes have those vulnerabilities (e.g., such as an it:host):

```
<risk:vuln nodes> -> edge:has:n2
```

Because the `risk:vuln` ndefs are the `n2` value of the edge nodes, we must specify `:n2` as the target property. The following pivot in operation will return the same results:

```
<risk:vuln nodes> <- edge:has
```

Pivot from a set of nodes to any edge nodes (e.g., edge:has, edge:refs) where the inbound nodes are the n1 of any of the edge nodes:

```
<query> -> edge:*
```

Pivot from Edge Nodes

Pivoting from edge nodes requires:

- the source node(s) (edge nodes) for the pivot;
- the pivot operator;
- the target of the pivot.

When pivoting from edge nodes, the target can be:

- a form name;
- a partial form name (wildcard match) - supported for pivot out / pivot out and join only;
- an interface; or
- a wildcard.

> **Tip**
>
> Storm uses some optimizations to simplify working with edge nodes.
>
> When pivoting out (`->` or `-+>`) from a set of edge nodes, the source of the pivot is assumed to be the `n2` of the edge nodes. If you want to pivot out from edge nodes' `n1` property, you must specify `:n1` as the source property.
>
> As an alternative, the pivot in operator (`<-`) can be used to specifically to pivot from the edge nodes' to the `n1` property. The use of the pivot in operator to pivot from edge nodes' `n2` property is not supported, even if you specify

it as the source property. In addition, the target of a pivot in operation cannot be a partial form name (wildcard match).

Syntax:

<*edge_form*> [**:n1**] <*pivot operator*> <*target*>

<*edge_form*> **<-** <*form*> | <*interface*> | ***

Examples:

Note

The examples below are for illustrative purposes to show the Storm syntax used to navigate edge nodes. Based on current modeling best practices, the relationships shown here using edge nodes would typically be represented using light edges.

Pivot from a set of "has" edge nodes (edge:has nodes) to all of the objects the nodes "have":

```
<edge:has nodes> -> *
```

Pivot from a set of "has" edge nodes (edge:has nodes) to all of the objects that "have" things:

```
<edge:has nodes> :n1 -> *
```

You can also use the pivot in operator to pivot from the `:n1` property by default:

```
<edge:has nodes> <- *
```

Pivot from a set of "has" edge nodes to any vulnerabilities that the objects "have":

```
<edge:has nodes> -> risk:vuln
```

Pivot Across Edge Nodes

Because edge nodes represent relationships, analytically we are often more interested in the nodes on "either side" of the edge node than we are in the edge node itself. For this reason, the pivot operators have been optimized to allow for easily navigating "across" these edge nodes.

Pivoting across edge nodes still entails two pivot operations (pivot to edges and pivot from edges, as described above). Like all Storm operations, each type of pivot can be performed independently and combined with other operations (e.g., lift, pivot to edges, filter, etc.)

When you pivot to edge nodes and immediately pivot from edge nodes (navigating "across" the edges), Storm optimizes the pivot syntax to simplify this process.

Specifically:

Two pivot out operators (`->` or `-+>`) can be combined to easily pivot from:

- source nodes to the edge nodes' `:n1` property, and
- the edge nodes; `:n2` property to the target nodes.

```
<source_nodes> -> <edge_nodes> -> <target_nodes>
```

By optimizing which proprty of the edge node is assumed to be the source or target of the pivot operation, Synapse makes it easy to navigate across the edge relationship intuitively from left (`:n1`) to right (`:n2`) without the need to explicitly specify source and target properties.

Similarly, two pivot in operators (`<-` or `<+-`) can be used to pivot from:

- source nodes to the edge nodes' `:n2` property, and
- the edge nodes' `:n1` property to the target nodes.

```
<source_nodes> <- <edge_nodes> <- <target_nodes>
```

This allows you to navigate intuitively across the edge relationship "backwards" from right (`:n2`) to left (`:n1`).

Traversal Operations

Traversal operations are used to navigate between sets of nodes that are linked using a lightweight (light) edge. Traversal is still considered a "pivot" between sets of nodes, but is named differently to distinguish light edge navigation from property-to-property pivot navigation.

> **Tip**
>
> There are no light edges (i.e., specific light edge verbs) defined within Synapse by default. Users can create and define their own according to their needs. However, both the Synapse Data Model *Forms* documentation and the Optic UI's Data Model Explorer list edges used by The Vertex Project by convention which are recommended for use (note that Power-Ups may create these edges).
>
> The Storm *model*, *edges*, and *lift.byverb* commands can be used to work with light edges in Synapse.

Each traversal operation requires:

- the source node(s) for the operation;
- the traversal operator; and
- the target forms for the traversal.

Traversal is also referred to as "walking" - that is, you can traverse a light edge or walk a light edge.

The traversal operator is an "arrow" with embedded parentheses. The parentheses enclose a string (commonly a verb) for the relationship(s) represented by the edge:

- `-(<verb>)>`

`<verb>` can be a single edge, a list of edges, or a wildcard.

Unlike property-to-property relationships, edge relationships have a **direction**. There is a "source" node (`n1`) and a "target" node (`n2`) for the relationship itself; an article (`media:news` node, the `n1`) can reference an indicator such as a hash (`hash:md5` node, the `n2`) but it does not make sense for a hash to "reference" an article.

The pivot operator (`->`) and its variations "point" from left to right (other than a few specialized cases) by convention. In contrast, the traversal operator can "point" in either direction, depending on which nodes (which "side" of the edge relationship) are inbound. Both of the syntaxes below are equally valid:

```
<media:news nodes> -(refs)> <hash:md5 nodes>
```

```
<hash:md5 nodes> <(refs)- <media:news nodes>
```

Tip

In Synapse, lightweight edge relationships are **explicit** relationships. The light edges used to connect nodes must be defined within Synapse, and nodes joined by light edges must be explicitly linked.

Unless otherwise specified, the target (*<target>*) of an edge traversal can be:

- a form name (e.g., `hash:md5`);
- a form name, comparison operator, and value (e.g., a primary property value, such as `inet:fqdn~=news`);
- a form and property name (e.g., `inet:url:fqdn`);
- a form and property name, comparison operator, and value (e.g., a secondary property value, such as `risk:tool:software:used@=(2018, 2022)`)
- a partial form name (wildcard match, e.g., `hash:*`);
- an interface name (e.g., `it:host:activity`);
- a list of form names (e.g., `( hash:sha256, file:bytes )`); or
- a wildcard / asterisk (`*`).

Note

The ability to specify a secondary property **and value** is supported in Synapse 2.x.x, but will be removed in 3.x.x. You can obtain the same result by traversing to a form and property name, and then filtering on the value. For example, the following Storm queries are equivalent:

```
media:news -(refs)> inet:url:fqdn~=justice.gov
```

and

```
media:news -(refs)> inet:url:fqdn +:fqdn~=justice.gov
```

Traverse a Specific Edge

Specify the name (verb) of the edge you want to traverse to navigate a single edge.

Syntax:

<query> **-(** *<verb>* **)>** *<target>*

<query> **<(** *<verb>* **)-** *<target>*

Examples:

Traverse the "uses" light edge from a threat cluster (risk:threat node) to the tools or malware (risk:tool:software nodes) used by the cluster:

```
<risk:threat> -(uses)> risk:tool:software
```

Traverse the "references" (refs) light edge from an article (media:news node) to all of the nodes "referenced" by the article:

```
<media:news> -(refs)> *
```

Traverse the "ipwhois" light edge from a set of IPv4 addresses (inet:ipv4 nodes) to the network registration / network WHOIS records (inet:whois:iprec nodes) the IPs are associated with:

```
<inet:ipv4 nodes> <(ipwhois)- inet:whois:iprec
```

Traverse the "seen" light edges from a set of DNS A records (inet:dns:a nodes) to the sources (meta:source nodes) that "saw" (observed or provided data for) the record:

```
<inet:dns:a nodes> <(seen)- meta:source
```

Traverse Multiple Edges

Specify a list of edge names (verbs) to traverse multiple edges to their targets.

Syntax:

<query> **-((** *<verb1>* **,** *<verb2>* **[,** *<verb3>* **]))>** *<target>*

<query> **<((** *<verb1>* **,** *<verb2>* **[,** *<verb3>* **]))-** *<target>*

Tip

Because each light edge represents a different relationship whose targets may vary widely, the wildcard (*) is frequently used as the target when traversing multiple edges (though this is not a requirement).

Example:

Traverse the "references" (refs) and "seen" light edges from an FQDN to any nodes linked via those light edges (i.e., articles (media:news nodes) that reference the FQDN and data sources (meta:source nodes) that "saw" the FQDN):

```
<inet:fqdn> <( ( refs, seen ) )- *
```

Traverse All Edges

Use the wildcard (asterisk) character (*) to traverse any edges present in the specified direction to their targets.

Tip

Using the wildcard to specify any edge name is useful when:

- you want to traverse any / all edges;
- you want to navigate to a specific set of targets (regardless of the particular edges); or
- if you are not familiar with the edges that may be used with your source nodes and simply want to explore any connections that may be present.

Syntax:

<query> **-(*)>** *<target>*

<query> **<(*)-** *<target>*

Examples:

For a threat cluster (risk:threat node), traverse any light edges linking the cluster to any vulnerabilities (risk:vuln nodes) or victim organizations (ou:org nodes):

```
<risk:threat> -(*)> ( risk:vuln, ou:org )
```

For a vulnerability (risk:vuln node), navigate to any forms that are connected to the vulnerability by any edge:

```
risk:vuln <(*)- *
```

Vertex Project conventions can link `risk:vuln` nodes to things that have the vulnerability (via `<(has)-` edges) or things that use the vulnerability (via `<(uses)-` edges - e.g., a threat cluster (`risk:threat`) or a file (`file:bytes`) that makes use of an exploit for the vulnerability, etc.).

Pivot and Traverse Operations

Property pivots and edge traversals can be combined into a single "pivot and traverse" operation to perform "both types" of navigation simultaneously from a set of source nodes. "Pivot and traverse" combines a pivot operation with a traverse all edges operation in the specified direction.

Each pivot and traverse operation requires:

- the source node(s) for the operation;
- the pivot and traverse operator; and
- the target of the operation.

The pivot and traverse operator is a "double arrow" (`-->`) with two dashes (vs. one for a standard pivot). The operator can point "out" or "in", depending on the specific pivot and traverse operation you want to perform.

Because pivot and traverse operations perform "all available" navigation in a given direction, the only valid target for this operation is the wildcard (`*`).

Tip

The combined "pivot and traverse" operators are commonly used to "explore" a subset of connected nodes. Note that the Storm *tee* command can be used to perform concurrent pivot in and traverse / pivot out and traverse operations on an inbound set of nodes:

```
<query> | tee { --> * } { <-- * }
```

This combined operation shows you **all** nodes connected to your source nodes by **any** property or edge. It is equivalent to using the Explore button in the Optic UI.

Pivot Out and Traverse

The pivot out and traverse (walk) light edges operator (`-->`) combines a wildcard pivot out ("refs out") operation (`-> *`) with a wildcard (any / all edges) edge traversal operation (`-(*)> *`).

Syntax:

***<query>* --> ***

Examples:

Pivot from a set of IP netblock registration records (inet:whois:iprec nodes) to all nodes associated with the records' secondary properties and all nodes linked to the records by light edges:

```
<inet:whois:iprec nodes> --> *
```

Pivot In and Traverse

The pivot in and traverse (walk) light edges operator (`<-- *`) combines a wildcard pivot in ("refs in") operation (`<- *`) with a wildcard (any / all edges) edge traversal operation (`<(*)- *`).

Syntax:

<query> **<-- ***

Examples:

Pivot from a set of IPv4 addresses (inet:ipv4 nodes) to all nodes that reference the IPs and all nodes linked to the IPs by light edges:

```
<inet:ipv4> <-- *
```

Join Operations

Like most Storm operations, pivots and traversals consume nodes. With both types of operations, you navigate "away" from your source nodes; the nodes that are the target of your operation become your working set / result set.

With join operations, the inbound nodes are retained and combined (joined) with the target nodes in a single result set.

Each join operation requires:

- the source node(s) for the operation;
- the appropriate join operator; and
- the target of the operation.

Join operators are variations on the standard pivot and traversal operators, but include a "plus" sign (+) in the operator to indicate the join. For example, the pivot and join operator is the pivot arrow (->) combined with the plus sign to represent "pivot and join" (-+>).

Pivot and Join

The pivot and join operator (-+>) is the pivot "arrow" with an embedded plus sign (+) to represent joining the source and target nodes. The operator can be used anywhere the standard pivot operator (->) is used, including the wildcard pivot out. Refer to the syntax examples under *Pivot Out* for the various types of pivot operations (e.g., primary to secondary property, secondary to secondary property, etc.)

Examples:

Pivot from a set of organizations (ou:org nodes) to any associated contacts (ps:contact nodes), retaining the organizations in the results:

```
<ou:org nodes> -+> ps:contact
```

Pivot from a set of DNS A records (inet:dns:a nodes) to their associated IPv4 addresses (inet:ipv4 nodes), retaining the DNS A records in the results:

```
<inet:dns:a nodes> -+> inet:ipv4
```

Pivot from a set of domain WHOIS records (inet:whois:rec nodes) to the DNS A records (inet:dns:a nodes) associated with the FQDNs, retaining the WHOIS records in the results:

```
<inet:whois:rec nodes> :fqdn -+> inet:dns:a:fqdn
```

Pivot from all secondary properties of a set of files (file:bytes nodes) to the associated nodes, retaining the files in the results:

```
<file:bytes nodes> -+> *
```

Pivot In and Join

The pivot in and join operator (<+-) can be used to perform a wildcard pivot in operation and join the results with the source nodes. Just as with a standard pivot in, the wildcard is the only valid target for this operation.

Syntax:

<query> **<+-** ***

Example:

Pivot from a set of files (file:bytes nodes) to any nodes that reference the files, retaining the original files in the results:

```
<file:bytes nodes> <+- *
```

Traverse and Join

The traverse and join operator (-(<verb>)+>) is a traversal "arrow" with a plus sign (+) to represent joining the source and target nodes. The operator can be used anywhere the standard (-(<verb>)>) traversal operator is used. The operator can be used with a named edge or edges (e.g., -(refs)+> or <+((uses, targets))-) or with a wildcard to represent any / all edges (e.g., -(*)+>).

Syntax:

<query> **-(** *<verb>* **)+>** *<target>*

<query> **<+(** *<verb>* **)-** *<target>*

<query> **-(** **(** *<verb1>* **,** *<verb2>* [**,** *<verb3>* ...] **)** **)+>** *<target>*

<query> **<+(** **(** *<verb1>* **,** *<verb2>* [**,** *<verb3>* ...] **)** **)-** *<target>*

<query> **-(** * **)+>** *<target>*

<query> **<+(** * **)-** *<target>*

Examples:

Traverse the "refs" light edge from an article (media:news node) and join the article with the FQDNs (inet:fqdn nodes) "referenced" by the article:

```
<media:news> -(refs)+> inet:fqdn
```

Join an article (media:news node) with any/all nodes referenced by the article:

```
<media:news> -(refs)+> *
```

Join a threat cluster (risk:threat node) with any nodes used or targeted by the cluster:

```
<risk:threat> -( (uses, targets) )+> *
```

Traverse and join any/all light edges from a vulnerability (risk:vuln node) to all nodes linked by any light edge:

```
<risk:vuln> <+(*)- *
```

Common edges used with vulnerabilites (risk:vuln nodes) include "uses" and "has".

Pivot, Traverse, and Join

The pivot, traverse, and join operator (`--+>`) combines the "pivot and traverse" double arrow with a plus sign (+) to represent joining the source and target nodes. The operator can be used anywhere the standard pivot and traverse operator (`-->`) is used. Because combined pivot and traverse operations perform "all available" navigation, the only valid target for this operation is the wildcard (*).

Syntax:

<query> **--+>** *

<query> **<+--** *

Examples:

Join a set of articles (media:news nodes) with all nodes representing the articles' secondary properties (pivot out) and all nodes linked by any "right-facing" light edge:

```
<media:news> --+> *
```

Join a set of IPv4 addresses (inet:ipv4 nodes) with all nodes that reference the IPs (pivot in) and all nodes linked to the IPs by "left-facing" light edges:

```
<inet:ipv4> <+-- *
```

3.6.6 Storm Reference - Data Modification

Storm can be used to modify data in Synapse by:

- adding or deleting nodes;
- setting, modifying, or deleting properties on nodes;
- adding or deleting light edges; and
- adding or deleting tags from nodes (including tag timestamps or tag properties).

The ability to create or modify data on the fly gives users a powerful degree of flexibility and efficiency.

Warning

The ability to add and modify data directly from Storm is powerful and convenient, but users can inadvertently modify (or even delete) data inappropriately through mistyped syntax, incorrect Storm logic, or premature striking of the "enter" key. While some built-in protections exist within Synapse itself, it is important to remember that **there is no "are you sure?" prompt before a Storm query executes.**

The following best practices will help prevent inadvertent changes to a Cortex:

- Where possible, *Fork a View* and test and perform your changes in the fork. Once you have validated the changes, they can be merged into the parent view; if anything goes wrong, the fork can simply be deleted.
  - Note that in Synapse 2.x, all **delete** operations must be performed in the layer where the data to be deleted exists; that is, if you are working in forked view, you cannot delete data in the underlying view/layer from the fork.
- Use extreme caution when constructing complex Storm queries that may modify (or delete) large numbers of nodes. It is **strongly recommended** that you validate the output of a query by first running the query on its own (without the edit or delete operations) to ensure it returns the expected results (set of nodes) before permanently modifying or deleting those nodes.

- Use the Synapse permissions system to enforce least privilege. Limit users to permissions appropriate for tasks they have been trained for / are responsible for.

Tip

For adding data at scale, we recommend use of the Synapse *csvtool*, the Synapse *feed* utility, the Optic *Ingest Tool*, or the programmatic ingest of data (e.g., using a *Power-Up*).)

See *Storm Reference - Document Syntax Conventions* for an explanation of the syntax format used below.

See *Storm Reference - Type-Specific Storm Behavior* for details on special syntax or handling for specific data types (*Type*).

Edit Mode

To perform an edit operation in Storm, you must enter "edit mode". Edit mode makes use of several conventions to specify what changes should be made and to what data:

- *Edit Brackets*
- *Edit Parentheses*
- *"Try" Operator*
- *Conditional Edit Operators*
- *Autoadds and Depadds*

Edit Brackets

The use of square brackets (`[ ]`) within a Storm query can be thought of as entering "edit mode" to perform an edit operation. The data in the brackets specifies the changes to be made involving nodes, properties, light edges, and tags. The only exception is deleting nodes, which is done using the Storm *delnode* command.

The square brackets used for the Storm data modification (edit) syntax indicate "perform the enclosed changes" in a generic way. Edit brackets are used to perform any of the following:

- *Add Nodes*
- *Add or Modify Properties*
- *Add or Modify Properties Using Subqueries*
- *Delete Properties*
- *Add Light Edges*
- *Delete Light Edges*
- *Add Tags*
- *Modify Tags*
- *Remove Tags*

All of the above directives can be specified within a single set of brackets (subject to Storm logic and Storm's pipeline behavior).

Warning

It is critical to remember that **the brackets are NOT a boundary that segregates nodes;** the brackets simply indicate the start and end of an edit operation. In other words, the brackets do **NOT** separate "nodes the modifications should apply to" from "nodes they should not apply to". Storm *Operation Chaining* with left-to-right processing order still applies. Editing is simply another Storm operation, so the specified edits will be performed on **ALL nodes inbound to the edit operation** as part of the Storm pipeline, regardless of whether those nodes are within or outside the brackets.

The exception is modifications that are placed within *Edit Parentheses*, which can be used to segregate specific edit operations.

Note

For simplicity, syntax examples below demonstrating how to add nodes, modify properties, etc. only use edit brackets. See *Combining Data Modification Operations* below for examples showing the use of edit brackets with and without edit parentheses.

Edit Parentheses

Storm supports the use of edit parentheses (`(` `)`) inside of *Edit Brackets*. Edit parentheses ("parens") explicitly limit a set of modifications to a specific node or nodes by enclosing the node(s) and their associated modification(s) within the parentheses. This "overrides" the default behavior for edit brackets, which is that every change specified within the brackets applies to **all nodes inbound to the edit operation.** Edit parens thus allow you to make limited changes "inline" with a more complex Storm query instead of having to use a smaller, separate query to make those changes.

Note that multiple sets of edit parens can be used within a single set of edit brackets; each set of edit parens delimits a separate set of edits.

See *Combining Data Modification Operations* below for examples showing the use of edit brackets with and without edit parentheses.

"Try" Operator

The Storm "try" operator can be used in edit operations when setting properties (`?=`) or adding tags (`+?#`).

Properties in Synapse are subject to *Type Enforcement*. Type enforcement makes a reasonable attempt to ensure that a value "makes sense" for the property in question - that the value you specify for an `inet:ipv4` node looks reasonably like an IPv4 address (and not an FQDN or URL). If you try to set a property value that does not pass Synapse's type enforcement validation, Synapse will generate a `BadTypeValu` error. The error will cause the currently executing Storm query to halt and stop processing.

When using the try operator, Synapse will to attempt (try) to set the property value. With the try operator, instead of halting in the event of a `BadTypeValu` error, Synapse will ignore the error (silently fail on that specific edit operation) but continue processing the rest of the Storm query.

The try operator is especially useful for Storm-based automated ingest of data where the data source may contain bad (improperly typed or poorly formatted) data, where a single badly-formatted entry could cause an ingest query to fail in the middle.

For example:

```
[ inet:ipv4 ?= woot.com ]
```

will silently fail to create an `inet:ipv4` node with the improper value `woot.com`.

In contrast:

```
[ inet:ipv4 = woot.com ]
```

will throw a `BadTypeValu` error and exit.

> **Tip**
>
> See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* for specialized "try" syntax when working with arrays.

Tags and the "Try" Operator

Tags are also nodes (`syn:tag` nodes), and tag values are also subject to type enforcement. As such, the "try" operator can also be used when applying tags:

```
inet:ipv4 = 58.158.177.102 [ +?#cno.infra.dns.sink.hole ]
```

While Synapse automatically normalizes tag elements (e.g., by replacing dash characters (-) or spaces with underscores (_)), some characters (such as ASCII symbols other than the underscore) are not allowed. The "try" operator may be useful when ingesting third-party data or constructing a tag using a *Variable* where the variable may contain unexpected values. For example:

```
inet:ipv4 = 8.8.8.8 [ +?#foo.$tag ]
```

... where `$tag` is a variable representing a tag element derived from the source data.

See the *syn:tag* section of the *Storm Reference - Type-Specific Storm Behavior* for additional detail on tags / `syn:tag` forms.

Conditional Edit Operators

The conditional edit operators (`*unset=` and `*$<varname>=`) can be used to only set properties when certain conditions are met.

The `*unset=` operator will only set a property when it does not already have a value to prevent overwriting existing data. For example:

```
inet:ipv4 = 1.2.3.4 [ :asn *unset= 12345 ]
```

will only set the `:asn` property on the `inet:ipv4` node if it is not already set. The conditional edit operators can also be combined with the "try" operator (`*unset?=`) to prevent failures due to bad data:

```
inet:ipv4 = 1.2.3.4 [ :asn *unset?= invalid ]
```

Variable values may also be used to control the conditional edit behavior, and allow two more values in addition to `unset`; `always` and `never`. For example:

```
$asn = 'always' $loc = 'never' inet:ipv4 = 1.2.4.5 [ :loc *$loc= us :asn *$asn?= 12345 ]
```

will never set the `:loc` property and will always attempt to set the `:asn` property. This behavior is useful when creating Storm ingest functions where fine tuned control over specific property edit behavior is needed. Rather than creating variations of the same ingest function with different combinations of property set behavior, one function can use a dictionary of configuration options to control the edit behavior used during each execution.

Autoadds and Depadds

Synapse makes use of two optimization features when adding nodes or setting secondary properties: automatic additions (*Autoadd*) and dependent additions (*Depadd*).

Autoadd is the process where, on node creation, Synapse will automatically set any secondary properties that are derived from a node's primary property. Because these secondary properties are based on the node's primary property (which cannot be changed once set), the secondary properties are read-only.

For example, when creating the email address `inet:email=visi@vertex.link`, Synapse will automatically set the node's secondary properties (the username `inet:email:user=visi` and domain `inet:email:fqdn=vertex.link`).

Depadd is the process where, on setting a node's secondary property value, if that property is of a type that is also a form, Synapse will automatically create the form with the corresponding primary property value. (You can view this as the secondary property "depending on" the existence of a node with the corresponding primary property.)

To use the same example, when creating the email `inet:email=visi@vertex.link` and setting the secondary properties above, Synapse willl also create the associated nodes `inet:user=visi` and `inet:fqdn=vertex.link`.

Autoadd and depadd work together (and recursively) to simplify adding data to Synapse.

Add Nodes

Operation to add the specified node(s) to a Cortex.

Syntax:

[<*form*> **=** | **?=** <*valu*> ... **]**

> **Tip**
>
> You can optionally use the *"Try" Operator* (?=) when adding nodes.

Examples:

Create a simple node (FQDN):

```
[ inet:fqdn = woot.com ]
```

Create a composite (comp) node (DNS A record):

```
[ inet:dns:a=(woot.com, 12.34.56.78) ]
```

Create a GUID node by generating an arbitrary guid using the asterisk character:

```
[ risk:threat='*' ]
```

Create a GUID node by specifying a list of string values used to generate a predictable guid:

```
[ risk:threat=(mandiant, apt1) ]
```

> **Tip**
>
> For information on the differences and use cases for arbitrary vs. predictable / deconflictable guids, see the *guid* section of the *Storm Reference - Type-Specific Storm Behavior*.

Storm also includes various *gen* ("generate") commands to simplify the creation of some common guid forms.

Create a digraph (edge) node:

```
[ edge:refs=((media:news, 00a1f0d928e25729b9e86e2d08c127ce), (inet:fqdn, woot.com)) ]
```

Note

In many cases, the use of an *Edge (Digraph) Form* has been replaced by a *Lightweight (Light) Edge*.

Create multiple nodes in a single edit operation:

```
[ inet:fqdn=woot.com inet:ipv4=12.34.56.78 hash:md5=d41d8cd98f00b204e9800998ecf8427e ]
```

Usage Notes:

- If a node specified within the edit brackets does not exist, Synapse creates and returns the node. If the node already exists, Synapse simply returns (lifts) the node.
- When creating a <*form*> whose <*valu*> consists of multiple components, the components must be passed as a comma-separated list enclosed in parentheses.
- Once a node is created, its primary property (<*form*> = <*valu*>) **cannot be modified.** The only way to "change" a node's primary property is to create a new node (and optionally delete the old node).

Add or Modify Properties

Operation to add (set) or change one or more properties on the specified node(s).

The same syntax is used to apply a new property or modify an existing property.

Syntax:

<*query*> **[:** <*prop*> **= | ?=** <*pval*> … **]**

<*query*> **[:** <*prop*> ***unset= | *unset?** <*pval*> … **]**

<*query*> **[:** <*prop*> ***$<varname>= | *$<varname>?=** <*pval*> … **]**

Tip

You can optionally use the *"Try" Operator* (?=) when setting or modifying properties.

Note

Synapse supports secondary properties that are **arrays** (lists or sets of typed forms), such as `ou:org:names`. See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* guide for the syntax used to add or modify array properties.

Examples:

Add (or modify) a secondary property:

```
<inet:ipv4> [ :loc=us.oh.wilmington ]
```

Add (or modify) a universal property:

```
<inet:dns:a> [ .seen=("2017/08/01 01:23", "2017/08/01 04:56") ]
```

Usage Notes:

- Specifying a property will set the <*prop*> = <*pval*> if it does not exist, or modify (overwrite) the <*prop*> = <*pval*> if it already exists. **There is no prompt to confirm overwriting of an existing property.**
- Storm will return an error if the inbound set of nodes contains any forms for which <*prop*> is not a valid property. For example, attempting to set a `:loc` property when the inbound nodes contain both domains and IP addresses will return an error as `:loc` is not a valid secondary property for a domain (`inet:fqdn`).
- Properties to be set or modified **must** be specified by their relative property name. For example, for the form `foo:bar` with the property `baz` (i.e., `foo:bar:baz`) the relative property name is specified as `:baz`.

Add or Modify Properties Using Subqueries

Secondary property values can be set using a **subquery** to assign the value. The subquery executes a Storm query to lift the node(s) whose primary property should be assigned as the value of the secondary property.

This is a specialized use case that is most useful when working with property values that are guids (see *GUID*) as it avoids the need to type or copy and paste the guid value. Using a subquery allows you to reference the guid node using a more "human friendly" method.

(See *Storm Reference - Subqueries* for additional detail on subqueries.)

Tip

You can optionally use the *"Try" Operator* (?=) when setting or modifying properties using a subquery.

Syntax:

<*query*> **[:** <*prop*> **= | ?= {** <*query*> **}** ... **]**

Examples:

Use a subquery to assign an organization's (ou:org) guid as the secondary property of a ps:contact node:

```
storm> ps:contact:orgname="U.S. Department of Justice" [ :org={ ou:org:names*[=usgovdoj]␣
↪} ]
ps:contact=d41d8cd98f00b204e9800998ecf8427e
        :address = 950 pennsylvania avenue nw, washington, dc, 20530-0001
        :loc = us.dc.washington
        :org = 0fa690c06970d2d2ae74e43a18f46c2a
        :orgname = u.s. department of justice
        :phone = +1 (202) 514-2000
        .created = 2025/07/03 18:39:49.086
```

In the example above, the subquery `ou:org:names*[=usgovdoj]` is used to lift the organization node with that `:names` property value and assign the `ou:org` node's guid value to the `:org` property of the `ps:contact` node.

Use a subquery to assign one or more industries (ou:industry) to an organization (ou:org):

```
storm> ou:org:name=apple [ :industries+={ ou:industry:name="computers and electronics"␣
↪ou:industry:name="telecommunications" } ]
ou:org=2848b564bf1e68563e3fea4ce27299f3
        :industries = ['8fa70aee5a624c691681e2159b3dbc2d',
↪'b83dd918c1abcf5eaa47cea02a560661']
        :loc = us.ca.cupertino
        :name = apple
        :names = ['apple', 'apple, inc.']
        :phone = +1 (408) 996-1010
        .created = 2025/07/03 18:39:49.107
```

In the example above, the subquery is used to lift the specified industry nodes (`ou:industry`) and assign both nodes' guid values to the `ou:org:industries` property for Apple's organization node.

Note

The `ou:org:industries` property is an **array** (a list or set of typed forms), so the query above uses array-specific syntax. See the *array* section of the *Storm Reference - Type-Specific Storm Behavior* guide for detail on the syntax used to add or modify array properties.

Usage Notes:

- When using a subquery to assign a property value, Storm will throw an error if the subquery fails to lift any nodes.
- When using a subquery to assign a value to a property that takes only a single value, Storm will throw an error if the subquery returns more than one node.
- When using a subquery to assign a property value, the subquery cannot iterate more than 128 times or Storm will throw an error. For example, attempting to assign "all the industries" to a single organization (`ou:org=<guid> [ :industries+={ ou:industry } ]`) will error if there are more than 128 `ou:industry` nodes.

Delete Properties

Operation to delete (fully remove) one or more properties from the specified node(s).

Note

In Synapse 2.x, a property must be deleted from the *Layer* where the property exists. Generally speaking, this means you must be in the *View* where the relevant layer is the topmost (writeable) layer in order to delete the property.

Syntax:

<query> **[-:** *<prop>* ... **]**

Examples:

Delete the :loc property from an inet:ipv4 node:

```
<inet:ipv4> [ -:loc ]
```

Delete multiple properties from a media:news node:

```
<media:news> [ -:author -:summary ]
```

Usage Notes:

- Deleting a property fully removes the property from the node; it does not set the property to a null value.

Delete Nodes

Nodes can be deleted from a Cortex using the Storm *delnode* command.

Add Light Edges

Operation that links the specified node(s) to another node or set of nodes (as specified by a Storm expression or variable) using a lightweight edge (light edge).

See *Lightweight (Light) Edge* for details on light edges.

Syntax:

<query> **[+(** *<verb>* **)> { <** *storm* **> } | <** *valu* **>]**

<query> **[<(** *<verb>* **)+ { <** *storm* **> } | <** *valu* **>]**

Note

The query syntax used to create light edges will yield the nodes that are **inbound to the edit brackets** (that is, the nodes represented by *<query>*).

The nodes specified by the Storm expression (`{ <storm> }`) must already exist in the Cortex or must be created as part of the Storm expression (i.e., using edit brackets) in order for the light edges to be created.

Examples:

Link the specified FQDN and IPv4 to the media:news node referenced by the Storm expression using a "refs" light edge:

```
inet:fqdn=woot.com inet:ipv4=1.2.3.4 [ <(refs)+ {␣
↪media:news=a3759709982377809f28fc0555a38193 } ]
```

Link the specified media:news node to the set of indicators tagged APT1 (#rep.mandiant.apt1) using a "refs" (references) light edge:

```
media:news=a3759709982377809f28fc0555a38193 [ +(refs)> { #rep.mandiant.apt1 } ]
```

Link the inet:whois:iprec netblock registration (whois) record to any IP address within the specified netblock range (as referenced by the Storm expression) that already exists in Synapse using an "ipwhois" light edge:

```
inet:whois:iprec:name=OVH-CUST-3399212 [ +(ipwhois)> { inet:ipv4=198.50.240.220-198.50.
↪240.223 } ]
```

Link the inet:whois:iprec netblock registration (whois) record to every IP in the specified netblock range (as referenced by the Storm expression) using an "ipwhois" light edge, creating the IPs if they do not exist:

```
inet:whois:iprec:name=OVH-CUST-3399212 [ +(ipwhois)> { [ inet:ipv4=198.50.240.220-198.50.
↪240.223 ] } ]
```

Link the specified media:news node to a node contained in a variable using a "refs" light edge:

```
$fqdn = { inet:fqdn=woot.com } media:news=a3759709982377809f28fc0555a38193 [ +(refs)>
↪$fqdn ]
```

Usage Notes:

- The plus sign (+) used with the light edge expression within the edit brackets is used to create the light edge(s).
- Light edges can be created in either "direction" (e.g., with the directional arrow pointing either right (`+(<verb>)>`) or left (`<(<verb>)+`) - whichever syntax is easier.
- Synapse does not include any pre-existing light edges / light edge verbs. Users can create and define light edges to meet their needs.
- Synapse's data model documentation for *Forms* lists various light edges that can be used with each form, based on The Vertex Project's recommendations. Use of these specific edges is not enforced by Synapse, although these edges may be created by various Vertex-provided Power-Ups.
- Light edge verbs are created "on the fly" when they are first used to link nodes; they do not need to be created or defined in advance before they can be used.
- A light edge's verb typically has a logical direction (a report "references" a set of indicators that it contains, but the indicators do not "reference" the report). It is up to the user to create the light edges in the correct direction and use forms that are sensical for the light edge verb. That is, there is nothing in the Storm syntax itself to prevent users linking arbitrary nodes in arbitrary directions using arbitrary light edges.
- The Storm *edges*, *lift*, and *model* commands can be used to work with light edges in Synapse.

Delete Light Edges

Operation that deletes the light edge linking the specified node(s) to the set of nodes specified by a given Storm expression or variable.

See *Lightweight (Light) Edge* for details on light edges.

> **Note**
>
> In Synapse 2.x, a light edge must be deleted from the *Layer* where the edge exists. Generally speaking, this means you must be in the *View* where the relevant layer is the topmost (writeable) layer in order to delete the edge.

Syntax:

<query> **[-(<*verb*>)> { <*storm*> } | <*valu*>]**

<query> **[<(<*verb*>)- { <*storm*> } | <*valu*>]**

> **Caution**
>
> The minus sign (-) used with a light edge **outside** any edit brackets simply instructs Storm to traverse ("walk") the specified light edge (see *Traversal Operations*). The minus sign used with a light edge **inside** edit brackets instructs Storm to **delete** the specified edges.

Examples:

Delete the "refs" light edge linking the MD5 hash of the empty file to the specified media:news node:

```
hash:md5=d41d8cd98f00b204e9800998ecf8427e [ <(refs)- {␣
↪media:news=a3759709982377809f28fc0555a38193 } ]
```

Delete the "ipwhois" light edge linking IP 1.2.3.4 to the specified netblock registration (whois) record:

```
inet:whois:iprec:name=OVH-CUST-3399212 [ -(ipwhois)> { inet:ipv4=1.2.3.4 } ]
```

Delete the "refs" light edge linking the specified media:news and a node contained in a variable:

```
$fqdn = { inet:fqdn=woot.com } media:news=a375970998237780 9f28fc0555a38193 [ -(refs)>
↪$fqdn ]
```

Usage Notes:

- The minus sign (`-`) used with the light edge expression within the edit brackets is used to delete the light edge(s).
- Light edges can be deleted in either "direction" (e.g., with the directional arrow pointing either right (`-(<verb>)>`) or left (`<(<verb>)-`) - whichever syntax is easier.

Add Tags

Operation to add one or more tags to the specified node(s).

> **Tip**
>
> You can optionally use the *"Try" Operator* (`+?#`) when adding tags.

Syntax:

<query> **[+# | +?#** *<tag>* **...** **]**

Examples:

Add a single tag:

```
<inet:ipv4> [ +#cno.infra.anon.tor.exit ]
```

Add multiple tags:

```
<inet:fqdn> [ +#rep.mandiant.apt1 +#cno.infra.dns.sink.holed ]
```

Add Tag Timestamps or Tag Properties

Synapse supports the use of *Tag Timestamps* and *Tag Properties* to provide additional context to tags where appropriate.

> **Tip**
>
> You can optionally use the *"Try" Operator* when setting or modifying tag timestamps or tag properties.
>
> - When using the try operator with tag timestamps, the operator is used with the tag name (`+?#<tag>=<time>` or `+?#<tag>=(<min_time>,<max_time>)`).
> - When using the try operator with a tag property, the operator is used with the tag property value (`+#<tag>:<tagprop>?=<pval>`).
>
> Note that the tag and tag timestamp(s) or the tag and tag property are evaluated as a whole; if any part of the tag expression is invalid, the full edit operation will fail. For example, when attempting to add a tag with timestamps where the tag is valid but the timestamp values are not, neither the tag nor the timestamps will be applied.

Syntax:

Add tag timestamps:

<query> **[+# |** **+?#** *<tag>* **=** *<time>* **|** **(** *<min_time>* **,** *<max_time>* **)** ... **]**

Add tag property:

<query> **[+#** *<tag>* **:** *<tagprop>* **= | ?=** *<pval>* ... **]**

Examples:

Add tag with single timestamp:

```
<inet:fqdn> [ +#cno.infra.dns.sink.holed=2018/11/27 ]
```

Add tag with a time interval (min / max):

```
<inet:fqdn> [ +#cno.infra.dns.sink.holed=(2014/11/06, 2016/11/06) ]
```

Tip

Tag timestamps are intervals (ival types). See the *ival* section of the *Storm Reference - Type-Specific Storm Behavior* for details on interval behavior and working with intervals.

Add tag with custom tag property and value:

```
<inet:fqdn> [ +#rep.symantec:risk = 87 ]
```

Tip

Tag properties must be defined and added to the data model before they can be used. See *Tag Properties* for additional information.

Usage Notes:

- *Tag Timestamps* and *Tag Properties* are applied only to the tags to which they are explicitly added. For example, adding a timestamp to the tag `#foo.bar.baz` does **not** add the timestamp to tags `#foo.bar` and `#foo`.

Modify Tags

Tags are "binary" in that they are either applied to a node or they are not. Tag names cannot be changed once set. To "change" the tag applied to a node, you must add the new tag and delete the old one.

Tip

The Storm *movetag* command can be used to modify tags in bulk - that is, migrate an entire set of tags (i.e., effectively "rename" the tags by creating and applying new tags and removing the old ones) or move a tag to a different tag tree.

Modify Tag Timestamps or Tag Properties

Tag timestamps or tag properties can be modified using the same syntax used to add the timestamp or property.

Tip

Tag timestamps are intervals (ival types). See the *ival* section of the *Storm Reference - Type-Specific Storm Behavior* for details on interval behavior when modifying interval values.

Remove Tags

Operation to delete one or more tags from the specified node(s).

Removing a tag from a node differs from deleting the node representing a tag (a `syn:tag` node), which can be done using the Storm *delnode* command.

Note

In Synapse 2.x, a tag must be deleted from the *Layer* where the tag exists. Generally speaking, this means you must be in the *View* where the relevant layer is the topmost (writeable) layer in order to delete the tag.

Syntax:

<*query*> **[-#** <*tag*> ... **]**

Examples:

Remove a leaf tag (i.e., the final or rightmost element of the tag):

```
<inet:ipv4> [ -#cno.infra.anon.tor.exit ]
```

Remove a full tag (i.e., the entire tag):

```
<inet:ipv4> [ -#cno ]
```

Usage Notes:

- Deleting a leaf tag deletes **only** the leaf tag from the node. For example, `[ -#foo.bar.baz ]` will delete the tag `#foo.bar.baz` but leave the tags `#foo.bar` and `#foo` on the node.
- Deleting a non-leaf tag deletes that tag and **all tags below it in the tag hierarchy** from the node. For example, `[ -#foo ]` used on a node with tags `#foo.bar.baz` and `#foo.hurr.derp` will remove **all** of the following tags:
  - `#foo.bar.baz`
  - `#foo.hurr.derp`
  - `#foo.bar`
  - `#foo.hurr`
  - `#foo`

Tip

The Storm *tag.prune* command can be used to recursively remove tags (i.e., from a leaf tag up through parent tags that do not have other children).

Remove Tag Timestamps

To remove a tag timestamp from a tag, you must remove the tag element that contains the timestamp. The tag element can be re-added without the timestamp if needed.

Remove Tag Properties

Removing a tag property deletes the property and any property value. The tag element to which the property was appended will remain.

Syntax:

Remove a tag property:

<query> **[-#** *<tag>* **:** *<tagprop>* ... **]**

Example:

Remove the custom tag property ':risk' from a tag:

```
<inet:fqdn> [ -#rep.symantec:risk ]
```

Combining Data Modification Operations

Storm allows you to perform multiple edits within a single edit operation (set of edit brackets).

Simple Examples

Create a node and add secondary properties:

```
[ inet:ipv4=94.75.194.194 :loc=nl :asn=60781 ]
```

Create a node and add a tag:

```
[ inet:fqdn=blackcake.net +#rep.mandiant.apt1 ]
```

Edit Brackets and Edit Parentheses Examples

Edit parentheses can be used within edit brackets to isolate edit operations (e.g., so a particular edit does not apply to all inbound nodes).

The following examples illustrate the differences in Storm behavior when using *Edit Brackets* alone vs. with *Edit Parentheses*.

When performing simple edit operations (i.e., Storm queries that add / modify a single node, or apply a tag to the nodes retrieved by a Storm lift operation) users can generally use edit brackets alone without delimiting edit operations within additional edit parentheses (edit parens).

Edit parens may be necessary when creating and modifying multiple nodes in a single query, or performing edits within a longer or more complex Storm query. In these cases, understanding the difference between edit brackets' "operate on everything inbound" vs. edit parens' "limit modifications to the specified nodes" is critical to avoid unintended data modifications.

Example 1:

Consider the following Storm query that uses only edit brackets:

```
inet:fqdn#rep.mandiant.apt1 [ inet:fqdn=somedomain.com +#rep.eset.sednit ]
```

The query will:

- Lift all domains that Mandiant associates with APT1 (i.e., tagged `#rep.mandiant.apt1`).
- Create the new domain `somedomain.com` (if it does not already exist) or lift it (if it does).
- Apply the tag `#rep.eset.sednit` to the domain `somedomain.com` **and** to all of the domains tagged `#rep.mandiant.apt1` (because those FQDNs are inbound to the edit operation / edit brackets).

We can see the effects in the output of our example query:

```
storm> inet:fqdn#rep.mandiant.apt1 [ inet:fqdn=somedomain.com +#rep.eset.sednit ]
inet:fqdn=newsonet.net
        :domain = net
        :host = newsonet
        :issuffix = false
        :iszone = true
        :zone = newsonet.net
        .created = 2025/07/03 18:39:49.144
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.eset.sednit
        #rep.mandiant.apt1
inet:fqdn=staycools.net
        :domain = net
        :host = staycools
        :issuffix = false
        :iszone = true
        :zone = staycools.net
        .created = 2025/07/03 18:39:49.146
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.eset.sednit
        #rep.mandiant.apt1
inet:fqdn=blackcake.net
        :domain = net
        :host = blackcake
        :issuffix = false
        :iszone = true
        :zone = blackcake.net
        .created = 2025/07/03 18:39:49.194
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.eset.sednit
        #rep.mandiant.apt1
inet:fqdn=purpledaily.com
        :domain = com
        :host = purpledaily
        :issuffix = false
        :iszone = true
        :zone = purpledaily.com
        .created = 2025/07/03 18:39:49.148
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.eset.sednit
        #rep.mandiant.apt1
inet:fqdn=hugesoft.org
        :domain = org
        :host = hugesoft
```

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```
        :issuffix = false
        :iszone = true
        :zone = hugesoft.org
        .created = 2025/07/03 18:39:49.147
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.eset.sednit
        #rep.mandiant.apt1
inet:fqdn=somedomain.com
        :domain = com
        :host = somedomain
        :issuffix = false
        :iszone = true
        :zone = somedomain.com
        .created = 2025/07/03 18:39:49.270
        #rep.eset.sednit
```

Consider the same query using edit parens inside the brackets:

```
inet:fqdn#rep.mandiant.apt1 [ ( inet:fqdn=somedomain.com +#rep.eset.sednit ) ]
```

Because we used the edit parens, the query will:

- Lift all domains that Mandiant associates with APT1 (i.e., tagged `#rep.mandiant.apt1`).
- Create the new domain `somedomain.com` (if it does not already exist) or lift it (if it does).
- Apply the tag `rep.eset.sednit` **only** to the domain `somedomain.com`.

We can see the difference in the output of the example query:

```
storm> inet:fqdn#rep.mandiant.apt1 [ ( inet:fqdn=somedomain.com +#rep.eset.sednit ) ]
inet:fqdn=newsonet.net
        :domain = net
        :host = newsonet
        :issuffix = false
        :iszone = true
        :zone = newsonet.net
        .created = 2025/07/03 18:39:49.144
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.mandiant.apt1
inet:fqdn=staycools.net
        :domain = net
        :host = staycools
        :issuffix = false
        :iszone = true
        :zone = staycools.net
        .created = 2025/07/03 18:39:49.146
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.mandiant.apt1
inet:fqdn=blackcake.net
        :domain = net
        :host = blackcake
        :issuffix = false
        :iszone = true
```

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```
        :zone = blackcake.net
        .created = 2025/07/03 18:39:49.194
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.mandiant.apt1
inet:fqdn=purpledaily.com
        :domain = com
        :host = purpledaily
        :issuffix = false
        :iszone = true
        :zone = purpledaily.com
        .created = 2025/07/03 18:39:49.148
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.mandiant.apt1
inet:fqdn=hugesoft.org
        :domain = org
        :host = hugesoft
        :issuffix = false
        :iszone = true
        :zone = hugesoft.org
        .created = 2025/07/03 18:39:49.147
        #cno.infra.dns.sink.holed = (2014/11/06 00:00:00.000, 2018/11/27 00:00:00.001)
        #rep.mandiant.apt1
inet:fqdn=somedomain.com
        :domain = com
        :host = somedomain
        :issuffix = false
        :iszone = true
        :zone = somedomain.com
        .created = 2025/07/03 18:39:49.270
        #rep.eset.sednit
```

Example 2:

Consider the following Storm query that uses only edit brackets:

```
[inet:ipv4=1.2.3.4 :asn=1111 inet:ipv4=5.6.7.8 :asn=2222]
```

The query will:

- Create (or lift) the IP address `1.2.3.4`.
- Set the IP's `:asn` property to `1111`.
- Create (or lift) the IP address `5.6.7.8`.
- Set the `:asn` property for **both** IP addresses to `2222`.

We can see the effects in the output of our example query:

```
storm> [inet:ipv4=1.2.3.4 :asn=1111 inet:ipv4=5.6.7.8 :asn=2222]
inet:ipv4=1.2.3.4
        :asn = 2222
        :type = unicast
        .created = 2025/07/03 18:39:49.283
inet:ipv4=5.6.7.8
```

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```
        :asn = 2222
        :type = unicast
        .created = 2025/07/03 18:39:49.284
```

Consider the same query using edit parens inside the brackets:

```
[ (inet:ipv4=1.2.3.4 :asn=1111) (inet:ipv4=5.6.7.8 :asn=2222) ]
```

Because the brackets separate the two sets of modifications, IP `1.2.3.4` has its `:asn` property set to `1111` while IP `5.6.7.8` has its `:asn` property set to `2222`:

```
storm> [ (inet:ipv4=1.2.3.4 :asn=1111) (inet:ipv4=5.6.7.8 :asn=2222) ]
inet:ipv4=1.2.3.4
        :asn = 1111
        :type = unicast
        .created = 2025/07/03 18:39:49.283
inet:ipv4=5.6.7.8
        :asn = 2222
        :type = unicast
        .created = 2025/07/03 18:39:49.284
```

3.6.7 Storm Reference - Subqueries

This section discusses the following topics:

- *Subquery*
- *Subquery Filter*
- *Using Subqueries to Reference Nodes*

Subquery

A **subquery** is a Storm query that is executed inside of another Storm query. Curly braces (`{ }`) are used to enclose the embedded query.

> **Note**
>
> Curly braces are a Storm syntax element that simply indicates "a Storm query is enclosed here". They can be used to denote a subquery, but have other uses as well.

Recall from *Storm Operating Concepts* that a Storm query can consist of multiple elements (lift, filter, pivot, pipe to command, etc.). This sequence of Storm operations acts as a "pipeline" through which the nodes in the query pass. Regardless of the number of nodes you start with (i.e., the number of nodes in your initial lift), each node is processed individually by each element in the query, from left to right.

The elements in the query can be thought of as "gates". The nodes "inbound" to each gate are processed by that gate in some way. For example, if the "gate" is a filter operation, some nodes may be allowed to pass, while others are dropped ("consumed"), based on the filter. If the gate is a pivot, the inbound node is dropped while the node that is the "target" of the pivot is picked up and added to the pipeline.

Note that in a standard Storm query (as described above) the set of nodes at any given point in the query is constantly changing - the "working set" of nodes is transformed by the various operations. The nodes that "go in" to a particular operation in the query are generally not the same ones that "come out". Note also that as described, this process is **linear** (hence "pipeline").

A **subquery** is another element that can be used as part of a longer Storm query, only in this case the "element" is itself an entire Storm query (as opposed to a filter, pivot, or Storm command).

One advantage of a subquery is that the actions that occur inside the subquery do not affect the "main" Storm execution pipeline - the nodes that "go in" to a subquery are the same nodes that "come out", regardless of what operations occur within the subquery itself. (In terms of the *Storm Operating Concepts*, subqueries do not **consume** nodes by default.) In this way, a subquery can allow you to "branch off" the main Storm execution pipeline, "do a thing" off to the side, and then return to the main execution pipeline as though nothing happened; you resume at the point you left off, with the same set of nodes in the pipeline as when you left.

If you want the nodes that result from the subquery operations to be returned, the `yield` option can be used to do so. Note that yielding the subquery nodes is **in addition to** the set of nodes that passed in to the subquery (not "instead of" the inbound nodes). If you **only** want the nodes resulting from the subquery, you probably don't need a subquery and can just use a standard Storm query instead.

Note

Any **actions** performed inside of a subquery will persist. For example, any modifications made to nodes inside a subquery (setting or modifying properties, applying tags, even creating new nodes) will remain; those changes will be present in the Cortex.

In addition, when setting or updating a *Variable* inside a subquery, the variable can pass back "out" of the subquery and be available to the main Storm query.

What remains unchanged is that the set of nodes inbound to the subquery will be the same set of nodes available (inbound) to the next element in the main Storm query - whatever happens inside the subquery does not affect the set of nodes in the **pipeline** (barring the use of `yield` of course).

This ability to "do a thing off to the side" inside of a Storm query pipeline can add efficiencies to certain queries, allowing you to perform some action inline that would otherwise require a second, separate query to perform. While subqueries have their uses in "standard" Storm, they are particularly useful for more advanced Storm use cases involving variables and control flow.

Note

A subquery is typically used to perform some action related to the Storm query in which it is embedded. But there is no requirement for this to be the case. The subquery can contain any valid Storm, so you could (for example) write a subquery that lifts ten arbitrary email addresses (`{ inet:email | limit 10 }`) in the middle of a longer query. There's not much point to this, but Storm will dutifully lift the nodes, discard them (unless the `yield` option is used), and continue on.

Finally, one important characteristic of a subquery is that **it requires inbound nodes in order to execute.** That is, the subquery is meant to be an element in a larger Storm pipeline, not a stand-alone query, and not the first element in a longer query. Even though the subquery does not affect the inbound nodes (that is, the nodes "pass through" the subquery and are still available as inbound nodes to the next query element), nodes must still be "fired into" the subquery for the subquery action(s) to take place.

For example, the following query will return zero nodes, even though the `yield` directive is present. Because no nodes are "inbound" to cause the subquery to execute, the embedded Storm is never run:

```
storm> yield { inet:email | limit 10 }
```

Syntax:

<query> [**yield**] **{** *<query>* **}** [*<query>*]

<query> [**yield**] { *<query>* [{ *<query>* }] } [*<query>*]

Examples:

- Pivot from a set of DNS A records to their associated IPs and then to additional DNS A records associated with those IPs. Use a subquery to check whether any of the IPs are RFC1918 addresses (i.e., have `:type=private`) and if so, tag the IP as non-routable.

```
<inet:dns:a> -> inet:ipv4 { +:type=private [ +#nonroutable ] } -> inet:dns:a
```

- Pivot from a set of IP addresses to any servers associated with those IPs. Use a subquery to check whether the IP has a location (`:loc`) property, and if not, call a third-party geolocation service to attempt to identify a location and set the property. (**Note:** Synapse does not include a geolocation service in its public distribution; this example assumes such a service has been implemented and is called using an extended Storm command named `ipgeoloc`.)

```
<inet:ipv4> { -:loc | ipgeoloc } -> inet:server
```

- Pivot from a set of FQDNs to any files (binaries) that query those FQDNs. Use a subquery with the `yield` option to return the file nodes as well as the original FQDNs.

```
<inet:fqdn> yield { -> inet:dns:request:query:name +:exe -> file:bytes }
```

Note

The "pivot and join" operator (`-+>`) allows you to combine a set of inbound nodes with the set of nodes reached by the pivot into a single result set. However, the operator only allows you to join sets of nodes that are "one degree" (one pivot) apart. The subquery syntax above effectively allows you to join two sets of nodes that are more than one pivot apart.

Usage Notes:

- Subqueries can be nested; you can place subqueries inside of subqueries.
- When the `yield` option is used, Storm will return the nodes from the subquery first, followed by the nodes from the original working set.

Subquery Filter

A **subquery filter** is a filter where the filter itself is a Storm expression.

Standard Storm filter operations are designed to operate on the nodes in the current working set, that is, the nodes actively passing through the Storm pipeline. Regardless of whether the filter uses a *Standard Comparison Operator* or *Extended Comparison Operator*, the filter evaluates some aspect of the node itself such as its primary or secondary property(ies), or whether or not the node has a particular tag.

A subquery filter allows you to use a subquery to filter the current set of nodes based on their relationship to other nodes, or on the properties or tags of "nearby" nodes. The subquery content is still evaluated "off to the side"; any pivots, filters, or other operations performed inside the subquery are still "contained within" the subquery. But the nodes passing through the main Storm pipeline are **evaluated against** the contents of the subquery, and are then filtered - passed or dropped - based on that evaluation.

For additional detail on subquery filters and examples of their use, refer to the *Subquery Filters* section of the *Storm Reference - Filtering* guide.

Using Subqueries to Reference Nodes

A subquery can be used as an alternative (and potentially simpler) way to reference a node in Synapse.

A common use case is to use a subquery as a simpler way to refer to a *GUID Form* or *Composite Form* without needing to enter (type, copy and paste) the form's primary property.

Examples:

Lift all of the contacts (ps:contact nodes) for The Vertex Project:

```
ps:contact:org = { ou:org:name = vertex }
```

Set the :id:number property of a contact (ps:contact node) to the ID number whose value is 444-44-4444:

```
ps:contact:name='ron the cat' [ :id:number = { ou:id:number:value = 444-44-4444 } ]
```

Tip

When a subquery is used to specify a property value (as in the queries above), Synapse will generate an error if the subquery expression returns more than node. Specifically, the `:org` property of a `ps:contact` node is a single `ou:org` guid. If `ou:org:name = vertex` returns more than one org node, Synapse returns a `BadTypeValu` error.

See the *Add or Modify Properties Using Subqueries* section of the *Storm Reference - Data Modification* document for additional examples of setting properties using subqueries.

3.6.8 Storm Reference - Model Introspection

This section provides a brief overview / tutorial of some basic Storm queries to allow introspection / navigation of Synapse's:

- *Data Model*
- *Analytical Model*

The sample queries below are meant to help users new to Synapse and Storm get started examining forms and tags within a Cortex. The queries all use standard Storm syntax and operations (such as pivots). For more detail on using Storm, see *Storm Reference - Introduction* and related Storm topics.

Data Model

Analysts working with the data in the Synapse hypergraph will quickly become familiar with the forms they work with most often. However, as the model expands - or when first learning Synapse - it is helpful to be able to easily reference forms that may be less familiar, as well as how different forms relate to each other.

While the data model can be referenced within the Synapse source code or via the auto-generated *Synapse Data Model* documentation, it can be inconvenient to stop in the middle of an analytical workflow to search for the correct documentation. It is even more challenging to stop and browse through extensive documentation when you're not sure what you're looking for (or whether an appropriate form exists for your needs).

For these reasons Synapse supports **data model introspection** within the Synapse hypergraph itself - that is, the Synapse data model is itself data stored within the Cortex. Introspection allows users to obtain the model definition for a given Cortex at run-time. The model definition contains a list of all native and custom types, forms, and properties supported by the current Cortex.

These model elements are generated as nodes in the Cortex from the current Synapse data model when a Cortex is initialized or when a new module is loaded. As nodes, they can be lifted, filtered, and pivoted across just like other

nodes. However, the model-specific nodes do not persist permanently in storage and they cannot be modified (edited) or tagged. Because they are generated at run-time they are known as run-time nodes or **runt nodes.**

The following runt node forms are used to represent the Synapse data model for types, forms, and properties, respectively.

- `syn:type`
- `syn:form`
- `syn:prop`

As nodes within the Cortex, these forms can be lifted, filtered, and pivoted across using the Storm query language, just like any other nodes (with the exception of editing or tagging). Refer to the various Storm documents for details on Storm syntax. A few simple example queries are provided below to illustrate some common operations for model introspection.

Example Queries

- Display all current types / forms / properties:

```
storm> syn:type | limit 2
syn:type=int
        :ctor = synapse.lib.types.Int
        :doc = The base 64 bit signed integer type.
        :opts = {'size': 8, 'signed': True, 'enums:strict': True, 'fmt': '%d', 'min':␣
↪None, 'max': None, 'ismin': False, 'ismax': False}
syn:type=float
        :ctor = synapse.lib.types.Float
        :doc = The base floating point type.
        :opts = {'fmt': '%f', 'min': None, 'minisvalid': True, 'max': None, 'maxisvalid
↪': True}
```

```
storm> syn:form | limit 2
syn:form=doc:policy:type:taxonomy
        :doc = A taxonomy of policy types.
        :runt = false
        :type = doc:policy:type:taxonomy
syn:form=doc:policy
        :doc = Guiding principles used to reach a set of goals.
        :runt = false
        :type = doc:policy
```

```
storm> syn:prop | limit 2
syn:prop=.seen
        :base = .seen
        :doc = The time interval for first/last observation of the node.
        :extmodel = false
        :relname = .seen
        :ro = false
        :type = ival
        :univ = true
syn:prop=.created
        :base = .created
        :doc = The time the node was created in the cortex.
```

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```
        :extmodel = false
        :relname = .created
        :ro = true
        :type = time
        :univ = true
```

- Display all types that are sub-types of 'string':

```
storm> syn:type:subof = str | limit 2
syn:type=ou:sic
        :ctor = synapse.lib.types.Str
        :doc = The four digit Standard Industrial Classification Code.
        :opts = {'enums': None, 'regex': '^[0-9]{4}$', 'lower': False, 'strip': False,
↪'replace': (), 'onespace': False, 'globsuffix': False}
        :subof = str
syn:type=ou:naics
        :ctor = synapse.lib.types.Str
        :doc = North American Industry Classification System codes and prefixes.
        :opts = {'enums': None, 'regex': '^[1-9][0-9]{1,5}?$', 'lower': False, 'strip':␣
↪True, 'replace': (), 'onespace': False, 'globsuffix': False}
        :subof = str
```

- Display a specific type:

```
storm> syn:type = inet:fqdn
syn:type=inet:fqdn
        :ctor = synapse.models.inet.Fqdn
        :doc = A Fully Qualified Domain Name (FQDN).
```

- Display a specific form:

```
storm> syn:form = inet:fqdn
syn:form=inet:fqdn
        :doc = A Fully Qualified Domain Name (FQDN).
        :runt = false
        :type = inet:fqdn
```

- Display a specific property of a specific form:

```
storm> syn:prop = inet:ipv4:loc
syn:prop=inet:ipv4:loc
        :base = loc
        :doc = The geo-political location string for the IPv4.
        :extmodel = false
        :form = inet:ipv4
        :relname = loc
        :ro = false
        :type = loc
        :univ = false
```

- Display a specific form and all its secondary properties (including universal properties):

```
storm> syn:prop:form = inet:fqdn | limit 2
syn:prop=inet:fqdn
        :doc = A Fully Qualified Domain Name (FQDN).
        :extmodel = false
        :form = inet:fqdn
        :type = inet:fqdn
        :univ = false
syn:prop=inet:fqdn.seen
        :base = .seen
        :doc = The time interval for first/last observation of the node.
        :extmodel = false
        :form = inet:fqdn
        :relname = .seen
        :ro = false
        :type = ival
        :univ = false
```

- Display all properties whose type is `inet:fqdn`:

```
storm> syn:prop:type = inet:fqdn | limit 2
syn:prop=inet:dns:a:fqdn
        :base = fqdn
        :doc = The domain queried for its DNS A record.
        :extmodel = false
        :form = inet:dns:a
        :relname = fqdn
        :ro = true
        :type = inet:fqdn
        :univ = false
syn:prop=inet:dns:aaaa:fqdn
        :base = fqdn
        :doc = The domain queried for its DNS AAAA record.
        :extmodel = false
        :form = inet:dns:aaaa
        :relname = fqdn
        :ro = true
        :type = inet:fqdn
        :univ = false
```

- Display all forms **referenced by** a specific form (i.e., the specified form contains secondary properties that are themselves forms):

```
storm> syn:prop:form = inet:whois:rec :type -> syn:form
syn:form=inet:whois:rec
        :doc = A domain whois record.
        :runt = false
        :type = inet:whois:rec
syn:form=inet:fqdn
        :doc = A Fully Qualified Domain Name (FQDN).
        :runt = false
        :type = inet:fqdn
syn:form=inet:whois:rar
        :doc = A domain registrar.
```

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```
        :runt = false
        :type = inet:whois:rar
syn:form=inet:whois:reg
        :doc = A domain registrant.
        :runt = false
        :type = inet:whois:reg
```

- Display all forms that **reference** a specific form (i.e., the specified form is a secondary property of another form):

```
storm> syn:form = inet:whois:rec -> syn:prop:type :form -> syn:form
syn:form=inet:whois:contact
        :doc = An individual contact from a domain whois record.
        :runt = false
        :type = inet:whois:contact
syn:form=inet:whois:rec
        :doc = A domain whois record.
        :runt = false
        :type = inet:whois:rec
syn:form=inet:whois:recns
        :doc = A nameserver associated with a domain whois record.
        :runt = false
        :type = inet:whois:recns
```

Analytical Model

As the number of tags used in the hypergraph increases, analysts must be able to readily identify tags, tag hierarchies, and the precise meaning of individual tags so they can be applied and interpreted correctly.

Unlike the runt nodes used for the Synapse data model, the `syn:tag` nodes that represent tags are regular objects in the Cortex that can be lifted, filtered, and pivoted across (as well as edited, tagged, and deleted) just like any other nodes. In a sense it is possible to perform **"analytical model introspection"** by examining the nodes representing a Cortex's analytical model (i.e., tags).

Lifting, filtering, and pivoting across `syn:tag` nodes is performed using the standard Storm query syntax; refer to the various Storm documents for details on using Storm. See also the `syn:tag` section of *Storm Reference - Type-Specific Storm Behavior* for additional details on working with `syn:tag` nodes.

A few simple example queries are provided below to illustrate some common operations for working with tags. As Synapse does not include any pre-populated `syn:tag` nodes, these examples assume you have a Cortex where some number of tags have been created.

Example Queries

- Lift a single tag:

```
storm> syn:tag = cno.infra.anon.tor
syn:tag=cno.infra.anon.tor
        :base = tor
        :depth = 3
        :doc = Various types of Tor infrastructure, including: a server representing a␣
↪Tor service or the associated IP address; a host known to be a Tor node / hosting a␣
↪Tor service; contact information associated with an entity responsible for a given Tor␣
↪node.
        :title = Tor Infrastructure
```

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```
        :up = cno.infra.anon
        .created = 2025/07/03 18:39:30.653
```

- Lift all root tags:

```
storm> syn:tag:depth = 0
syn:tag=cno
        :base = cno
        :depth = 0
        .created = 2025/07/03 18:39:30.650
```

- Lift all tags one level "down" from the specified tag:

```
storm> syn:tag:up = cno.infra.anon
syn:tag=cno.infra.anon.vpn
        :base = vpn
        :depth = 3
        :doc = A server representing an anonymous VPN service, or the associated IP␣
↪address. Alternately, an FQDN explicilty denoting an anonymous VPN that resolves to␣
↪the associated IP.
        :title = Anonymous VPN
        :up = cno.infra.anon
        .created = 2025/07/03 18:39:30.654
syn:tag=cno.infra.anon.tor
        :base = tor
        :depth = 3
        :doc = Various types of Tor infrastructure, including: a server representing a␣
↪Tor service or the associated IP address; a host known to be a Tor node / hosting a␣
↪Tor service; contact information associated with an entity responsible for a given Tor␣
↪node.
        :title = Tor Infrastructure
        :up = cno.infra.anon
        .created = 2025/07/03 18:39:30.653
```

- Lift all tags that start with a given prefix, regardless of depth:

```
storm> syn:tag ^= cno.infra
syn:tag=cno.infra
        :base = infra
        :depth = 1
        :doc = Top-level tag for infrastructre.
        :title = Infrastructure
        :up = cno
        .created = 2025/07/03 18:39:30.650
syn:tag=cno.infra.anon
        :base = anon
        :depth = 2
        :doc = Top-level tag for anonymization services.
        :title = Anonymization services
        :up = cno.infra
        .created = 2025/07/03 18:39:30.652
syn:tag=cno.infra.anon.tor
        :base = tor
```

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```
        :depth = 3
        :doc = Various types of Tor infrastructure, including: a server representing a␣
↪Tor service or the associated IP address; a host known to be a Tor node / hosting a␣
↪Tor service; contact information associated with an entity responsible for a given Tor␣
↪node.
        :title = Tor Infrastructure
        :up = cno.infra.anon
        .created = 2025/07/03 18:39:30.653
syn:tag=cno.infra.anon.vpn
        :base = vpn
        :depth = 3
        :doc = A server representing an anonymous VPN service, or the associated IP␣
↪address. Alternately, an FQDN explicilty denoting an anonymous VPN that resolves to␣
↪the associated IP.
        :title = Anonymous VPN
        :up = cno.infra.anon
        .created = 2025/07/03 18:39:30.654
```

- Lift all tags that share the same base (rightmost) element:

```
storm> syn:tag:base = sofacy
syn:tag=rep.talos.sofacy
        :base = sofacy
        :depth = 2
        :doc = Indicator or activity talos calls (or associates with) sofacy.
        :title = sofacy(talos)
        :up = rep.talos
        .created = 2025/07/03 18:39:30.665
syn:tag=rep.uscert.sofacy
        :base = sofacy
        :depth = 2
        :doc = Indicator or activity uscert calls (or associates with) sofacy.
        :title = sofacy(uscert)
        :up = rep.uscert
        .created = 2025/07/03 18:39:30.664
```

3.6.9 Storm Reference - Type-Specific Storm Behavior

Some data types (*Type*) within Synapse have additional optimizations. These include optimizations for:

- indexing (how the type is stored for retrieval);
- parsing (how the type can be specified for input);
- insertion (how the type can be used to create or modify nodes);
- operations (how the type can be lifted, filtered, or otherwise compared).

Types that have been optimized in various ways are documented below along with any specialized operations that may be available for those types.

This section is **not** a complete reference of all available types. In addition, this section does **not** address the full range of type enforcement constraints that may restrict the values that can be specified for a given type (such as via a constructor (`ctor`)). For details on available types and type constraints or enforcement, see the online documentation or the Synapse source code.

- *array* (array)
- *duration* (duration)
- *file:bytes* (file)
- *guid* (globally unique identifier)
- *inet:fqdn* (FQDN)
- *inet:ipv4* (IPv4)
- *int* (integer)
- *ival* (time interval)
- *loc* (location)
- *str* (string)
- *syn:tag* (tag)
- *taxonomy* (taxonomy)
- *time* (date/time)

array

An `array` is a specialized type that consists of either a list or a set of typed values. That is, an array is a type that consists of one or more values that are themselves all of a single, defined type.

Tip

An array that is a **list** can have duplicate entries in the list. An array that is a **set** consists of a unique group of entries.

`Array` types can be used for secondary properties where that property is likely to have multiple values. Examples of array secondary properties include `media:news:authors`, `inet:email:message:headers`, and `ps:person:names`. You can view all secondary properties that are `array` types using the following Storm query:

```
syn:prop:type=array
```

Tip

Some forms include both a singular and an array property for the same type. This allows you to record a primary value along with optional variations (e.g., such as `ou:org:name` and `ou:org:names`), or a primary and optional secondary values (e.g., such as `ou:campaign:goal` and `ou:campaign:goals`).

Indexing

N/A

Parsing

Because an `array` is a list or set of typed values, `array` elements can be input in any format supported by the type of the elements themselves. For example, if an `array` consists of `inet:ipv4` values, the values can be input in any supported `inet:ipv4` format (e.g., integer, hex, dotted-decimal string, etc.).

Insertion

Because an array may contain multiple values, an `array` property must be set using comma-separated values enclosed in parentheses (this is true even if the array contains only a single element; you must still use parentheses, and the single element must still be followed by a trailing comma). Single or double quotes are required in accordance with the standard rules for using *Whitespace and Literals in Storm*.

Example:

Set the `:names` property of an organization (`ou:org`) node to a single value:

```
storm> ou:org:name=vertex [ :names=('The Vertex Project',) ]
ou:org=669be83d696b99fcb8e518a5d6708634
        :name = vertex
        :names = ['the vertex project']
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.060
```

Example:

Set the `:names` property of an organization (`ou:org`) node to contain multiple variations of the organization name:

```
storm> ou:org:name=vertex [ :names=('The Vertex Project', 'The Vertex Project, LLC',␣
↪Vertex) ]
ou:org=669be83d696b99fcb8e518a5d6708634
        :name = vertex
        :names = ['the vertex project', 'the vertex project, llc', 'vertex']
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.060
```

Warning

Using the equals (=) operator to set an array property value will set or update (overwrite) the **entire** property value. To add or remove individual elements from an array, use the +=, -=, ++=, or --= operators.

Example:

Add a name to the array of names associated with an organization:

```
storm> ou:org:name='Monty Python' [ :names+='The Spanish Inquisition' ]
ou:org=79d50236cbf7ac82e79db487147fcfec
        :name = monty python
        :names = ['monty python', 'the spanish inquisition']
        .created = 2025/07/03 18:38:44.087
```

Remove a name from the array of names associated with an organization:

```
storm> ou:org:name='Monty Python' [ :names-='The Spanish Inquisition' ]
ou:org=79d50236cbf7ac82e79db487147fcfec
        :name = monty python
        :names = ['monty python']
        .created = 2025/07/03 18:38:44.087
```

Add multiple values to the array of names associated with an organization:

```
storm> ou:org:name=vertex [ :names ++= ('The Vertex Project', 'The Vertex Project, LLC',␣
↪Vertex) ]
ou:org=669be83d696b99fcb8e518a5d6708634
        :name = vertex
        :names = ['the vertex project', 'the vertex project, llc', 'vertex']
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.060
```

Remove multiple values from the array of names associated with an organization:

```
storm> ou:org:name=vertex [ :names --= ('The Vertex Project', 'The Vertex Project, LLC',␣
↪Vertex) ]
ou:org=669be83d696b99fcb8e518a5d6708634
        :name = vertex
        :names = []
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.060
```

Tip

The standard "edit try" operator (?=) (see *"Try" Operator* in the *Storm Reference - Data Modification*) can be used to attempt to set a **full** array property value where you are unsure whether the value will succeed. The specialized ?+= or ?-= operators can be used to attempt to add or remove a **single** array value in a similar manner. The ?++= and ?--= operators can be used to attempt to add or remove multiple values from an array value, ignoring any items which fail to normalize.

Example:

Use the specialized "edit try" operator to attempt to add a single value to the `:authors` array property of an article (`media:news` node). (**Note:** a type-inappropriate value (a name) is used below to show the "fail silently" behavior for the "edit try" operator. The `:authors` property is an array of `ps:contact` nodes and requires `ps:contact` guid values.)

```
storm> media:news:publisher:name=kaspersky [ :authors?+='john smith' ]
media:news=ea94ab6b48eb9f9f846909bc0de640d3
        :publisher:name = kaspersky
        :title = new report on really bad threat
        .created = 2025/07/03 18:38:44.099
```

Usage Notes:

- When using the standard "edit try" operator (?=) to attempt to set the **full** value of an array property (vs. adding or removing an element from an array), the **entire** attempt will fail if **any** value in the list of values fails. For example, if you try to set `[ :identities:emails?=(alice@vertex.link, bob) ]` on an X509 certificate (`crypto:x509:cert`), Synapse will fail to set the property altogether because `bob` is not a valid email address type (even though `alice@vertex.link` is).
- The "edit try" operators for **removing** elements from an array (?-= or ?--=) are unique to arrays as they are the only type that allows removal of a individual elements from a property. (Properties with a single value are either set, modified (updated), or the property is deleted altogether.) As with other uses of "edit try", use of the operator allows the operation to silently fail (vs. error and halt) if the operation attempts to remove a value from an array that does not match the array's defined type. For example, attempting to remove an IPv4 from an array of email addresses will halt with a `BadTypeValu` error if the standard remove operator (-=) is used, but silently fail (do nothing and continue) if the "edit try" version (?-=) is used.

Operations

Lifting and Filtering

Lifting or filtering array properties using the equals (=) operator requires an **exact match** of the full array property value. This makes sense for forms with simple values like `inet:ipv4=1.2.3.4`, but is often infeasible for arrays because lifting by the **full** array value requires you to know the **exact** values of each of the array elements as well as their **exact** order:

```
storm> ou:org:names=("The Vertex Project", "The Vertex Project, LLC", Vertex)
```

For this reason, Storm offers a special "by" syntax for lifting and filtering with `array` types. The syntax consists of an asterisk (*) preceding a set of square brackets (`[ ]`), where the square brackets contain a comparison operator and a value that can match one or more elements in the array. This allows users to match one or more elements in the array similarly to how they would match individual property values.

> **Note**
>
> The square brackets used to lift or filter based on values in an array should not be confused with square brackets used to add or modify nodes or properties in *Edit Mode*.

Examples:

Lift the `ou:org` node(s) whose `:names` property contains a name that exactly matches `vertex`:

```
storm> ou:org:names*[=vertex]
```

Lift the `ou:org` node(s) whose `:names` property contains a name that includes the string `vertex`:

```
storm> ou:org:names*[~=vertex]
```

Note: the above query returns three "copies" of the `ou:org` node because each of the three values in the `:names` array matches the queried string.

Lift the x509 certificate nodes that reference the domain `microsoft.com`:

```
storm> crypto:x509:cert:identities:fqdns*[=microsoft.com]
crypto:x509:cert=3d30629da82f41ab04c5befaf8c70e5a
        :identities:fqdns = ['microsoft.com', 'verisign.com']
        .created = 2025/07/03 18:38:44.110
```

Filter a set of `ou:org` nodes to include only those with a name that starts with "acme":

```
storm> ou:org +:names*[^=acme]
ou:org=07a22b45a495d32ebac6708f5bd95ab2
        :name = acme consulting
        :names = ['acme consulting']
        .created = 2025/07/03 18:38:44.120
ou:org=26bb6b95153fe7f56baca881e6afe1d6
        :name = acme construction
        :names = ['acme construction']
        .created = 2025/07/03 18:38:44.121
```

See *Lift by (Arrays) (*[ ])* and *Filter by (Arrays) (*[ ])* for additional details.

Pivoting

Synapse and Storm are type-aware and will facilitate pivoting between properties of the same type. This includes pivoting between individual typed properties and array properties consisting of those same types. Type awareness for arrays includes both standard form and property pivots as well as wildcard pivots.

Examples:

Pivot from a set of x509 certificate nodes to the set of domains referenced by the certificates (such as in the `:identities:fqdns` array property):

```
storm> crypto:x509:cert -> inet:fqdn
inet:fqdn=microsoft.com
        :domain = com
        :host = microsoft
        :issuffix = false
        :iszone = true
        :zone = microsoft.com
        .created = 2025/07/03 18:38:44.111
inet:fqdn=verisign.com
        :domain = com
        :host = verisign
        :issuffix = false
        :iszone = true
        :zone = verisign.com
        .created = 2025/07/03 18:38:44.111
```

Pivot from a set of `ou:name` nodes to any nodes that reference those names (this would include `ou:org` nodes where the `ou:name` is present in the `:name` property or as an element in the `:names` array):

```
storm> ou:name^=acme <- *
ou:org=26bb6b95153fe7f56baca881e6afe1d6
        :name = acme construction
        :names = ['acme construction']
        .created = 2025/07/03 18:38:44.121
ou:org=26bb6b95153fe7f56baca881e6afe1d6
        :name = acme construction
        :names = ['acme construction']
        .created = 2025/07/03 18:38:44.121
ou:org=07a22b45a495d32ebac6708f5bd95ab2
        :name = acme consulting
        :names = ['acme consulting']
        .created = 2025/07/03 18:38:44.120
ou:org=07a22b45a495d32ebac6708f5bd95ab2
        :name = acme consulting
        :names = ['acme consulting']
        .created = 2025/07/03 18:38:44.120
```

duration

`duration` is a type that represents a period (length) of time.

Indexing

A `duration` is stored as an integer value representing the number of milliseconds.

Parsing

A `duration` is commonly specified using a string value (days / hours / minutes / seconds / milliseconds as appropriate) with the following notation:

```
##D hh:mm:ss.mmm
```

The literal uppercase letter "D" is used to represent the number of days. When entering a duration value as a string, single or double quotes are required in accordance with the standard rules for using *Whitespace and Literals in Storm*.

A `duration` can also be specified as the number of milliseconds expressed as an integer value enclosed in parentheses:

```
(218262777)
```

Tip

Similar to *time* types, Synapse expects that users will generally enter duration values using "human friendly" strings, and will attempt to parse the input as such. Using parentheses tells Synapse to interpret the value as a raw integer.

Note that this parentheses syntax only applies when setting or updating a `duration` property using Storm. When setting or updating a property in the Optic UI by editing a field, you must enter a duration string value.

Insertion

When setting a `duration` value, enter the value using either format above.

Examples:

Set the duration of a compromise (`risk:compromise` node) to six days, six hours, 46 minutes, and 23 seconds:

```
storm> [ risk:compromise = * :name = 'example compromise' :duration = '6D 06:46:23' ]
risk:compromise=bbc97d4451d2c82822a05bec2f926c70
        :duration = 6D 06:46:23.000
        :name = example compromise
        .created = 2025/07/03 18:38:44.139
```

Or:

```
storm> [ risk:compromise = * :name = 'example compromise' :duration = (542783000) ]
risk:compromise=14dce830c47a3e2aa3c77c5f3928b8e4
        :duration = 6D 06:46:23.000
        :name = example compromise
        .created = 2025/07/03 18:38:44.153
```

Values can be set at any level of granularity; e.g., `[ :duration = 19D ]` is acceptable, as are values to millisecond resolution.

Note

Forms that have `duration` properties may have related *time* properties as appropriate for the form, such as a start time or end time or both. A compromise (`risk:compromise` node) is one example and includes start time (`:time`), end time (`:lasttime`), and duration (`:duration`). This allows you to set any or all properties, depending on the

information available. For example, you may know when a compromise was fully remediated (ended), but not when it began or how long it lasted.

While start, end, and duration values are related, Synapse does **not** currently calculate values for these properties. That is, entering a start time and a duration will not automatically calculate and set the ending time. Similarly, if all three values are set and you modify one of the values, the other value(s) are not updated to reflect the change (e.g., changing the duration will not automatically update the ending time).

That said, in cases where a node has start, end, and duration properties and you have two of the three values, you can use variables to calculate and set the third value. For example, given a `risk:compromise:name = 'my compromise'` with `:time = '2023/09/22 10:40'` and `:lasttime = '2023/10/06 14:00'` you could set the `:duration` value using the following Storm query:

```
risk:compromise:name='my compromise' $min=:time $max=:lasttime [ :duration=( $max - $min ) ]
```

This will set `:duration = 14D 03:20:00.000`.

Operations

As `duration` types are stored as integers, they support any operations suitable for integer values. This includes:

- comparison using mathematical operators (such as greater than (>));
- finding low or high values using the *min* or *max* commands;
- use of the range (`*range=`) comparison operator;

. . . etc.

file:bytes

`file:bytes` is a special type used to represent any file (i.e., any arbitrary set of bytes). Note that a file can be represented as a node within a Cortex regardless of whether the file itself (the specific set of bytes) is available (i.e., stored in an Axon). This is essential as many other data model elements allow (or depend on) the concept of a file (as opposed to a hash).

The `file:bytes` type is a specialized *guid* type. A file can be uniquely represented by the specific contents of the file itself. As it is impractical to use "all the bytes" as a primary property value, it makes sense to use a shortened representation of those bytes - that is, a hash. MD5 collisions can now be generated with ease, and SHA1 collisions were demonstrated in 2017. For this reason, Synapse uses the SHA256 hash of a file (considered sufficiently immune from collision attacks for the time being) as "unique enough" to act as the primary property of a `file:bytes` node if available. Otherwise, a `guid` is generated and used.

Indexing

N/A

Parsing

`file:bytes` must be input using their complete primary property. It is impractical to manually type a SHA256 hash or 128-bit `guid` value. For this reason `file:bytes` forms are most often specified by referencing the node via a more human-friendly secondary property or by pivoting to the node. Alternately, the `file:bytes` value can be copied and pasted for use in a query.

The primary property of a `file:bytes` node indicates how the node was created (i.e., via the SHA256 hash or via a guid):

- A node created using the SHA256 hash will have a primary property value consisting of `sha256:` prepended to the SHA256 hash:

  `file:bytes=sha256:e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855`

- A node created using a `guid` will have a primary property value consisting of `guid:` prepended to the `guid` value:

  `file:bytes=guid:22d4ed1b75c9eb5ff8070e0df1e8ed6b`

Note

When specifying a SHA256-based `file:bytes` node, entering the `sha256:` prefix is optional. The following are equivalent representations of the same file:

```
file:bytes=sha256:e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855

file:bytes=e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
```

Insertion

A `file:bytes` node can be created in one of three ways:

SHA256 Hash

A SHA256 hash can be specified as the node's primary property. The `sha256:` prefix can optionally be specified, but is not required (it will be added automatically on node creation). Storm will recognize the primary property value as a SHA256 hash and also set the `:sha256` secondary property. Any other secondary properties must be set manually.

```
storm> [ file:bytes = 44daad9dbd84c92fa9ec52649b028b4c0f7d285407685778d09bad4b397747d0 ]
file:bytes=sha256:44daad9dbd84c92fa9ec52649b028b4c0f7d285407685778d09bad4b397747d0
        :sha256 = 44daad9dbd84c92fa9ec52649b028b4c0f7d285407685778d09bad4b397747d0
        .created = 2025/07/03 18:38:44.156
```

Because the SHA256 is considered unique (for now) for our purposes, the node is fully deconflictable. If additional secondary properties such as `:size` or other hashes are obtained later, or if the actual file is obtained, the node can be updated with the additional properties based on deconfliction with the SHA256 hash.

GUID Value

The asterisk can be used to generate a `file:bytes` node with an arbitrary guid value:

```
storm> [ file:bytes = * ]
file:bytes=guid:73a50c1c6747c09cdff2d4aa86324335
        .created = 2025/07/03 18:38:44.158
```

Alternately, a potentially deconflictable `guid` can be generated by specifying a list of one or more values to the `guid` generator (for example, an MD5 and / or SHA1 hash). This will generate a predictable `guid`:

```
storm> [ file:bytes = (63fcc49b2ac6cbd686f4d9704446c673,)␣
↪:md5=63fcc49b2ac6cbd686f4d9704446c673 ]
file:bytes=guid:34f71d05b9e06558b184aac6f4010a12
        :md5 = 63fcc49b2ac6cbd686f4d9704446c673
        .created = 2025/07/03 18:38:44.160
```

Synapse does not recognize any strings passed to the `guid` generator as specific types or properties and will not use values used to generate the `guid` to set any secondary property values; those properties must be explicitly set (e.g., the `:md5` property in the example above).

See the section on type-specific behavior for *guid* types for additional discussion of arbitrary (non-deconflictable) vs. deconflictable `guids`.

Note

"Deconflicting" `file:bytes` nodes based on an MD5 or SHA1 hash alone is potentially risky because both of those hashes are subject to collision attacks. In other words, two files that have the same MD5 hash or the same SHA1 hash are not guaranteed to be the same file based on that single hash alone.

In short, creating `file:bytes` nodes using the MD5 and / or SHA1 hash can allow the creation of "potentially" deconflictable nodes when no other data is available. However, this deconfliction is subject to some limitations, as noted above. In addition, if the actual file (full bytes) or corresponding SHA256 hash is obtained later, it is not possible to "convert" a `guid`-based `file:bytes` node to one whose primary property is based on the SHA256 hash.

Actual Bytes

You can also create a `file:bytes` node by adding the actual file (set of bytes) to Synapse (specifically, to Synapse's Axon storage). Adding the file will create the `file:bytes` node in the Cortex based on the file's SHA256 value. Synapse will also calculate and set additional properties for the `file:bytes` node's size and other hashes (e.g., MD5, SHA1, etc.).

Creating `file:bytes` nodes in this manner is often done programmatically (such as via a Synapse *Power-Up*) that can download or ingest files. Other options include:

- the built-in Synapse *wget* command;
- the **Upload File** menu option available from the Optic UI, which allows you to either upload a file from local disk, or download a file from a specified URL; or
- the `pushfile` tool, available from the CLI in the community version of Synapse (see *pushfile*).

Tip

Like other external (to Storm) commands, the pushfile tool is accessible from the Storm CLI (see *storm*) as `! pushfile`.

Similarly, Storm's HTTP library (*$lib.inet.http*) could be leveraged to retrieve a web-based file and use the returned bytes as input (potentially using Storm variables - see *Storm Reference - Advanced - Variables*) to the `guid` generator. A detailed discussion of this method is beyond the scope of this section; see the *Storm Libraries* technical documentation for additional detail.

Operations

For some lift and filter operations, you may optionally specify `file:bytes` nodes using a "sufficiently unique" partial match of the node's primary property. For example, the prefix operator (`^=`) may be used to specify a unique prefix for the `file:bytes` node's SHA256 or guid value:

```
storm> file:bytes^=sha256:021b4ce5
file:bytes=sha256:021b4ce5c4d9eb45ed016fe7d87abe745ea961b712a08ea4c6b1b81d791f1eca
```

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```
        :md5 = 8934aeed5d213fe29e858eee616a6ec7
        :name = adobeupdater.exe
        :sha1 = a7e576f41f7f100c1d03f478b05c7812c1db48ad
        :sha256 = 021b4ce5c4d9eb45ed016fe7d87abe745ea961b712a08ea4c6b1b81d791f1eca
        :size = 182820
        .created = 2025/07/03 18:38:44.163
```

Usage Notes:

- When using the prefix operator, the `sha256:` or `guid:` prefix string must be included.
- The length of the value that is "sufficiently unique" to select a single `file:bytes` will vary depending on the data in your instance of Synapse. If your selection criteria matches more than one `file:bytes` node, Synapse will return all matches.
- Alternatively, the regular expression operator (`~=`) may be used to specify a partial string match anywhere in the `file:bytes` node's primary property value (though this is an inefficient way to specify a `file:bytes` node).

guid

Within Synapse, the Globally Unique Identifier (`guid`) *Type* refers to a 128-bit value used as a form's primary property. The value is represented in hex (e.g., `4b0c2c5671874922ce001d69215d032f`).

The term should not be confused with the definition of GUID used by Microsoft, or with other types of identifiers used within Synapse (e.g., such as node identifiers / node idens).

The `guid` type is used as the primary property for forms that cannot be uniquely defined by any set of specific properties. See the background documents on the Synapse data model for additional details on the *Guid Form*.

A guid value may be generated arbitrarily or in a predictable (i.e., repeatable) manner based on a defined set of inputs.

See the section on *file:bytes* types for discussion of `file:bytes` as a specialized instance of a `guid` type.

Indexing

N/A

Parsing

It is generally impractical to manually type a guid when lifting or otherwise specifying a guid form. While guids can be specified by a sufficiently unique prefix (e.g., `ou:org^=4b0c2`), it is more common to reference a guid node via a more human-friendly secondary property. For example:

```
storm> ou:org:name = vertex
ou:org=669be83d696b99fcb8e518a5d6708634
        :name = vertex
        :names = []
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.060
```

Alternately, the guid value can be copied and pasted.

Insertion

Guids can be generated **arbitrarily** or as **predictable** values. When choosing a method, you should consider how you will **deconflict** guid-based nodes. (Recall that Synapse deconflicts forms based on their primary property value.) See *Guid Best Practices* below for additional discussion.

Arbitrary Guids

When creating a guid node, you can specify the asterisk (*) as the primary property value of the new node. This tells Synapse to generate a unique, **arbitrary** guid for the node. For example:

```
storm> [ ou:org=* :name="The Vertex Project" :url=https://vertex.link/ ]
ou:org=073f8740a8eb5d7358442995a46e5842
        :name = the vertex project
        :url = https://vertex.link/
        .created = 2025/07/03 18:38:44.170
```

The above query creates a new organization node with a unique arbitrary guid for its primary property, and sets the specified secondary properties.

Warning

Because the guid generated by the asterisk is **arbitrary,** if you run the same query again Synapse will create a second `ou:org` node with the same `:name` and `:url` values but a **new** unique, arbitrary guid.

The advantage of arbitrary values is that they are simple to generate. This is particularly useful for analysts who need to manually create one-off guid nodes (for example, `ps:contact` or `ou:technique` nodes) as part of their workflow.

The disadvantage is that arbitrary values are truly arbitrary; there is no easy way to deconflict the nodes. This can have undesirable consequences:

- Users may inadvertently create duplicate nodes. That is, two users can independently create nodes with different guids to represent the same object. The only way to prevent this is by convention - for example, establishing internal processes where users "check first" before creating certain nodes. While this may limit duplication, it is unlikely to eliminate it entirely.
- Bulk data that is ingested using arbitrary guids cannot be reingested, at least not in the same way. Reingesting the same data will create a second set of nodes for the same data but with different arbitrary guids.

Because arbitrary guids may limit your ability to deconflict nodes, their use cases are fairly limited. For example:

- Analysts who need to manually create "one-off" nodes that are unlikely to require deconfliction, or that can be deconflicted (if necessary) in the future using additional secondary properties (see *Secondary Property Deconfliction* below).
- Data that is both unique (i.e., the same or similar data is not available from another source) **and** will only ever be ingested once (i.e., you never plan to reingest the data to improve the ingest logic or capture additional information).

In most cases, the use of predictable guid values is preferred for consistency and to help "future proof" your data in the event you need to reingest the same data later.

Predictable Guids

You can generate a guid value in a predictable manner based on a defined set of inputs. The inputs are specified as a comma-separated list within a set of parentheses. The guid generator uses these values as "seed" data to create a **predictable** guid value; the same set of seed data always generates the same guid.

For example:

```
storm> [ ou:org=('the vertex project',https://vertex.link) :name='the vertex project'␣
↪:url=https://vertex.link ]
ou:org=6f08c79ef95d73102af8b4ebca9c22f9
        :name = the vertex project
        :url = https://vertex.link
        .created = 2025/07/03 18:38:44.173
```

The query above creates a new organization node whose guid is generated using the company name and web site as a set of (presumably) unique inputs that will result in a unique but predictable guid.

The advantage of predictable guids is that they are re-encounterable and therefore deconflictable: if you ingest data using a predictable guid, the same data can be reingested without creating duplicate nodes. This is helpful in cases where a preliminary data set is loaded into Synapse for analysis, and subsequent changes (improvements to the ingest logic, additions to the Synapse data model) allow you to capture additional detail from the original data set.

The disadvantage is that this method is more complicated for users who need to manually create guid nodes. It is unrealistic to expect a group of users to all remember to specify the same set of inputs in the same order (and without typos) each time they create a guid node.

In addition, predictable guids may not fully address challenges associated with ingesting similar data from different sources. Multiple vendors may provide similar information on the same entity. If you obtain data for the same object (an organization, a person, a certificate) from different sources, you may end up with two different nodes if the "predictable" guids are generated with different seed data from each data source.

> **Note**
>
> Predictable guids can be combined with *Secondary Property Deconfliction* for a more robust method of deconflicting and creating guid-based nodes.

When using predictable guids, the "seed" data to generate the guid should be unique to both the node being created and the specific data source. For example, your inputs could include:

- A string representing the **data source.**
- The **timestamp** associated with the data, if one exists.
- The values of one or more **secondary properties** for the node you are creating. Be sure to choose properties where:
  - the property / properties will **always** be present for the given data source; and
  - the set of properties is sufficient to create a unique node.

For example, a `media:news` node might be created using:

- A data source string (e.g., `my_data_source`).
- The publication date of the article (e.g., `2022/09/12`)
- The URL where the article was published (e.g., `https://www.example.com/my_article.html`)

Predictable guid values can be generated directly (as part of Storm *Edit Mode* syntax):

```
storm> [ media:news = (my_data_source, 2022/09/12, https://www.example.com/my_article.
↪html) ]
media:news=f9515b24f615448ed44601645d547f6a
        .created = 2025/07/03 18:38:44.176
```

Alternately, guid values can be generated and assigned to a variable using the Storm `$lib.guid()` library (see *$lib.guid(*args, valu=$lib.undef)*). The values provided as arguments to `$lib.guid()` can be either specific values or variables:

```
storm> $guid = $lib.guid(my_data_source, 2022/09/12, https://www.example.com/my_article.
↪html) [ media:news = $guid ]
media:news=f9515b24f615448ed44601645d547f6a
        .created = 2025/07/03 18:38:44.176
```

```
storm> $source = my_data_source $published = 2022/09/12 $url = https://www.example.com/
↪my_article.html $guid = $lib.guid($source, $published, $url) [ media:news = $guid ]
media:news=f9515b24f615448ed44601645d547f6a
        .created = 2025/07/03 18:38:44.176
```

Note that the same guid value is generated in each of the three examples above.

Note

The input to the `guid` generator is interpreted as a **structured list,** specifically, a list of string values (i.e., `(str_0, str_1, str_2...str_n)`). Deconfliction depends on the same list being submitted to the generator in the same order each time.

The `guid` generator is **not** "model aware" and will not recognize items in the list as having a particular data type or representing a particular property value. That is, Synapse will not set any secondary property values based on data provided to the `guid` generator. Any property values must be set as part of the node creation process.

A full discussion of writing ingest code (such as ingest scripts or Power-Ups) is beyond the scope of this User Guide. For more information, see the *Synapse Developer Guide*.

Secondary Property Deconfliction

Secondary property deconfliction refers to the process of attempting to identify whether a guid-based node already exists based on the value of one or more distinctive secondary properties.

Guid forms are unique in that their primary property has no obvious relationship to the object it represents. The primary property `ou:org=44db774d29f27684add0d892931c6e86` tells me this is an organization node, but provides no clue whether the organization is The Vertex Project, the World Bank, or the University of Michigan marching band.

The important information about "what" a guid form represents is stored in the form's secondary properties. From a deconfliction standpoint, the best way to see if a guid node already exists is to:

- Query for an existing node based on one or more meaningful secondary properties.
- Lift (return) the selected node(s), if found; otherwise
- Create a new guid node (ideally by using a predictable guid).

Example

SSL/TLS certificate data is available from various data sources / APIs. Different vendors may provide similar information about the same certificate. Certificate metadata (i.e., information such as fingerprints,

validity dates, etc.) is represented as a `crypto:x509:cert` node, which is a guid form. If you obtain data about the same certificate from different data sources, you risk the creation of duplicate nodes.

Instead, when ingesting data about a specific certificate, a user (or process) can first check for a `crypto:x509:cert` node based on a unique property, such as a certificate fingerprint (e.g., `crypto:x509:cert:sha1`, or ideally `crypto:x509:cert:sha256` to avoid hash collisions). If an existing node is found, that node can be selected and updated (or otherwise operated on); otherwise a new node for that certificate can be created.

Tip

When choosing a secondary property (or properties) to deconflict on, you should select ones that can sufficiently deconflict (uniquely identify) the form **and** are likely to be present in the data source(s) you may use to obtain information about the form.

Secondary property deconfliction is not guaranteed to eliminate all duplications, but is highly effective in many cases. This method can be used programmatically (i.e., in any ingest scripts or Power-Ups) and by users who can "spot check" for the existence of a node before manually creating one.

Note

Synapse implements several Storm commands known as generator ("gen") commands. These commands simplify secondary property deconfliction and node creation for several common guid nodes. Instead of manually "spot checking" for existing nodes, users (and code) can use `gen` commands to deconflict and create many guid nodes.

For example, the *gen.ou.org* command takes an organization name as input (e.g, "vertex"), checks for any `ou:org` nodes with that name (i.e., in the `:name` or `:names` properties) and either lifts the existing node, or creates a new node based on a predictable guid, using the provided name as input.

See the *gen* section in the *Storm Reference - Storm Commands* for available generator commands (or run `help` from your Synapse CLI).

Guid Best Practices

Secondary property deconfliction combined with predictable guid generation is the most robust method for creating guid-based nodes and is recommended in most cases - in particular for any automated data ingest. This includes both ongoing ingests (such as via Power-Ups) and one-time scripted ingests (such as via the CSV Tool or the Optic Ingest Tool).

For users who need to create one-off guid forms, this process can be simpilfied via custom Storm commands (such as the `gen.*` commands) or automation (such as a macro that performs the necessary deconfliction and node creation, if a `gen.*` command is not available).

Predictable guids used on their own (i.e., without first performing secondary property deconfliction) may be sufficient in some cases. For example, for data sources that are unique you can use predictable guids to ensure that individual nodes are created in a repeatable way (in case you need to reingest the same data) without worrying about deconfliction (because there is no alternate source for the same data to deconflict with). Internal log or alert data are examples of this type of "single source" data.

In addition, predictable guids are a "next best" option in cases where secondary deconfliction is not possible. This may be the case if an object's secondary properties are not unique enough, or data sources are sparse and you cannot identify a property that is guaranteed to be present across all data sources.

Use **arbitrary guids** when:

- you will never need to deconflict the data, so the guid value doesn't matter.

- a user needs to manually create a guid node, and the asterisk (*) is the simplest means to do so (e.g., if a `gen.*` command or other automation does not exist for the kind of node in question).

There are still some deconfliction risks (as described above) when using the asterisk. However, the "ease of use" of the asterisk may be an acceptable trade off in some circumstances. For example, the number of user-created nodes is likely to be small compared to the volume of data ingested through Power-Ups or other automation; and nodes initially created with arbitrary guids may later be "recognized" (and deconflicted appropriately) by automation that uses secondary property deconfliction.

Operations

Because guid values are unwieldy to use on the command line (outside of copy and paste operations), it is often easier to lift guid nodes by a unique secondary property.

Examples:

Lift an org node by a single name in the names property:

```
storm> ou:org:names *[ = choam ]
ou:org=5807b99dd52200f44febf1a22a8b8545
        :name = combine honnete ober advancer mercantiles
        :names = ['choam']
        .created = 2025/07/03 18:38:44.206
```

Lift a DNS request node by the name used in the DNS query:

```
storm> inet:dns:request:query:name = pop.seznam.cz
inet:dns:request=e73c319f0e97c609e929ad6ec36c0975
        :query:name = pop.seznam.cz
        :query:name:fqdn = pop.seznam.cz
        :time = 2020/04/30 09:30:33.000
        .created = 2025/07/03 18:38:44.211
```

It is also possible to lift and filter guid nodes using a "sufficiently unique" prefix match of the guid value.

Example:

Lift a `ps:contact` node by a partial prefix match:

```
storm> ps:contact ^= 13c9663e
ps:contact=13c9663e5f553014eb50d00bb7c6945a
        :name = seongsu park
        :orgname = kaspersky lab
        .created = 2025/07/03 18:38:44.218
```

The length of the value that is "sufficiently unique" will vary depending on the data in your instance of Synapse. If your selection criteria matches more than one node, Synapse will return all matches.

When **setting** or **updating** a secondary property that is a guid value, you may use a "human friendly" Storm query (specifically a subquery) to reference the node whose primary property (guid value) you wish to set for the secondary property.

Example:

Set the `:org` property for a `ps:contact` node to the guid value of the associated `ou:org` node using a Storm query:

```
storm> ps:contact:name = 'ron the cat' [ :org = { ou:org:name = vertex } ]
ps:contact=7d7ea9d2b958a09a70871d55c6d6a60a
```

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```
        :name = ron the cat
        :org = 669be83d696b99fcb8e518a5d6708634
        :title = cattribution analyst
        .created = 2025/07/03 18:38:44.223
```

Note

The Storm query used to specify the guid node must return exactly one node. If the query returns more than one node, or does not return any nodes, Synapse will generate an error.

See *Add or Modify Properties Using Subqueries* for additional details.

inet:fqdn

Fully qualified domain names (FQDNs) are structured as a set of string elements separated by the dot (`.`) character. The Domain Name System acts as a "reverse hierarchy" (operating from right to left instead of from left to right) separated along the dot boundaries - i.e., `com` is the hierarchical root for domains such as `google.com` or `microsoft.com`.

Because of this logical structure, Synapse includes certain optimizations for working with `inet:fqdn` types:

- Reverse string indexing on `inet:fqdn` types.
- Default values for the secondary properties `:issuffix` and `:iszone` of a given `inet:fqdn` node based on the values of those properties for the node's parent domain.

Indexing

Synapse performs **reverse string indexing** on `inet:fqdn` types. Domains are indexed in full reverse order - that is, the domain `this.is.my.domain.com` is indexed as `moc.niamod.ym.si.siht` to account for the "reverse hierarchy" implicit in the DNS structure.

Parsing

N/A

Insertion

When `inet:fqdn` nodes are created (or modifications to certain properties are made), Synapse uses some built-in logic to set certain secondary properties related to zones of control (specifically, `:issuffix`, `:iszone`, and `:zone`).

The reverse hierarchy implicit in dotted FQDNs represents elements such as <*host*>.<*domain*>.<*suffix*>, but can also represent implicit or explicit **zones of control.** The term "zone of control" is loosely defined, and is not meant to represent control or authority by any specific organization or entity. Instead, "zone of control" can be thought of as a boundary within an individual FQDN hierarchy where control of a portion of the domain namespace shifts from one entity or owner to another.

A simple example is the `com` top-level domain (managed by Verisign) vs. the domain `microsoft.com` (controlled by Microsoft Corporation). `Com` represents one zone of control where `microsoft.com` represents another.

The `inet:fqdn` form in the Synapse data model uses several secondary properties that relate to zones of control:

- `:issuffix` = primary zone of control
- `:iszone` = secondary zone of control

- `:zone` = authoritative zone for a given domain or subdomain

(**Note:** contrast `:zone` with `:domain` which simply represents the next level "up" in the hierarchy from the current domain).

Synapse uses the following logic for suffixes and zones upon `inet:fqdn` creation:

1. All domains consisting of a single element (such as `com`, `museum`, `us`, `br`, etc.) are considered **suffixes** and receive the following default values:
   - `:issuffix = 1`
   - `:iszone = 0`
   - `:zone = <none / property not created>`
   - `:domain = <none / property not created>`
2. Any domain whose **parent domain is a suffix** is considered a **zone** and receives the following default values:
   - `:issuffix = 0`
   - `:iszone = 1`
   - `:zone = <set to self>`
   - `:domain = <set to parent domain>`
3. Any domain whose **parent domain is a zone** is considered a "normal" subdomain and receives the following default values:
   - `:issuffix = 0`
   - `:iszone = 0`
   - `:zone = <set to parent domain>`
   - `:domain = <set to parent domain>`
4. Any domain whose parent domain is a "normal" subdomain receives the following default values:
   - `:issuffix = 0`
   - `:iszone = 0`
   - `:zone = <set to first fqdn "up" the domain hierarchy with :iszone = 1>`
   - `:domain = <set to parent domain>`

> **Note**
>
> The above logic is **recursive** over all nodes in a Cortex. Changing an `:issuffix` or `:iszone` property on an existing `inet:fqdn` node will not only modify that node, but also propagate any changes associated with those properties to any existing subdomains.

Potential Limitations

This logic works well for single-element top-level domains (TLDs) (such as `com` vs `microsoft.com`). However, it does not address cases that may be relevant for certain types of analysis, such as:

- **Top-level country code domains and their subdomains.** Under Synapse's default logic `uk` is a suffix and `co.uk` is a zone. However, `co.uk` could **also** be considered a suffix in its own right, because subdomains such as `somecompany.co.uk` are under the control of the organization that registers them. In this case, `uk` would be a

suffix, `com.uk` could be considered both a suffix **and** a zone, and `somecompany.co.uk` could be considered a zone.

- **Special-case zones of control.** Some domains (such as those used to host web-based services) can be considered specialized zones of control. In these cases, the service provider typically owns the "main" domain (such as `wordpress.com`) but individual customers can register personal subdomains for their hosted services (such as `joesblog.wordpress.com`). The division between `wordpress.com` and individual customer subdomains could represent different zones of control. In this case, `com` would be a suffix, `wordpress.com` could be considered both a suffix **and** a zone, and `joesblog.wordpress.com` could be considered a zone.

Examples such as these are **not accounted for** by Synapse's suffix / zone logic. The definition of additional domains as suffixes and / or zones is an implementation decision (though once the relevant properties are set, the changes are propagated recursively as noted above).

Operations

Because of Synapse's reverse string indexing for `inet:fqdn` types, domains can be lifted or filtered based on matching any partial domain suffix string. The asterisk (`*`) is the extended operator used to perform this operation. The asterisk does **not** have to be used along dot boundaries but can match anywhere in any FQDN element.

Examples

Lift all domains that end with `yahooapis.com`:

```
storm> inet:fqdn='*yahooapis.com'
inet:fqdn=ayuisyahooapis.com
        :domain = com
        :host = ayuisyahooapis
        :issuffix = false
        :iszone = true
        :zone = ayuisyahooapis.com
        .created = 2025/07/03 18:38:44.242
inet:fqdn=micyuisyahooapis.com
        :domain = com
        :host = micyuisyahooapis
        :issuffix = false
        :iszone = true
        :zone = micyuisyahooapis.com
        .created = 2025/07/03 18:38:44.243
inet:fqdn=usyahooapis.com
        :domain = com
        :host = usyahooapis
        :issuffix = false
        :iszone = true
        :zone = usyahooapis.com
        .created = 2025/07/03 18:38:44.244
```

Lift all domains ending with `s.wordpress.com`:

```
storm> inet:fqdn="*s.wordpress.com"
inet:fqdn=s.wordpress.com
        :domain = wordpress.com
        :host = s
        :issuffix = false
        :iszone = false
        :zone = wordpress.com
```

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```
        .created = 2025/07/03 18:38:44.251
inet:fqdn=dogs.wordpress.com
        :domain = wordpress.com
        :host = dogs
        :issuffix = false
        :iszone = false
        :zone = wordpress.com
        .created = 2025/07/03 18:38:44.250
inet:fqdn=sss.wordpress.com
        :domain = wordpress.com
        :host = sss
        :issuffix = false
        :iszone = false
        :zone = wordpress.com
        .created = 2025/07/03 18:38:44.253
inet:fqdn=www.sss.wordpress.com
        :domain = sss.wordpress.com
        :host = www
        :issuffix = false
        :iszone = false
        :zone = wordpress.com
        .created = 2025/07/03 18:38:44.253
inet:fqdn=cats.wordpress.com
        :domain = wordpress.com
        :host = cats
        :issuffix = false
        :iszone = false
        :zone = wordpress.com
        .created = 2025/07/03 18:38:44.249
```

Downselect a set of DNS A records to those with domains ending with `.museum`:

```
storm> inet:dns:a +:fqdn="*.museum"
inet:dns:a=('woot.museum', '5.6.7.8')
        :fqdn = woot.museum
        :ipv4 = 5.6.7.8
        .created = 2025/07/03 18:38:44.261
```

Usage Notes

- Because the asterisk is a non-alphanumeric character, the string to be matched must be enclosed in single or double quotes (see *Whitespace and Literals in Storm*).
- Because domains are reverse-indexed instead of prefix indexed, for **lift** operations, partial string matching can only occur based on the end (suffix) of a domain. It is not possible to **lift** FQDNs by prefix. For example, `inet:fqdn^=yahoo` is invalid.
- Domains can be **filtered** by prefix (`^=`). For example, `inet:fqdn="*.biz" +inet:fqdn^=smtp` is valid.
- Domains cannot be **filtered** based on suffix matching (note that a "lift by suffix" is effectively a combined "lift and filter" operation).
- Domains can be lifted or filtered using the regular expression (regex) extended operator (`~=`). For example `inet:fqdn~=google` is valid (see *Lift by Regular Expression (~=)* and *Filter by Regular Expression (~=)*).

inet:ipv4

IPv4 addresses are stored as integers and represented (displayed) to users as dotted-decimal strings.

Indexing

IPv4 addresses are indexed as integers. This optimizes various comparison operations, including greater than / less than, range, etc.

Parsing

While IPv4 addresses are stored and indexed as integers, they can be input into Storm (and used within Storm operations) as any of the following.

- integer: `inet:ipv4 = 3232235521`
- hex: `inet:ipv4 = 0xC0A80001`
- dotted-decimal string: `inet:ipv4 = 192.168.0.1`
- range: `inet:ipv4 = 192.168.0.1-192.167.0.10`
- CIDR: `inet:ipv4 = 192.168.0.0/24`

Insertion

The ability to specify IPv4 values using either range or CIDR format allows you to "bulk create" sets of `inet:ipv4` nodes without the need to specify each address individually.

Examples

Note: results (output) not shown below due to length.

Create ten `inet:ipv4` nodes:

```
[ inet:ipv4 = 192.168.0.1-192.168.0.10 ]
```

Create the 256 addresses in the range 192.168.0.0/24:

```
[ inet:ipv4 = 192.168.0.0/24 ]
```

Operations

Similar to node insertion, lifting or filtering IPV4 addresses by range or by CIDR notation will operate on every `inet:ipv4` node that exists within the Cortex and falls within the specified range or CIDR block. This allows operating on multiple contiguous IP addresses without the need to specify them individually.

Examples

Lift all `inet:ipv4` nodes within the specified range that exist within the Cortex:

```
storm> inet:ipv4 = 169.254.18.24-169.254.18.64
inet:ipv4=169.254.18.30
        :type = linklocal
        .created = 2025/07/03 18:38:44.324
inet:ipv4=169.254.18.36
        :type = linklocal
        .created = 2025/07/03 18:38:44.325
inet:ipv4=169.254.18.53
```

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```
        :type = linklocal
        .created = 2025/07/03 18:38:44.325
```

Filter a set of DNS A records to only include those whose IPv4 value is within the 172.16.* RFC1918 range:

```
storm> inet:dns:a:fqdn=woot.com +:ipv4=172.16.0.0/12
inet:dns:a=('woot.com', '172.16.47.12')
        :fqdn = woot.com
        :ipv4 = 172.16.47.12
        .created = 2025/07/03 18:38:44.332
```

int

An `int` is an integer value. Synapse stores, indexes, and displays integer values as decimal integers, but will also accept as hex or octal values as input.

Indexing

N/A

Parsing

When adding or modifying integer values, Synapse will accept integer, hex (preceded by 0x), and octal (preceded by 0o) values and represent them as decimal integer values.

Examples

Set the `:count` of the `biz:bundle` to 42:

```
storm> biz:bundle=9688955d141aae88194277e74d82084d [ :count=42 ]
biz:bundle=9688955d141aae88194277e74d82084d
        :count = 42
        .created = 2025/07/03 18:38:44.336
```

Use a hex value to set the `:ip:proto` property for the `inet:flow` node to 6:

```
storm> inet:flow=684babd42810ae9dc11132805abc2831 [ :ip:proto=0x06 ]
inet:flow=684babd42810ae9dc11132805abc2831
        :dst = tcp://142.118.95.50
        :dst:ipv4 = 142.118.95.50
        :dst:proto = tcp
        :ip:proto = 6
        .created = 2025/07/03 18:38:44.341
```

Use an octal value to set the `:posix:perms` property for the `file:archive:entry` node to 755:

```
storm> file:archive:entry=3a24e1008b43bc2f1e35b3e872f201fc [ :posix:perms=0o426 ]
file:archive:entry=3a24e1008b43bc2f1e35b3e872f201fc
        :added = 2023/08/11 11:33:00.000
        :file = sha256:0c72088f529dc53e813de8e7df47922b1a9137924e072468559f7865eb7ad18b
        :posix:perms = 278
        :user = ozzie
        .created = 2025/07/03 18:38:44.346
```

Insertion

Same as for parsing.

Operations

Use integer, hex, or octal values to lift and filter integer types using standard comparison operators.

Examples

Lift all `risk:alert` nodes where the `:priority` is set to less than 10:

```
storm> risk:alert:priority<10
risk:alert=a592f0ee299c0000ce34cad33604d3b9
        :desc = outbound traffic to SOC-reported IP
        :detected = 2023/08/01 09:00:00.000
        :name = suspicious outbound traffic
        :priority = 8
        .created = 2025/07/03 18:38:44.352
```

Lift all `inet:flow` nodes tagged with `#my.tag` and filter to include only those where the `:ip:proto` property is set to the hex equivalent of 6:

```
storm> inet:flow#mytag +:ip:proto=0x06
```

Use an octal value to lift all `it:group` nodes where the `:posix:gid` values equate to 278:

```
storm> it:group:posix:gid=0o426
it:group=32076583262d2fd0e065812bc88723cf
        :desc = threat researchers group
        :host = a6f4147c23421ef47a1fabea899b3aeb
        :name = research
        :posix:gid = 278
        .created = 2025/07/03 18:38:44.376
```

ival

`ival` ("interval") is a specialized type consisting of two `time` types in a paired `(<min>, <max>)` relationship. As such, the individual values in an `ival` are subject to the same specialized handling as individual *time* values.

`ival` types have their own optimizations in addition to those related to `time` types.

Indexing

N/A

Parsing

An `ival` type is typically specified as two comma-separated time values enclosed in parentheses. Alternately, an `ival` can be specified as a single time value with no parentheses (see **Insertion** below for `ival` behavior when specifying a single time value).

Single or double quotes are required in accordance with the standard rules for using *Whitespace and Literals in Storm*. For example:

- `.seen=("2017/03/24 12:13:27", "2017/08/05 17:23:46")`
- `+#sometag=(2018/09/15, "+24 hours")`

- `.seen=2019/03/24`

As `ival` types are a pair of values (i.e., an explicit minimum and maximum), the values must be placed in parentheses and separated by a comma: `(<min>, <max>)`. The parser expects two **explicit** values.

An `ival` can also be specified as a single time value, in which case the value must be specified **without** parentheses: `<time>`. See **Insertion** below for `ival` behavior when adding vs. modifying using a single time value vs. a `(<min>, <max>)` pair.

When entering an `ival` type, each time value can be input using most of the acceptable formats for *time* types, including explicit times (including lower resolution times and wildcard times), relative times, and the special values `now` and `?`.

`ival` types also support relative times using `+-` format to represent both a positive and negative offset from a given point (i.e., `"+-1 hour"`).

When entering relative times in an `ival` type:

- A relative time in the **first** (`<min>`) position is calculated relative to the **current time** (`now`).
- A relative time in the **second** (`<max>`) position is calculated relative to the **first** (`<min>`) time.

For example:

- `.seen="+1 hour"` means from the current time (now) to one hour after the current time.
- `.seen=(2018/12/01, "+1 day")` means from 12:00 AM December 1, 2018 to 12:00 AM December 2, 2018.
- `.seen=(2018/12/01, "-1 day")` means from 12:00 AM November 30, 2018 to 12:00 AM December 1, 2018.
- `.seen=(now, "+-5 minutes")` means from 5 minutes ago to 5 minutes from now.
- `.seen=("-30 minutes", "+1 hour")` means from 30 minutes ago to 30 minutes from now.

When specifying minimum and maximum times for an `ival` type (or when specifying minimum and maximum `time` values to the `*range=` comparator), the following restrictions should be kept in mind:

- Minimums and maximums that use explicit times and / or special terms (`now`, `?`) should be specified in `<min>, <max>` order.
  - Specifying a `<max>, <min>` order will **not** result in an error message, but because it results in an exclusionary time window, it will not return any nodes (i.e., no time / interval can be both greater than a max value and less than a min value).
  - Similarly, combinations of relative times that result in an effective `<max>, <min>` after relative offsets are calculated are allowed (will not generate an error), but will result in an exclusionary time window that does not return any nodes.
- Values that result in a nonsensical `<min>, <max>` are not allowed and will generate an error. For example:
  - The special value `?` cannot be used as a minimum value in a `(<min>, <max>)` pair.
  - A `+-` relative time cannot be used as a minimum value in a `(<min>, <max>)` pair.
  - When specifying a `+-` relative time as the maximum value in a `(<min>, <max>)` pair, an explicit `<min>` value is also required (i.e., either an explicit time or `now`).

Insertion

- When **adding** an `ival` as a `(<min>, <max>)` pair, the `ival` can be specified as described above.
  - If the values for `<min>` and `<max>` are identical, then `<min>` will be set to the specified value and `<max>` will be set to `<min>` plus 1 ms.
- When **adding** an `ival` as a single time value, it must be specified **without** parentheses.

  - When a single time value is used, the <min> value will be set to the specified time and the <max> will be set to the <min> time plus 1 ms.

- When **modifying** an existing ival property (including tag timestamps) with either a (<min>, <max>) pair or a single time value, the existing ival is **not** simply overwritten (as is the norm for modifying properties - see *Storm Reference - Data Modification*). Instead, the <min> and / or <max> are **only** updated if the new value(s) are:

  - Less than the current <min>, and / or
  - Greater than the current <max>.

  This means that once set, <min> and <max> can only be "pushed out" to a lower minimum and / or a higher maximum. Specifying a time or times that fall **within** the current minimum and maximum will have no effect (i.e., the current values will be retained).

  This means that it is not possible to "shrink" an ival directly; to specify a higher minimum or a lower maximum (or to remove the timestamps altogether), you must delete the ival property (or remove the timestamped tag) and re-add it with the updated values.

Operations

ival types can be lifted and filtered (see *Storm Reference - Lifting* and *Storm Reference - Filtering*) with the standard equivalent (=) operator, which will match the **exact** <min> and <max> values specified.

Example:

Lift the DNS A nodes whose observation window is **exactly** from 2018/12/13 01:05 to 2018/12/16 12:57:

```
storm> inet:dns:a.seen=("2018/12/13 01:05", "2018/12/16 12:57")
inet:dns:a=('yoyodyne.com', '16.16.16.16')
        :fqdn = yoyodyne.com
        :ipv4 = 16.16.16.16
        .created = 2025/07/03 18:38:44.390
        .seen = ('2018/12/13 01:05:00.000', '2018/12/16 12:57:00.000')
```

ival types cannot be used with comparison operators such as "less than" or "greater than or equal to".

ival types are most often lifted or filtered using the custom interval comparator (@=) (see *Lift by Time or Interval (@=)* and *Filter by Time or Interval (@=)*). @= is intended for time-based comparisons (including comparing ival types with time types).

Example:

Lift all the DNS A nodes whose observation window overlaps with the interval of March 1, 2019 through April 1, 2019:

```
storm> inet:dns:a.seen@=(2019/03/01, 2019/04/01)
inet:dns:a=('hurr.com', '4.4.4.4')
        :fqdn = hurr.com
        :ipv4 = 4.4.4.4
        .created = 2025/07/03 18:38:44.397
        .seen = ('2019/01/05 09:38:00.000', '2019/03/12 18:17:00.000')
inet:dns:a=('derp.net', '8.8.8.8')
        :fqdn = derp.net
        :ipv4 = 8.8.8.8
        .created = 2025/07/03 18:38:44.398
        .seen = ('2019/03/08 07:26:00.000', '2019/03/22 10:14:00.000')
inet:dns:a=('blergh.org', '2.2.2.2')
        :fqdn = blergh.org
```

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```
        :ipv4 = 2.2.2.2
        .created = 2025/07/03 18:38:44.400
        .seen = ('2019/03/28 22:22:00.000', '2019/04/27 00:03:00.000')
```

`ival` types cannot be used with the `*range=` custom comparator. `*range=` can only be used to specify a range of individual values (such as `time` or `int`).

Tip

By definition, an `ival` is a **pair** of date/time values treated as a single combined value. This means that when using variables to work with `ival` types, the full value of the property is assigned to the variable by default. For example, given a node (such as an `inet:dns:a` node) with a `.seen` value of `(2023/07/08 11:19:02, 2023/12/14 21:18:47)`, the variable assignment `$time = .seen` will assign the **pair** of date/times to `$time`.

You can access each date/time of an `ival` independently by assigning the value to a **pair** of variables as follows:

```
( $min, $max ) = .seen
```

`$min` will represent the value `2023/07/08 11:19:02` and `$max` will represent the value `2023/12/14 21:18:47`.

loc

`Loc` is a specialized type used to represent geopolitical locations (i.e., locations within geopolitical boundaries) as a series of user-defined dot-separated hierarchical strings - for example, *<country>.<region>.<city>*. This allows specifying locations such as `us.fl.miami`, `gb.london`, and `ca.on.toronto`.

`Loc` is an extension of the *str* type. However, because `loc` types use strings that comprise a dot-separated hierarchy, they exhibit slightly modified behavior from standard string types for certain operations.

Indexing

The `loc` type is an extension of the *str* type and is **prefix-indexed** like other strings. However, the use of dot-separated boundaries impacts operations using `loc` values.

`loc` values are normalized to lowercase.

Parsing

`loc` values can be input using any case (uppercase, lowercase, mixed case) but will normalized to lowercase.

Components of a `loc` value must be separated by the dot (`.`) character. A `loc` value that consists of a single element does not require a trailing dot.

The dot is a reserved character for the `loc` type and is used to separate string elements along hierarchical boundaries. The use of the dot as a reserved boundary marker impacts some operations using the `loc` type. Note that this means the dot cannot be used as part of a location string. For example, the following location value would be interpreted as a hierarchical location with four elements (`us`, `fl`, `st`, and `petersburg`):

- `:loc = us.fl.st.petersburg`

To appropriately represent the "city" element of the above location, an alternate syntax must be used. For example:

- `:loc = us.fl.stpetersburg`
- `:loc = "us.fl.st petersburg"`
- `:loc = us.fl.st_petersburg`

- ...etc.

As an extension of the `str` type, `loc` types are subject to Synapse's restrictions regarding using *Whitespace and Literals in Storm*.

Insertion

Same as for parsing.

As `loc` values are simply dot-separated strings, the use or enforcement of any specific convention for geolocation values and hierarchies is an implementation decision.

Operations

The use of the dot character (`.`) as a reserved boundary marker impacts prefix (`^=`) and equivalent (`=`) operations using the `loc` type.

Prefix Operator

When **lifting** or **filtering** on `loc` property values using the prefix comparison operator (`^=`), the specified value must fall on a dot boundary.

String and string-derived types are **prefix-indexed** to optimize lifting or filtering strings that start with a given substring. For standard strings, the prefix operator can be used with strings of arbitrary length. However, for `loc` types, the prefix operator works along dot boundaries. This is because it is generally more analytically meaningful to lift all locations within the US (`^= us`) or within Florida (`^= us.fl`) than it is to lift all locations in the US within states that start with "V" (`^= us.v`).

Prefix comparison for `loc` types is useful because it easily allows lifting or filtering at any appropriate level of resolution within the dotted hierarchy:

Examples:

Lift all organizations located in Turkey (`tr`):

```
storm> ou:org:loc ^= tr
ou:org=7f53829dddd164117207c23d8d834ba0
        :loc = tr.ankara
        :name = republic of turkey ministry of foreign affairs
        .created = 2025/07/03 18:38:44.407
ou:org=f20790c90592e22d39650cc0b240fc89
        :loc = tr.istanbul
        :name = adeo it consulting services
        .created = 2025/07/03 18:38:44.408
```

Lift all IP addresses geolocated in the province of Ontario, Canada (`ca.on`):

```
storm> inet:ipv4:loc ^= ca.on
inet:ipv4=149.248.52.240
        :loc = ca.on
        :type = unicast
        .created = 2025/07/03 18:38:44.502
inet:ipv4=49.51.12.195
        :loc = ca.on.barrie
        :type = unicast
        .created = 2025/07/03 18:38:44.503
inet:ipv4=199.201.123.200
```

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```
        :loc = ca.on.keswick
        :type = unicast
        .created = 2025/07/03 18:38:44.504
```

> **Note**
>
> Specifying a more granular prefix value will not match values that are less granular. That is, `inet:ipv4:loc ^= ca.on` will fail to match `inet:ipv4:loc = ca`.

Equals Operator

When **lifting** or **filtering** on `loc` property values using the equals operator (=), Synapse will return **exact** matches for the specified value. The query below will only lift `geo:place` nodes with `:loc = us.wa.seattle`; it will not lift nodes with `:loc = us.wa` or `:loc = us.washington.seattle`:

Lift all places in the city of Seattle, Washington:

```
storm> geo:place:loc = us.wa.seattle
geo:place=3923fa5825943b8e57dc4f76a7960db2
        :latlong = 47.4502535,-122.3110105
        :loc = us.wa.seattle
        :name = seattle-tacoma international airport
        .created = 2025/07/03 18:38:44.510
geo:place=1c3ef59505c56f329b902e6abfadc299
        :latlong = 47.6205099,-122.3514714
        :loc = us.wa.seattle
        :name = space needle
        .created = 2025/07/03 18:38:44.509
```

When **lifting** on `:loc` property values using the equals operator (=), a single asterisk (*) can be used as a "wildcard" to represent any trailing string following a dot boundary (including no trailing string - `:loc = us.*` will match `:loc = us` as well as `:loc = us.tx.austin`). The asterisk must immediately follow a dot boundary and must be the final character in the expression (e.g., expressions such as `:loc = us.*.rochester` and `:loc = us.m*` are invalid; the expressions will not generate an error but will fail to return any nodes).

Lift all organizations located in Turkey:

```
storm> ou:org:loc = tr.*
ou:org=7f53829dddd164117207c23d8d834ba0
        :loc = tr.ankara
        :name = republic of turkey ministry of foreign affairs
        .created = 2025/07/03 18:38:44.407
ou:org=f20790c90592e22d39650cc0b240fc89
        :loc = tr.istanbul
        :name = adeo it consulting services
        .created = 2025/07/03 18:38:44.408
```

Lift all IP addresses geolocated in the province of Ontario, Canada:

```
storm> inet:ipv4:loc = ca.on.*
inet:ipv4=149.248.52.240
        :loc = ca.on
```

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```
        :type = unicast
        .created = 2025/07/03 18:38:44.502
inet:ipv4=49.51.12.195
        :loc = ca.on.barrie
        :type = unicast
        .created = 2025/07/03 18:38:44.503
inet:ipv4=199.201.123.200
        :loc = ca.on.keswick
        :type = unicast
        .created = 2025/07/03 18:38:44.504
```

Note

Lifting by `loc` property value using the wildcard is equivalent to a prefix lift. The following queries will return the same results:

Wildcard: `ou:org:loc = de.*`

Prefix match: `ou:org:loc ^= de`

str

Indexing

String (and string-derived) types are indexed by **prefix** (character-by-character from the beginning of the string). This allows matching on any initial substring.

Parsing

Some string types and string-derived types are normalized to all lowercase to facilitate pivoting across like values without case-sensitivity. For types that are normalized in this fashion, the string can be entered in mixed-case and will be automatically converted to lowercase.

Strings are subject to Synapse's restrictions regarding using *Whitespace and Literals in Storm*.

Insertion

Same as for parsing.

Operations

Because of Synapse's use of **prefix indexing,** string and string-derived types can be lifted or filtered based on matching an initial substring of any string using the prefix extended comparator (`^=`) (see *Lift by Prefix (^=)* and *Filter by Prefix (^=)*).

Prefix matching is case-sensitive based on the specific type being matched. If the target property's type is case-sensitive, the string to match must be entered in case-sensitive form. If the target property is case-insensitive (i.e., normalized to lowercase) the string to match can be entered in any case (upper, lower, or mixed) and will be automatically normalized by Synapse.

Examples

Lift all organizations whose name starts with the word "Acme ":

```
storm> ou:org:name^='acme '
ou:org=26bb6b95153fe7f56baca881e6afe1d6
        :name = acme construction
        :names = ['acme construction']
        .created = 2025/07/03 18:38:44.121
ou:org=07a22b45a495d32ebac6708f5bd95ab2
        :name = acme consulting
        :names = ['acme consulting']
        .created = 2025/07/03 18:38:44.120
```

Filter a set of Internet accounts to those with usernames starting with 'matrix':

```
storm> inet:web:acct:site=twitter.com +:user^=matrix
inet:web:acct=twitter.com/matrixneo
        :site = twitter.com
        :user = matrixneo
        .created = 2025/07/03 18:38:44.521
inet:web:acct=twitter.com/matrixmaster
        :site = twitter.com
        :user = matrixmaster
        .created = 2025/07/03 18:38:44.520
```

Strings and string-derived types can also be lifted or filtered using the regular expression extended comparator (~=) (see *Lift by Regular Expression (~=)* and *Filter by Regular Expression (~=)*).

syn:tag

`syn:tag` is a specialized type used for *Tag* nodes and properties within Synapse. Tags are used to group related nodes; provide context to nodes; and often represent domain-specific, analytically relevant observations or assessments. Tags support a hierarchical namespace based on user-defined dot-separated strings. This hierarchy allows recording classes or categories of observations that can be defined with increasing specificity. (See *Analytical Model* for more information.)

Indexing

The `syn:tag` type is an extension of the *str* type and is **prefix-indexed** like other strings.

`syn:tag` values are normalized to lowercase.

Parsing

Components of a `syn:tag` value must be separated by the dot (`.`) character. The dot is a reserved character for the `syn:tag` type and is used to separate string elements along hierarchical boundaries. A `syn:tag` value that consists of a single element does not require a trailing dot.

`syn:tag` values can contain ASCII lowercase characters, numerals, and underscores, as well as Unicode words (including most characters that can be part of a word in any language). Spaces and ASCII symbols (other than the underscore) are not allowed.

The following are all acceptable `syn:tag` values:

- `syn:tag = cno`
- `syn:tag = rep.vt.exploit`
- `syn:tag = rep.microsoft.forest_blizzard`

- `syn:tag = .`

When creating a `syn:tag` node or setting a property whose type is `syn:tag` (such as `risk:threat:tag`), Synapse will automatically normalize the value by:

- converting uppercase letters to lowercase;
- converting dashes (`-`) or spaces to underscores (`_`).
- ignoring any disallowed characters.

Examples:

```
storm> [ syn:tag = "rep.us-cisa.LAPSUS$" ]
syn:tag=rep.us_cisa.lapsus
        :base = lapsus
        :depth = 2
        :up = rep.us_cisa
        .created = 2025/07/03 18:38:44.526
```

In the above example:

- the dash in `us-cisa` is converted to an underscore;
- `LAPSUS` is lowercased to `lapsus`; and
- the dollar sign (`$`) is ignored.

Note

If you attempt to **apply** a tag that contains invalid characters to a node, Synapse will throw a Storm syntax error. The only normalization Synapse performs in this situation is to gracefully convert any uppercase letters to lowercase. The following Storm query will throw an error:

`[ inet:fqdn = woot.com +#rep.us-cisa.LAPSUS$ ]`

Insertion

`syn:tag` are unique in that they are a type that can also be applied as a label to other nodes.

A `syn:tag` (as a node) does not have to be created before the equivalent tag (label) can be applied to another node. That is, applying a tag to a node will result in the automatic creation of the corresponding `syn:tag` node or nodes (assuming the appropriate user permissions). For example:

```
storm> [ inet:fqdn = woot.com +#some.new.tag ]
inet:fqdn=woot.com
        :domain = com
        :host = woot
        :issuffix = false
        :iszone = true
        :zone = woot.com
        .created = 2025/07/03 18:38:44.260
        #some.new.tag
```

The Storm syntax above will apply the tag `#some.new.tag` to the node `inet:fqdn = woot.com` and automatically create the node `syn:tag = some.new.tag` if it does not already exist (as well as `syn:tag = some` and `syn:tag = some.new`).

Operations

Like strings and other string-derived types, `syn:tag` types are **prefix-indexed**. This means that `syn:tag` values can be lifted and filtered using the prefix comparison operator (`^=`).

When lifting and filtering `syn:tag` types by prefix, the expression to match is **not** constrained by the dot (`.`) boundary that separates tag elements.

Prefix comparison for `syn:tag` types is useful because it allows you to easily identify a subset of tags or to lift / filter tags at any appropriate level of resolution within a tag hierarchy.

Examples:

Lift all tags in the computer network operations (`cno`) tree:

```
storm> syn:tag ^= cno
syn:tag=cno
        :base = cno
        :depth = 0
        .created = 2025/07/03 18:38:44.532
syn:tag=cno.mal
        :base = mal
        :depth = 1
        :up = cno
        .created = 2025/07/03 18:38:44.532
syn:tag=cno.mal.redtree
        :base = redtree
        :depth = 2
        :up = cno.mal
        .created = 2025/07/03 18:38:44.532
syn:tag=cno.threat
        :base = threat
        :depth = 1
        :up = cno
        .created = 2025/07/03 18:38:44.532
syn:tag=cno.threat.t27
        :base = t27
        :depth = 2
        :up = cno.threat
        .created = 2025/07/03 18:38:44.532
```

Lift all threats (`risk:threat` nodes) whose `:tag` value is associated with Dell Secureworks threats whose name begins with "br":

```
storm> risk:threat:tag ^=rep.secureworks.br
risk:threat=3d73cfac5fcc6daf3101ca54db1e00bf
        :org:name = bronze elgin
        :reporter:name = secureworks
        :tag = rep.secureworks.bronze_elgin
        .created = 2025/07/03 18:38:44.538
risk:threat=a0b2b4327e3926ecbdb2f2f5753c586d
        :org:name = bronze president
        :reporter:name = secureworks
        :tag = rep.secureworks.bronze_president
        .created = 2025/07/03 18:38:44.539
```

Usage notes:

- Specifying a more granular prefix value will **not** match values that are less granular. That is, `syn:tag^=cno.infra` will fail to match `syn:tag = cno`.
- Use of the equals comparator (=) with `syn:tag` types will match the **exact value only.** So `syn:tag = rep` will **only** match that tag and will not match `syn:tag = rep.symantec` or `syn:tag = rep.trend.pawnstorm`.
- When lifting or filtering `syn:tag` types, use of the wildcard (*) is not allowed. For example, the following Storm expression is invalid and will throw a syntax error: `syn:tag = rep.*.cobalt_strike`

Note

Working with (lifting, filtering, etc.) `syn:tag` **types** (`syn:tag` forms or property values) is different from working with **tags** applied to nodes. In particular, when filtering based on the tag(s) applied to a set of nodes, you can filter using single or double asterisks (* or **). See *Filter by Tag Globs* or the general *Tag Filters* or *Tag Lifts* sections for details on working with tags applied to nodes.

taxonomy

A `taxonomy` in Synapse is used to represent a set of hierarchical types or categories that can be used to classify objects (forms). Many forms in Synapse include `:type` properties (such as `risk:tool:software:type`, `geo:place:type`, or `media:news:type`).

Tip

`taxonomy` is a base *Type* that is commonly extended to define form-specific taxonomies. That is, a tool (`risk:tool:software`) has a `:type` property that can represent a set of tool/malware types or categories. The `risk:tool:software:type` property has a form-specific type of `risk:tool:software:taxonomy`.

While this section describes the behavior of taxonomies generally, keep in mind that each form can have its own taxonomy / set of categories independent of other taxonomies. This allows you to define one taxonomy to categorize tools/malware and a separate taxonomy to categorize articles or publications, for example.

Most taxonomy types are also forms (i.e., `risk:tool:software:taxonomy`), so you can lift, view, and work with them just like other nodes in Synapse. To ensure consistency across the numerous taxonomy forms, most taxonomies inherit the `meta:taxonomy` *Interface*.

Given their hierarchical structure, taxonomies share some similarities with tags:

- Taxonomies can be hierarchical, using a dotted (dot-separated) namespace to represent various levels in the hierarchy.
- Taxonomy forms include properties such as `:base`, `:depth`, and `:parent` that allow you to lift, pivot, and navigate among taxonomy nodes similar to the way you navigate *Tags as Nodes*.

There are no "pre-defined" taxonomies in Synapse. You can make use of taxonomies (or not), and can define taxonomies that are tailored to your specifc analysis needs. For example, you can construct a multi-level taxonomy to help subdivide and organize industries using their `:type` property:

- `ou:industry:type = education`
- `ou:industry:type = education.colleges`
- `ou:industry:type = education.colleges.universities`
- `ou:industry:type = education.colleges.junior`
- `ou:industry:type = finance`
- `ou:industry:type = finance.banking`

- `ou:industry:type = finance.defi`

...etc.

Taxonomies do not have to be multi-level / hierarchcial. If you only need a simple set of categories, you can define a flat taxonomy with only one level. The following uses a flat taxonomy to populate `risk:tool:software:type` properties:

- `risk:tool:software:type = backdoor`
- `risk:tool:software:type = downloader`
- `risk:tool:software:type = dropper`
- `risk:tool:software:type = utility`

... etc.

Indexing

The `taxonomy` type is an extension of the *str* type and is **prefix-indexed** like other strings.

`taxonomy` values are normalized to lowercase. A `taxonomy` value always includes a trailing dot (`.`), regardless of the number of elements (taxons) in the value.

The trailing dot is masked / omitted when displaying the taxonomy value. This difference can be seen when displaying the value's representation (display value, using the method `$node.repr()`) as opposed to its actual value (using the method `$node.value()`):

```
storm> ou:goal:type:taxonomy=financial_gain $lib.print($node.repr()) $lib.print($node.
↪value())
financial_gain
financial_gain.
ou:goal:type:taxonomy=financial_gain
        :base = financial_gain
        :depth = 0
        .created = 2025/07/03 18:38:44.543
```

Parsing

Components of a `taxonomy` value must be separated by the dot (`.`) character. The dot is a reserved character for the `taxonomy` type and is used to separate elements (taxons) along hierarchical boundaries. All `taxonomy` values end in a trailing dot.

`taxonomy` values can contain ASCII lowercase characters, numerals, and underscores, as well as Unicode words (including most characters that can be part of a word in any language). Spaces and ASCII symbols (other than the underscore) are not allowed.

When creating a `taxonomy` node or setting a `taxonomy` property, Synapse will automatically normalize the value by:

- converting uppercase letters to lowercase;
- converting dashes (`-`) or spaces to underscores (`_`);
- ignoring any disallowed characters; and
- adding the trailing dot (`.`) to the stored value if not specified.

Insertion

N/A - no special behavior when working with `taxonomy` nodes or properties other than as specified above.

Operations

Like strings and other string-derived types, `taxonomy` types are **prefix-indexed**. This means that `taxonomy` values can be lifted and filtered using the prefix comparison operator (`^=`).

When lifting and filtering `taxonomy` types by prefix, the expression to match is **not** constrained by the dot (`.`) boundary that separates taxonomy elements.

Prefix comparison for `taxonomy` types is useful because it allows you to easily identify a subset of forms based on lifting or filtering those forms using any appropriate level of resolution within the form's taxonomy.

Examples:

Lift all industries (`ou:industry` nodes) within the "media" catetgory / taxonomy:

```
storm> ou:industry:type ^= media
ou:industry=666fb100964e865d4713383a23d9507b
        :name = media
        :type = media
        .created = 2025/07/03 18:38:44.557
ou:industry=d5683c31f6c79a188eeab14d7829b765
        :name = entertainment
        :type = media.entertainment
        .created = 2025/07/03 18:38:44.562
ou:industry=ee3adc67863fd17e405af11f56269495
        :name = journalism and news media
        :type = media.journalism
        .created = 2025/07/03 18:38:44.558
ou:industry=c8327ef9a87cead9cec3d4bb4cf5978e
        :name = journalists and reporters
        :type = media.journalism.reporters
        .created = 2025/07/03 18:38:44.559
ou:industry=01dfa330c1f21e591ffcd59b0566f443
        :name = publishing
        :type = media.publishing
        .created = 2025/07/03 18:38:44.560
ou:industry=e5fe072177addc2f95fd4b553c89d783
        :name = print media
        :type = media.publishing.print
        .created = 2025/07/03 18:38:44.561
```

Lift all industries (`ou:industry` nodes) within the "media" catetgory / taxonomy whose subcategory starts with "j":

```
storm> ou:industry:type ^= media.j
ou:industry=ee3adc67863fd17e405af11f56269495
        :name = journalism and news media
        :type = media.journalism
        .created = 2025/07/03 18:38:44.558
ou:industry=c8327ef9a87cead9cec3d4bb4cf5978e
        :name = journalists and reporters
        :type = media.journalism.reporters
        .created = 2025/07/03 18:38:44.559
```

Usage notes:

- Specifying a more granular prefix value will not match values that are less granular. That is, `risk:tool:software:availability ^= public.commercial` will fail to match `risk:tool:software:availability = public`
- Use of the equals comparator (=) with `taxonomy` types will match the exact value only. So `ou:industry:type = energy` will only match that taxonomy and will not match `ou:industry:type = energy.electricity` or `ou:industry:type = energy.electricity.distribution`.
- When lifting or filtering `taxonomy` types, use of the wildcard (*) is not allowed. For example, the following Storm expression is invalid and will throw a syntax error: `risk:attacktype = phishing.*`.

time

Synapse stores `time` types in Epoch milliseconds (millis) - that is, the number of milliseconds since January 1, 1970. The `time` type is technically a date/time because it encompasses both a date and a time. A time value alone, such as 12:37 PM (12:37:00.000), is invalid.

See also the section on *ival* (interval) types for details on how `time` types are used as minimum / maximum pairs.

Indexing

N/A

Parsing

`time` values can be input into Storm as any of the following:

- **Explicit** times:
  - Human-readable (YYYY/MM/DD hh:mm:ss.mmm):

    ```
    "2018/12/16 09:37:52.324"
    ```

  - Human-readable "Zulu" (YYYY/MM/DDThh:mm:ss.mmmZ):

    ```
    2018/12/16T09:37:52.324Z
    ```

  - Human-readable with time zone (YYYY-MM-DD hh:mm:ss.mmm+/-hh:mm). No spaces are allowed between the time value and the time zone offset:

    ```
    2018-12-16 09:37:52.324-04:00
    ```

    > **Note**
    >
    > Synapse does not support the **storage** of an explicit time zone with a time value (i.e., +0800). Synapse stores time values in UTC for consistency. If a time zone is specified using an acceptable time zone offset format on input, Synapse will automatically convert the value to UTC for storage. If no time zone is specified, Synapse will assume the value is in UTC.

  - No formatting (YYYYMMDDhhmmssmmm):

    ```
    20181216093752324
    ```

  - Epoch millis:

    ```
    (1544953072324)
    ```

> **Tip**
>
> Synapse expects that users will generally enter time values using "human friendly" strings, and will attempt to parse the input as such. Using parentheses tells Synapse to interpret the value as a raw integer.
>
> Note that this parentheses syntax only applies when setting or updating a `time` property using Storm. When setting or updating a property in the Optic UI by editing a field, you must enter a time string value.

- **Relative** (offset) time values in the format:

  + | **-** | **+-** <*count*> <*unit*>

  where <*count*> is a numeric value and <*unit*> is one of the following:

  - `minute(s)`
  - `hour(s)`
  - `day(s)`

  Examples:

  - `"+7 days"`
  - `"-15 minutes"`
  - `"+-1 hour"`

- **"Special"** time values:

  - the keyword `now` is used to represent the current date/time.
  - a question mark (`?`) is used to effectively represent an unspecified / indefinite time in the future (technically equivalent to 9223372036854775807 millis, i.e., "some really high value that is probably the heat death of the universe". Note that technically the largest valid millis value is 9999999999999 (thirteen 9's), which represents 2286/11/20 09:46:39.999).

    The question mark can be used as the maximum value of an interval (*ival*) type to specify that the data or assessment associated with the `ival` should be considered valid indefinitely. (Contrast that with a maximum interval value set to the equivalent of `now` that would need to be continually updated over time in order to remain current.)

Standard rules regarding using *Whitespace and Literals in Storm* apply. For example, `"2018/12/16 09:37:52.324"` needs to be entered in single or double quotes, but `2018/12/16` does not. Similarly, relative times starting with `+` or `-` and the special time value `?` need to be placed in single or double quotes.

Lower Resolution Time Values and Wildcard Time Values

`time` values (including tag timestamps) must be entered at a minimum resolution of year (`YYYY`) and can be entered up to a maximum resolution of milliseconds (`YYYY/MM/DD hh:mm:ss.mmm`).

Where lower resolution values are entered, Synapse will make logical assumptions about the intended date / time value and zero-fill the remainder of the equivalent epoch mills date / time. For example:

- A value of `2016` will be interpreted as 12:00 AM on January 1, 2016 (`2016/01/01 00:00:00.000`).
- A value of `2018/10/27` will be interpreted as 12:00 AM on that date (`2018/10/27 00:00:00.000`).
- A value of `"2020/03/16 05"` will be interpreted as 05:00 AM on that date (`2020/03/16 05:00:00.000`).

- A value of `"2018/10/27 14:00-04:00"` will be interpreted as 14:00 (2:00 PM) on that date with a 4 hour offset from UTC (`2018/10/27 14:00:00.000-04:00`, stored in UTC as `2018/10/27 18:00:00.000`).

Synapse also supports the use of the wildcard (`*`) character to specify a partial time value match:

- A value of `2016*` will be interpreted as "any date / time within the year 2016".
- A value of `2018/10/27*` will be interpreted as "any time on October 27, 2018".
- A value of `"2020/03/16 05*"` will be interpreted as "any time within the hour of 05:00 on March 16, 2020".

Note

When using wildcard syntax, the wildcard must be used on a sensible time value boundary, such as `YYYYMM*`. You cannot us a wildcard to "split" values (i.e., `YYMMD*` is invaild syntax).

Examples:

Set the time of a DNS request to the current time:

```
storm> [ inet:dns:request="*" :query:name=woot.com :time=now ]
inet:dns:request=eeeface90903ac09441ccc557435cab4
        :query:name = woot.com
        :query:name:fqdn = woot.com
        :time = 2025/07/03 18:38:44.570
        .created = 2025/07/03 18:38:44.569
```

Set the observed time window (technically an `ival` type) for when an IP address was a known sinkhole (via the `#cno.infra.dns.sink.hole` tag) from its known start date to an indefinite future time (i.e., the sinkhole is presumed to remain a sinkhole indefinitely / until the values are manually updated with an explicit end date):

```
storm> [ inet:ipv4=1.2.3.4 +#cno.infra.dns.sink.hole=(2017/06/13, "?") ]
inet:ipv4=1.2.3.4
        :type = unicast
        .created = 2025/07/03 18:38:44.260
        #cno.infra.dns.sink.hole = (2017/06/13 00:00:00.000, ?)
```

- Set the observed time window using a time zone offset:

```
storm> [ inet:ipv4=5.6.7.8 +#cno.infra.dns.sink.hole=(2017/06/13 09:46+04:00, "?") ]
inet:ipv4=5.6.7.8
        :type = unicast
        .created = 2025/07/03 18:38:44.261
        #cno.infra.dns.sink.hole = (2017/06/13 05:46:00.000, ?)
```

Insertion

When adding or modifying `time` types, any of the above formats (explicit / relative / special terms) can be specified.

In addition, when adding or modifying `time` types, a lower resolution time and a wildcard time behave identically. In other words, the following are equivalent Storm queries (both will set the `:time` value of the newly created DNS request node to `2021/01/23 00:00:00.000`):

```
[ inet:dns:request="*" :time=2021/01/23 ]

[ inet:dns:request="*" :time=2021/01/23* ]
```

When specifying a relative time for a `time` value, **the offset will be calculated from the current time** (`now`):

```
storm> [ inet:dns:request="*" :query:name=woot.com :time="-5 minutes" ]
inet:dns:request=35f75e57a2a9c6b281d1e612c1109515
        :query:name = woot.com
        :query:name:fqdn = woot.com
        :time = 2025/07/03 18:33:44.584
        .created = 2025/07/03 18:38:44.583
```

Plus / minus (`+-`) relative times cannot be specified for `time` types, as the type requires a single value. See the section on *ival* (interval) types for details on using `+-` times with `ival` types.

Operations

`time` types can be lifted and filtered using:

- Standard logical and mathematical comparison operators (comparators).
- The extended range (`*range=`) custom comparator.
- The extended interval (`@=`) custom comparator.

Standard Operators

`time` types can be lifted and filtered with the standard logical and mathematical comparators (see *Storm Reference - Lifting* and *Storm Reference - Filtering*). This includes the use of lower resolution time values and wildcard time values.

Example:

Downselect a set of DNS request nodes to those that occurred prior to June 1, 2019:

```
storm> inet:dns:request +:time<2019/06/01
inet:dns:request=9f4d1ee8dab0f3def682784656ed0b37
        :query:name = derp.net
        :query:name:fqdn = derp.net
        :time = 2015/12/14 19:22:00.000
        .created = 2025/07/03 18:38:44.588
inet:dns:request=fdfa429a8dad45d5effa0ab938838c39
        :query:name = hurr.com
        :query:name:fqdn = hurr.com
        :time = 2018/06/28 17:43:00.000
        .created = 2025/07/03 18:38:44.587
```

Note

It is important to understand the differences in behavior when lifting and filtering `time` types using lower resolution time values (which Synpase zero-fills) or wildcard time values (which Synpase wildcard-matches). These behaviors vary based on the specific operator used.

- When lifting or filtering using the equivalent (`=`) operator, behavior is **different:**
  - `:time=2021/05/13` means equal to **the exact date/time value** `2021/05/13 00:00:00.000`.
  - `:time=2021/05/13*` means equal to **any** time on that date (`2021/05/13 00:00:00.000` through `2021/05/13 23:59:59.999`).

- When lifting or filtering using the greater than (>) / greater than or equal to (>=) operators, behavior is **equivalent:**
  - `:time>2021/05/13` and `:time>2021/05/13*` **both** mean any date / time greater than `2021/05/13 00:00:00.000`.
  - `:time>=2021/05/13` and `:time>=2021/05/13*` **both** mean any date / time greater than or equal to `2021/05/13 00:00:00.000`.

  Both are equivalent because in this case Synapse interprets the wildcard syntax as "greater than or equal to the **lowest** possible wildcard match", which in this case is `2021/05/13 00:00:00.000`.
- When lifting or filtering using the less than (<) / less than or equal to (<=) operators, behavior is **different:**
  - `:time<2021/05/13` / `:time<=2021/05/13` mean any date / time less than (or less than or equal to) `2021/05/13 00:00:00.000`.
  - `:time<2021/05/13*` / `:time<=2021/05/13*` both mean any date / time less than (or less than or equal to) `2021/05/13 23:59:59.999`.

  The behavior differs because in this case Synapse interprets the wildcard syntax as "less than or equal to the **highest** possible wildcard match", which in this case is `2021/05/13 23:59:59.999`.

Tip

The wildcard syntax is useful because it can provide a simplified, more intuitive means to specify certain time ranges / time intervals without needing to use the range (`*range=`) or interval (`@=`) operators. For example, the following three Storm queries are equivalent and will return all files compiled at any time within the year 2019:

```
file:bytes:mime:pe:compiled=2019*

file:bytes:mime:pe:compiled*range=('2019/01/01 00:00:00.000', '2019/12/31 23:59:59.999
↪')

file:bytes:mime:pe:compiled@=('2019/01/01', '2020/01/01')
```

(A **range** maximum value represents "less than or equal to" that value, while an **interval** maximum value represents "less than" that value.)

Range Custom Operator

`time` types can lifted and filtered using the `*range=` custom comparator (see *Lift by Range (*range=)* and *Filter by Range (*range=)*).

Example:

Lift a set of `file:bytes` nodes whose PE compiled time is between January 1, 2019 and today:

```
storm> file:bytes:mime:pe:compiled*range=(2019/01/01, now)
file:bytes=sha256:9f9d96e99cef99cbfe8d02899919a7f7220f2273bb36a084642f492dd3e473da
        :mime:pe:compiled = 2019/10/07 12:42:45.000
        :sha256 = 9f9d96e99cef99cbfe8d02899919a7f7220f2273bb36a084642f492dd3e473da
        .created = 2025/07/03 18:38:44.593
file:bytes=sha256:bd422f912affcf6d0830c13834251634c8b55b5a161c1084deae1f9b5d6830ce
        :mime:pe:compiled = 2021/04/13 00:23:14.000
        :sha256 = bd422f912affcf6d0830c13834251634c8b55b5a161c1084deae1f9b5d6830ce
        .created = 2025/07/03 18:38:44.594
```

> **Note**
>
> Both lower resolution times and wildcard times can be used for values specified within the `*range=` operator. Because the range operator is a shorthand syntax for "greater than or equal to <*range_min*> and less than or equal to <*range_max*>", users should be aware of differences in behavior between each kind of time value with greater than / less than operators.

See the Storm documents referenced above for additional examples using the range (`*range=`) comparator.

Interval Custom Operator

`time` types can be lifted and filtered using the interval (`@=`) custom comparator (see *Lift by Time or Interval (@=)* and *Filter by Time or Interval (@=)*). The comparator is specifically designed to compare `time` types and `ival` types, which can be useful (for example) for filtering to a set of nodes whose `time` properties fall within a specified interval.

Example:

Lift a set of DNS A records whose window of observation includes March 16, 2019 at 13:00 UTC:

```
storm> inet:dns:a.seen@='2019/03/16 13:00'
inet:dns:a=('aaaa.org', '1.2.3.4')
        :fqdn = aaaa.org
        :ipv4 = 1.2.3.4
        .created = 2025/07/03 18:38:44.600
        .seen = ('2018/12/29 12:36:27.000', '2019/06/03 18:14:33.000')
inet:dns:a=('derp.net', '8.8.8.8')
        :fqdn = derp.net
        :ipv4 = 8.8.8.8
        .created = 2025/07/03 18:38:44.398
        .seen = ('2019/03/08 07:26:00.000', '2019/03/22 10:14:00.000')
inet:dns:a=('bbbb.edu', '5.6.7.8')
        :fqdn = bbbb.edu
        :ipv4 = 5.6.7.8
        .created = 2025/07/03 18:38:44.601
        .seen = ('2019/03/16 12:59:59.000', '2019/03/16 13:01:01.000')
```

> **Note**
>
> Both lower resolution times and wildcard time can be used for values specified within the `@=` operator. Because the interval operator is a shorthand syntax for "greater than or equal to <*ival_min*> and less than <*ival_max*>", users should be aware of differences in behavior between each kind of time value with greater than / less than operators.

See the Storm documents referenced above for additional examples using the interval (`@=`) comparator.

3.6.10 Storm Reference - Storm Commands

Storm commands are built-in or custom commands that can be used natively within Synapse Storm queries.

Built-in commands are native to the Storm library and loaded by default within a given Cortex. Built-in commands comprise a set of helper commands that perform a variety of specialized tasks that are useful regardless of the types of data stored in Synapse or the types of analysis performed.

Custom commands are Storm commands that have been added to a Cortex to invoke the execution of dynamically loaded modules. Synapse **Power-Ups** (*Power-Up*) are examples of modules that may install additional Storm commands

to implement functionality specific to that Power-Up (such as querying a third-party data source to automatically ingest and model the data in Synapse).

Storm Commands and the Pipe Character

The pipe character (`|`) is used with Storm commands to:

- Return to Storm query syntax after running a Storm command.
- Separate individual Storm commands and their parameters (i.e., if you are "chaining" multiple commands together).

For example:

```
inet:fqdn=woot.com nettools.whois | nettools.dns --type A AAAA NS | -> inet:dns:a
```

The query above:

- lifts the FQDN `woot.com`,
- performs a live "whois" lookup using the Synapse-Nettools *Power-Up*,
- performs a live DNS query for the FQDN's A, AAAA, and NS records, and
- pivots from the FQDN to any associated DNS A records.

The pipe is used:

- to separate the two `nettools.*` commands, and
- to separate the `nettools.dns` command and its switches from the subsequent query operation (the pivot).

Tip

A pipe character is **not** required between a Storm operation and any **initial** Storm command (e.g., between the `inet:fqdn=woot.com` lift operation and the subsequent `nettools.whois` command in the example above). A pipe character can **optionally** be placed in this location (some users may find it easier to remember the "rules" for pipe use as "place a pipe between Storm operations and Storm commands"), but is not necessary.

Storm Command Reference

The full list of Storm commands (built-in and custom) available in a given instance of Synapse can be displayed with the `help` command.

Help for a specific Storm command can be displayed with `<command> --help`.

Tip

This section details the usage and syntax for **built-in** Storm commands. Many of the commands below - such as `count`, `intersect`, `limit`, `max` / `min`, `uniq`, or the various `gen` (generate) commands - directly support analysis tasks.

Other commands, such as those used to manage daemons, queues, packages, or services, are likely of greater interest to Synapse administrators or developers.

- *help*
- *aha*
- *auth*

- *background*
- *batch*
- *copyto*
- *cortex.httpapi*
- *count*
- *cron*
- *delnode*
- *diff*
- *divert*
- *dmon*
- *edges*
- *feed*
- *gen*
- *graph*
- *iden*
- *intersect*
- *layer*
- *lift*
- *limit*
- *macro*
- *max*
- *merge*
- *min*
- *model*
- *movenodes*
- *movetag*
- *nodes*
- *note*
- *once*
- *parallel*
- *pkg*
- *ps*
- *queue*
- *reindex*
- *runas*
- *scrape*

- *service*
- *sleep*
- *spin*
- *stats*
- *tag*
- *tee*
- *tree*
- *trigger*
- *uniq*
- *uptime*
- *vault*
- *version*
- *view*
- *wget*

See *Storm Reference - Document Syntax Conventions* for an explanation of the syntax format used below.

The Storm query language is covered in detail starting with the *Storm Reference - Introduction* section of the Synapse User Guide.

Tip

Storm commands, including custom commands, are added to Synapse as **runtime nodes** ("runt nodes" - see *Node, Runt*) of the form `syn:cmd`. With a few restrictions, these runt nodes can be lifted, filtered, and operated on similar to the way you work with other nodes.

Example

Lift the `syn:cmd` node for the Storm `movetag` command:

```
storm> syn:cmd=movetag
syn:cmd=movetag
        :doc = Rename an entire tag tree and preserve time intervals.
```

help

The `help` command displays the list of available commands within the current instance of Synapse and a brief message describing each command. Help for individual commands is available via `<command> --help`. The `help` command can also be used to inspect information about *Storm Libraries* and *Storm Types*.

Syntax:

```
storm> help --help


    List available information about Storm and brief descriptions of different items.

    Notes:
```

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```
        If an item is provided, this can be a string or a function.

    Examples:

        // Get all available commands, libraries, types, and their brief descriptions.

        help

        // Only get commands which have "model" in the name.

        help model

        // Get help about the base Storm library

        help $lib

        // Get detailed help about a specific library or library function

        help --verbose $lib.print

        // Get detailed help about a named Storm type

        help --verbose str

        // Get help about a method from a $node object

        <inbound $node> help $node.tags


Usage: help [options] <item>

Options:

  --help                      : Display the command usage.
  -v                          : Display detailed help when available.

Arguments:

  [item]                      : List information about a subset of commands or a␣
↪specific item.
```

aha

Storm includes `aha.*` commands that allow you to work with Synapse's AHA service, specifically with AHA service pools.

- *aha.pool.add*
- *aha.pool.del*
- *aha.pool.list*
- *aha.pool.svc.add*

- *aha.pool.svc.del*
- *aha.svc.list*
- *aha.svc.stat*

Help for individual `aha.*` commands can be displayed using:

```
<command> --help
```

aha.pool.add

The `aha.pool.add` command creates a new AHA service pool.

Syntax:

```
storm> aha.pool.add --help

Create an AHA service pool configuration.

Usage: aha.pool.add [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the new AHA service pool.
```

aha.pool.del

The `aha.pool.del` command deletes an AHA service pool configuration.

Syntax:

```
storm> aha.pool.del --help

Delete an AHA service pool configuration.

Usage: aha.pool.del [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the AHA pool to delete.
```

aha.pool.list

The `aha.pool.list` command lists AHA service pools and their associated services.

Syntax:

```
storm> aha.pool.list --help

Display a list of AHA service pools and their services.

Usage: aha.pool.list [options]

Options:

  --help                      : Display the command usage.
```

aha.pool.svc.add

The `aha.pool.svc.add` command adds a service to an existing AHA service pool.

Syntax:

```
storm> aha.pool.svc.add --help


            Add an AHA service to a service pool.

            Examples:

                // add 00.cortex... to the existing pool named pool.cortex
                aha.pool.svc.add pool.cortex... 00.cortex...


Usage: aha.pool.svc.add [options] <poolname> <svcname>

Options:

  --help                      : Display the command usage.

Arguments:

  <poolname>                  : The name of the AHA pool.
  <svcname>                   : The name of the AHA service.
```

aha.pool.svc.del

The `aha.pool.svc.del` command removes a service from an existing AHA service pool.

Syntax:

```
storm> aha.pool.svc.del --help

Remove an AHA service from a service pool.

Usage: aha.pool.svc.del [options] <poolname> <svcname>

Options:

  --help                      : Display the command usage.
```

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```
Arguments:

  <poolname>                  : The name of the AHA pool.
  <svcname>                   : The name of the AHA service.
```

aha.svc.list

The `aha.svc.list` command lists AHA services.

Syntax:

```
storm> aha.svc.list --help

List AHA services.

If the --nexus argument is given, the Cortex will attempt to connect to each service and␣
↪report the Nexus offset of the service.

The ready column indicates that a service has entered into the realtime change window␣
↪for synchronizing changes from its leader.

Usage: aha.svc.list [options]

Options:

  --help                      : Display the command usage.
  --nexus                     : Try to connect to online services and report their nexus␣
↪offset.
```

aha.svc.stat

The `aha.svc.stat` command displays all information for an AHA service.

Syntax:

```
storm> aha.svc.stat --help

Show all information for a specific AHA service.

If the --nexus argument is given, the Cortex will attempt to connect the service and␣
↪report the Nexus offset of the service.

The ready value indicates that a service has entered into the realtime change window for␣
↪synchronizing changes from its leader.


Usage: aha.svc.stat [options] <svc>

Options:

  --help                      : Display the command usage.
```

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```
  --nexus                     : Try to connect to online services and report their nexus␣
↪offset.

Arguments:

  <svc>                       : The service to inspect.
```

auth

Storm includes `auth.*` commands that allow you create and manage users and roles, and manage their associated permissions (rules).

- *auth.gate.show*
- *auth.perms.list*
- *auth.role.add*
- *auth.role.addrule*
- *auth.role.del*
- *auth.role.delrule*
- *auth.role.list*
- *auth.role.mod*
- *auth.role.show*
- *auth.user.add*
- *auth.user.addrule*
- *auth.user.allowed*
- *auth.user.delrule*
- *auth.user.grant*
- *auth.user.list*
- *auth.user.mod*
- *auth.user.revoke*
- *auth.user.show*

Help for individual `auth.*` commands can be displayed using:

```
<command> --help
```

auth.gate.show

The `auth.gate.show` command displays the user, roles, and permissions associated with the specified *Auth Gate*.

Syntax

```
storm> auth.gate.show --help
```

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```
            Display users, roles, and permissions for an auth gate.

            Examples:
                // Display the users and roles with permissions to the top layer of the␣
↪current view.
                auth.gate.show $lib.layer.get().iden

                // Display the users and roles with permissions to the current view.
                auth.gate.show $lib.view.get().iden


Usage: auth.gate.show [options] <gateiden>

Options:

  --help                      : Display the command usage.

Arguments:

  <gateiden>                  : The GUID of the auth gate.
```

auth.perms.list

The `auth.perms.list` command displays the set of permissions currently defined within the Cortex. This includes native Synapse permissions as well as any permissions associated with other packages and services, including Power-Ups. Each permission includes a brief description of the permission, the associated auth gate (e.g., 'cortex', 'layer') and the default state (true/allowed or false/denied).

Syntax:

```
storm> auth.perms.list --help

Display a list of the current permissions defined within the Cortex.

Usage: auth.perms.list [options]

Options:

  --help                      : Display the command usage.
  --find <find>               : A search string for permissions.
```

auth.role.add

The `auth.role.add` command creates a role.

Syntax:

```
storm> auth.role.add --help


            Add a role.

```

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```
            Examples:

                // Add a role named "ninjas"
                auth.role.add ninjas


Usage: auth.role.add [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the role.
```

auth.role.addrule

The `auth.role.addrule` command adds a rule (permission) to a role.

Syntax:

```
storm> auth.role.addrule --help


            Add a rule to a role.

            Examples:

                // add an allow rule to the role "ninjas" for permission "foo.bar.baz"
                auth.role.addrule ninjas foo.bar.baz

                // add a deny rule to the role "ninjas" for permission "foo.bar.baz"
                auth.role.addrule ninjas "!foo.bar.baz"

                // add an allow rule to the role "ninjas" for permission "baz" at the␣
↪first index.
                auth.role.addrule ninjas baz --index 0


Usage: auth.role.addrule [options] <name> <rule>

Options:

  --help                      : Display the command usage.
  --gate <gate>               : The auth gate id to add the rule to. (default: None)
  --index <index>             : Specify the rule location as a 0 based index. (default:␣
↪None)

Arguments:

  <name>                      : The name of the role.
```

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```
  <rule>                       : The rule string.
```

auth.role.del

The `auth.role.del` command deletes a role.

Syntax:

```
storm> auth.role.del --help


            Delete a role.

            Examples:

                // Delete a role named "ninjas"
                auth.role.del ninjas


Usage: auth.role.del [options] <name>

Options:

  --help                       : Display the command usage.

Arguments:

  <name>                       : The name of the role.
```

auth.role.delrule

The `auth.role.delrule` command removes a rule (permission) from a role.

Syntax:

```
storm> auth.role.delrule --help


            Remove a rule from a role.

            Examples:

                // Delete the allow rule from the role "ninjas" for permission "foo.bar.
↪baz"
                auth.role.delrule ninjas foo.bar.baz

                // Delete the deny rule from the role "ninjas" for permission "foo.bar.
↪baz"
                auth.role.delrule ninjas "!foo.bar.baz"

                // Delete the rule at index 5 from the role "ninjas"
                auth.role.delrule ninjas --index  5
```

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```
Usage: auth.role.delrule [options] <name> <rule>

Options:

  --help                      : Display the command usage.
  --gate <gate>               : The auth gate id to remove the rule from. (default: None)
  --index                     : Specify the rule as a 0 based index into the list of␣
↪rules.

Arguments:

  <name>                      : The name of the role.
  <rule>                      : The rule string.
```

auth.role.list

The `auth.role.list` lists all roles in the Cortex.

Syntax:

```
storm> auth.role.list --help


            List all roles.

            Examples:

                // Display the list of all roles
                auth.role.list


Usage: auth.role.list [options]

Options:

  --help                      : Display the command usage.
```

auth.role.mod

The `auth.role.mod` modifies an existing role.

Syntax:

```
storm> auth.role.mod --help


            Modify properties of a role.

            Examples:

```

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```
                // Rename the "ninjas" role to "admins"
                auth.role.mod ninjas --name admins


Usage: auth.role.mod [options] <rolename>

Options:

  --help                      : Display the command usage.
  --name <name>               : The new name for the role.

Arguments:

  <rolename>                  : The name of the role.
```

auth.role.show

The `auth.role.show` displays the details for a given role.

Syntax:

```
storm> auth.role.show --help



            Display details for a given role by name.

            Examples:

                // Display details about the role "ninjas"
                auth.role.show ninjas


Usage: auth.role.show [options] <rolename>

Options:

  --help                      : Display the command usage.

Arguments:

  <rolename>                  : The name of the role.
```

auth.user.add

The `auth.user.add` command creates a user.

Syntax:

```
storm> auth.user.add --help


```

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```
            Add a user.

            Examples:

                // Add a user named "visi" with the email address "visi@vertex.link"
                auth.user.add visi --email visi@vertex.link


Usage: auth.user.add [options] <name>

Options:

  --help                      : Display the command usage.
  --email <email>             : The user's email address. (default: None)

Arguments:

  <name>                      : The name of the user.
```

auth.user.addrule

The `auth.user.addrule` command adds a rule (permission) to a user.

Syntax:

```
storm> auth.user.addrule --help


            Add a rule to a user.

            Examples:

                // add an allow rule to the user "visi" for permission "foo.bar.baz"
                auth.user.addrule visi foo.bar.baz

                // add a deny rule to the user "visi" for permission "foo.bar.baz"
                auth.user.addrule visi "!foo.bar.baz"

                // add an allow rule to the user "visi" for permission "baz" at the␣
↪first index.
                auth.user.addrule visi baz --index 0


Usage: auth.user.addrule [options] <name> <rule>

Options:

  --help                      : Display the command usage.
  --gate <gate>               : The auth gate id to grant permission on. (default: None)
  --index <index>             : Specify the rule location as a 0 based index. (default:␣
↪None)
```

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```
Arguments:

  <name>                        : The name of the user.
  <rule>                        : The rule string.
```

auth.user.allowed

The `auth.user.allowed` command checks whether a user has a permission for the specified scope (view or layer; if no scope is specified with the `--gate` option, the permission is checked globally).

The command retuns whether the permission is allowed (true) the source of the permission (e.g., if the permission is due to having a particular role).

Syntax:

```
storm> auth.user.allowed --help


            Show whether the user is allowed the given permission and why.

            Examples:

                auth.user.allowed visi foo.bar


Usage: auth.user.allowed [options] <username> <permname>

Options:

  --help                        : Display the command usage.
  --gate <gate>                 : An auth gate to test the perms against.

Arguments:

  <username>                    : The name of the user.
  <permname>                    : The permission string.
```

auth.user.delrule

The `auth.user.delrule` command removes a rule (permission) from a user.

Syntax:

```
storm> auth.user.delrule --help


            Remove a rule from a user.

            Examples:

                // Delete the allow rule from the user "visi" for permission "foo.bar.baz
↪"
                auth.user.delrule visi foo.bar.baz
```

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```
                // Delete the deny rule from the user "visi" for permission "foo.bar.baz"
                auth.user.delrule visi "!foo.bar.baz"

                // Delete the rule at index 5 from the user "visi"
                auth.user.delrule visi --index  5


Usage: auth.user.delrule [options] <name> <rule>

Options:

  --help                      : Display the command usage.
  --gate <gate>               : The auth gate id to grant permission on. (default: None)
  --index                     : Specify the rule as a 0 based index into the list of␣
↪rules.

Arguments:

  <name>                      : The name of the user.
  <rule>                      : The rule string.
```

auth.user.grant

The `auth.user.grant` command grants a role (and its associated permissions) to a user.

Syntax:

```
storm> auth.user.grant --help


            Grant a role to a user.

            Examples:

                // Grant the role "ninjas" to the user "visi"
                auth.user.grant visi ninjas

                // Grant the role "ninjas" to the user "visi" at the first index.
                auth.user.grant visi ninjas --index 0



Usage: auth.user.grant [options] <username> <rolename>

Options:

  --help                      : Display the command usage.
  --index <index>             : Specify the role location as a 0 based index. (default:␣
↪None)

Arguments:
```

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```
  <username>                  : The name of the user.
  <rolename>                  : The name of the role.
```

auth.user.list

The `auth.user.list` command displays all users in the Cortex.

Syntax:

```
storm> auth.user.list --help


            List all users.

            Examples:

                // Display the list of all users
                auth.user.list


Usage: auth.user.list [options]

Options:

  --help                      : Display the command usage.
```

auth.user.mod

The `auth.user.mod` command modifies a user account.

Syntax:

```
storm> auth.user.mod --help


            Modify properties of a user.

            Examples:

                // Rename the user "foo" to "bar"
                auth.user.mod foo --name bar

                // Make the user "visi" an admin
                auth.user.mod visi --admin $lib.true

                // Unlock the user "visi" and set their email to "visi@vertex.link"
                auth.user.mod visi --locked $lib.false --email visi@vertex.link

                // Grant admin access to user visi for the current view
                auth.user.mod visi --admin $lib.true --gate $lib.view.get().iden
```

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```
                // Revoke admin access to user visi for the current view
                auth.user.mod visi --admin $lib.false --gate $lib.view.get().iden


Usage: auth.user.mod [options] <username>

Options:

  --help                      : Display the command usage.
  --name <name>               : The new name for the user.
  --email <email>             : The email address to set for the user.
  --passwd <passwd>           : The new password for the user. This is best passed into␣
↪the runtime as a variable.
  --admin <admin>             : True to make the user and admin, false to remove their␣
↪remove their admin status.
  --gate <gate>               : The auth gate iden to grant or revoke admin status on.␣
↪Use in conjunction with `--admin
                                <bool>`.
  --locked <locked>           : True to lock the user, false to unlock them.

Arguments:

  <username>                  : The name of the user.
```

auth.user.revoke

The `auth.user.revoke` command revokes a role (and its associated permissions) from a user.

Syntax:

```
storm> auth.user.revoke --help


            Revoke a role from a user.

            Examples:

                // Revoke the role "ninjas" from the user "visi"
                auth.user.revoke visi ninjas



Usage: auth.user.revoke [options] <username> <rolename>

Options:

  --help                      : Display the command usage.

Arguments:

  <username>                  : The name of the user.
  <rolename>                  : The name of the role.
```

auth.user.show

The `auth.user.show` command displays information for a specific user.

Syntax:

```
storm> auth.user.show --help


            Display details for a given user by name.

            Examples:

                // Display details about the user "visi"
                auth.user.show visi


Usage: auth.user.show [options] <username>

Options:

  --help                      : Display the command usage.

Arguments:

  <username>                  : The name of the user.
```

background

The `background` command allows you to execute a Storm query as a background task (e.g., to free up the CLI / Storm runtime for additional queries).

> **Note**
>
> Use of `background` is a "fire-and-forget" process - any status messages (warnings or errors) are not returned to the console, and if the query is interrupted for any reason, it will not resume.

See also *parallel*.

Syntax:

```
storm> background --help


    Execute a query pipeline as a background task.
    NOTE: Variables are passed through but nodes are not


Usage: background [options] <query>

Options:

  --help                      : Display the command usage.
```

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```
Arguments:

  <query>                     : The query to execute in the background.
```

batch

The `batch` command allows you to run a Storm query with batched sets of nodes.

Note that in most cases, Storm queries are meant to operate in a "streaming" manner on individual nodes. This command is intended to be used in cases such as querying external APIs that support aggregate queries (i.e., an API that allows you to query 100 objects in a single API call as part of the API's quota system).

Syntax:

```
storm> batch --help


    Run a query with batched sets of nodes.

    The batched query will have the set of inbound nodes available in the
    variable $nodes.

    This command also takes a conditional as an argument. If the conditional
    evaluates to true, the nodes returned by the batched query will be yielded,
    if it evaluates to false, the inbound nodes will be yielded after executing the
    batched query.

    NOTE: This command is intended to facilitate use cases such as queries to external
          APIs with aggregate node values to reduce quota consumption. As this command
          interrupts the node stream, it should be used carefully to avoid unintended
          slowdowns in the pipeline.

    Example:

        // Execute a query with batches of 5 nodes, then yield the inbound nodes
        batch $lib.false --size 5 { $lib.print($nodes) }


Usage: batch [options] <cond> <query>

Options:

  --help                      : Display the command usage.
  --size <size>               : The number of nodes to collect before running the␣
↪batched query (max 10000). (default:
                                10)

Arguments:

  <cond>                      : The conditional value for the yield option.
  <query>                     : The query to execute with batched nodes.
```

copyto

The `copyto` command allows you to copy nodes from the current view to a specified target view. Nodes are copied to the write layer (the topmost layer) in the target view.

When copying nodes, the history of the node (i.e., changes to the node, timestamps, associated user) in the **source** view (the view layer(s)) is preserved; the changes written to the **target** view's write layer are owned by the user executing the `copyto` command.

See the *movenodes* command to move nodes between layers in the same layer stack.

> **Note**
>
> The `copyto` command, like the `movenodes` command, is meant to be used by Synapse **administrators** in specific use cases.

Syntax:

```
storm> copyto --help


    Copy nodes from the current view into another view.

    Examples:

        // Copy all nodes tagged with #cno.mal.redtree to the target view.

        #cno.mal.redtree | copyto 33c971ac77943da91392dadd0eec0571


Usage: copyto [options] <view>

Options:

  --help                      : Display the command usage.
  --no-data                   : Do not copy node data to the destination view.

Arguments:

  <view>                      : The destination view ID to copy the nodes to.
```

cortex.httpapi

> **Note**
>
> See the *Extended HTTP API* guide for additional background on Extended HTTP API endpoints.

Storm includes `cortex.httpapi.*` commands that allow a user to list and manage Extended HTTP API endpoints.

- *cortex.httpapi.index*
- *cortex.httpapi.list*
- *cortex.httpapi.stat*

Help for individual `cortex.httpapi.*` commands can be displayed using:

```
<command> --help
```

cortex.httpapi.index

The `cortex.httpapi.index` command is used to change the resolution order of the Extended HTTP API endpoints.

Syntax:

```
storm> cortex.httpapi.index --help

Set the index of an Extended HTTP API endpoint.

Examples:

    // Move an endpoint to the first index.
    cortex.httpapi.index 60e5ba38e90958fd8e2ddd9e4730f16b 0

    // Move an endpoint to the third index.
    cortex.httpapi.index dd9e4730f16b60e5ba58fd8e2d38e909 2


Usage: cortex.httpapi.index [options] <iden> <index>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : The iden of the endpoint to move. This will also match␣
↪iden prefixes or name prefixes.
  <index>                     : Specify the endpoint location as a 0 based index.
```

cortex.httpapi.list

The `cortex.httpapi.list` command is used to list the Extended HTTP API endpoints.

Syntax:

```
storm> cortex.httpapi.list --help

List Extended HTTP API endpoints

Usage: cortex.httpapi.list [options]

Options:

  --help                      : Display the command usage.
```

cortex.httpapi.stat

The `cortex.httpapi.stat` command is used to show the detailed information for a single Extended HTTP API Endpoint.

Syntax:

```
storm> cortex.httpapi.stat --help

Get details for an Extended HTTP API endpoint.

Usage: cortex.httpapi.stat [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : The iden of the endpoint to inspect. This will also␣
↪match iden prefixes or name prefixes.
```

cortex.storm.pool

Note

See the *Synapse Deployment Guide* section on *Configure a Storm Query Pool (optional)* for additional background on Storm query pools.

Storm includes `cortex.storm.pool.*` commands that allow a user to work with Storm query mirror pools.

- *cortex.storm.pool.del*
- *cortex.storm.pool.get*
- *cortex.storm.pool.set*

Help for individual `cortex.storm.pool.*` commands can be displayed using:

```
<command> --help
```

cortex.storm.pool.del

The `cortex.storm.pool.del` command deletes a Storm query offload mirror pool configuration.

Syntax:

```
storm> cortex.storm.pool.del --help


    Remove a Storm query offload mirror pool configuration.

    Notes:
        This will result in tearing down any Storm queries currently being serviced by␣
↪the Storm pool.
        This may result in this command raising an exception if it was offloaded to a␣
```

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```
↪pool member. That would be an expected behavior.


Usage: cortex.storm.pool.del [options]

Options:

  --help                      : Display the command usage.
```

cortex.storm.pool.get

The `cortex.storm.pool.get` command displays the Storm query offload mirror pool configuration.

Syntax:

```
storm> cortex.storm.pool.get --help


    Display the current Storm query offload mirror pool configuration.


Usage: cortex.storm.pool.get [options]

Options:

  --help                      : Display the command usage.
```

cortex.storm.pool.set

The `cortex.storm.pool.set` command sets the Storm query offload mirror pool configuration.

Syntax:

```
storm> cortex.storm.pool.set --help


    Setup a Storm query offload mirror pool for the Cortex.


Usage: cortex.storm.pool.set [options] <url>

Options:

  --help                      : Display the command usage.
  --connection-timeout <connection_timeout>: The maximum amount of time to wait for a␣
↪connection from the pool to become available.
                                (default: 2)
  --sync-timeout <sync_timeout>: The maximum amount of time to wait for the mirror to be␣
↪in sync with the leader
                                (default: 2)

Arguments:
```

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```
  <url>                       : The telepath URL for the AHA service pool.
```

count

The `count` command enumerates the number of nodes returned from a given Storm query and displays the final tally. The associated nodes can optionally be displayed with the `--yield` switch.

Syntax:

```
storm> count --help


    Iterate through query results, and print the resulting number of nodes
    which were lifted. This does not yield the nodes counted, unless the
    --yield switch is provided.

    Example:

        # Count the number of IPV4 nodes with a given ASN.
        inet:ipv4:asn=20 | count

        # Count the number of IPV4 nodes with a given ASN and yield them.
        inet:ipv4:asn=20 | count --yield



Usage: count [options]

Options:

  --help                      : Display the command usage.
  --yield                     : Yield inbound nodes.
```

Examples:

- Count the number of IP address nodes that Trend Micro reports are associated with the threat group Earth Preta:

```
storm> inet:ipv4#rep.trend.earthpreta | count
Counted 5 nodes.
```

- Count nodes from a lift and yield the output:

```
storm> inet:ipv4#rep.trend.earthpreta | count --yield
inet:ipv4=66.129.222.1
        :type = unicast
        .created = 2025/07/03 18:38:36.014
        #rep.trend.earthpreta
inet:ipv4=184.82.164.104
        :type = unicast
        .created = 2025/07/03 18:38:36.016
        #rep.trend.earthpreta
inet:ipv4=209.161.249.125
```

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```
        :type = unicast
        .created = 2025/07/03 18:38:36.018
        #rep.trend.earthpreta
inet:ipv4=69.90.65.240
        :type = unicast
        .created = 2025/07/03 18:38:36.018
        #rep.trend.earthpreta
inet:ipv4=70.62.232.98
        :type = unicast
        .created = 2025/07/03 18:38:36.019
        #rep.trend.earthpreta
Counted 5 nodes.
```

- Count the number of DNS A records for the domain woot.com where the lift produces no results:

```
storm> inet:dns:a:fqdn=woot.com | count
Counted 0 nodes.
```

cron

Note

See the *Storm Reference - Automation* guide for additional background on cron jobs (as well as triggers and macros), including examples.

Storm includes `cron.*` commands that allow you to create and manage scheduled *Cron* jobs. Within Synapse, jobs are Storm queries that execute on a recurring or one-time (`cron.at`) basis.

- *cron.add*
- *cron.at*
- *cron.cleanup*
- *cron.list*
- *cron.stat*
- *cron.mod*
- *cron.move*
- *cron.disable*
- *cron.enable*
- *cron.del*

Help for individual `cron.*` commands can be displayed using:

```
<command> --help
```

Tip

Cron jobs (including jobs created with `cron.at`) are added to Synapse as **runtime nodes** ("runt nodes" - see *Node, Runt*) of the form `syn:cron`. With a few restrictions, these runt nodes can be lifted, filtered, and operated on similar to the way you work with other nodes.

cron.add

The `cron.add` command creates an individual cron job within a Cortex.

Syntax:

```
storm> cron.add --help


Add a recurring cron job to a cortex.

Notes:
    All times are interpreted as UTC.

    All arguments are interpreted as the job period, unless the value ends in
    an equals sign, in which case the argument is interpreted as the recurrence
    period.  Only one recurrence period parameter may be specified.

    Currently, a fixed unit must not be larger than a specified recurrence
    period.  i.e. '--hour 7 --minute +15' (every 15 minutes from 7-8am?) is not
    supported.

    Value values for fixed hours are 0-23 on a 24-hour clock where midnight is 0.

    If the --day parameter value does not start with a '+' and is an integer, it is
    interpreted as a fixed day of the month.  A negative integer may be
    specified to count from the end of the month with -1 meaning the last day
    of the month.  All fixed day values are clamped to valid days, so for
    example '-d 31' will run on February 28.
    If the fixed day parameter is a value in ([Mon, Tue, Wed, Thu, Fri, Sat,
    Sun] if locale is set to English) it is interpreted as a fixed day of the
    week.

    Otherwise, if the parameter value starts with a '+', then it is interpreted
    as a recurrence interval of that many days.

    If no plus-sign-starting parameter is specified, the recurrence period
    defaults to the unit larger than all the fixed parameters.   e.g. '--minute 5'
    means every hour at 5 minutes past, and --hour 3, --minute 1 means 3:01 every day.

    At least one optional parameter must be provided.

    All parameters accept multiple comma-separated values.  If multiple
    parameters have multiple values, all combinations of those values are used.

    All fixed units not specified lower than the recurrence period default to
    the lowest valid value, e.g. --month +2 will be scheduled at 12:00am the first of
    every other month.  One exception is if the largest fixed value is day of the
    week, then the default period is set to be a week.
```

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```
    A month period with a day of week fixed value is not currently supported.

    Fixed-value year (i.e. --year 2019) is not supported.  See the 'at'
    command for one-time cron jobs.

    As an alternative to the above options, one may use exactly one of
    --hourly, --daily, --monthly, --yearly with a colon-separated list of
    fixed parameters for the value.  It is an error to use both the individual
    options and these aliases at the same time.

Examples:
    Run a query every last day of the month at 3 am
    cron.add --hour 3 --day -1 {#foo}

    Run a query every 8 hours
    cron.add --hour +8 {#foo}

    Run a query every Wednesday and Sunday at midnight and noon
    cron.add --hour 0,12 --day Wed,Sun {#foo}

    Run a query every other day at 3:57pm
    cron.add --day +2 --minute 57 --hour 15 {#foo}


Usage: cron.add [options] <query>

Options:

  --help                     : Display the command usage.
  --pool                     : Allow the cron job to be run by a mirror from the query␣
↪pool.
  --minute <minute>          : Minute value for job or recurrence period.
  --name <name>              : An optional name for the cron job.
  --doc <doc>                : An optional doc string for the cron job.
  --hour <hour>              : Hour value for job or recurrence period.
  --day <day>                : Day value for job or recurrence period.
  --month <month>            : Month value for job or recurrence period.
  --year <year>              : Year value for recurrence period.
  --hourly <hourly>          : Fixed parameters for an hourly job.
  --daily <daily>            : Fixed parameters for a daily job.
  --monthly <monthly>        : Fixed parameters for a monthly job.
  --yearly <yearly>          : Fixed parameters for a yearly job.
  --iden <iden>              : Fixed iden to assign to the cron job
  --view <view>              : View to run the cron job against

Arguments:

  <query>                    : Query for the cron job to execute.
```

cron.at

The `cron.at` command creates a non-recurring (one-time) cron job within a Cortex. Just like standard (recurring) cron jobs, jobs created with `cron.at` will persist (remain in the list of cron jobs and as `syn:cron` runt nodes) until they are explicitly removed using `cron.del`.

Syntax:

```
storm> cron.at --help


Adds a non-recurring cron job.

Notes:
    This command accepts one or more time specifications followed by exactly
    one storm query in curly braces.  Each time specification may be in synapse
    time delta format (e.g --day +1) or synapse time format (e.g.
    20501217030432101).  Seconds will be ignored, as cron jobs' granularity is
    limited to minutes.

    All times are interpreted as UTC.

    The other option for time specification is a relative time from now.  This
    consists of a plus sign, a positive integer, then one of 'minutes, hours,
    days'.

    Note that the record for a cron job is stored until explicitly deleted via
    "cron.del".

Examples:
    # Run a storm query in 5 minutes
    cron.at --minute +5 {[inet:ipv4=1]}

    # Run a storm query tomorrow and in a week
    cron.at --day +1,+7 {[inet:ipv4=1]}

    # Run a query at the end of the year Zulu
    cron.at --dt 20181231Z2359 {[inet:ipv4=1]}


Usage: cron.at [options] <query>

Options:

  --help                     : Display the command usage.
  --minute <minute>          : Minute(s) to execute at.
  --hour <hour>              : Hour(s) to execute at.
  --day <day>                : Day(s) to execute at.
  --dt <dt>                  : Datetime(s) to execute at.
  --now                      : Execute immediately.
  --iden <iden>              : A set iden to assign to the new cron job
  --view <view>              : View to run the cron job against

Arguments:
```

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```
  <query>                     : Query for the cron job to execute.
```

cron.cleanup

The `cron.cleanup` command can be used to remove any one-time cron jobs ("at" jobs) that have completed.

Syntax:

```
storm> cron.cleanup --help

Delete all completed at jobs

Usage: cron.cleanup [options]

Options:

  --help                      : Display the command usage.
```

cron.list

The `cron.list` command displays the set of cron jobs in the Cortex that the current user can view / modify based on their permissions.

Cron jobs are displayed in alphanumeric order by job *Iden*. Jobs are sorted upon Cortex initialization, so newly-created jobs will be displayed at the bottom of the list until the list is re-sorted the next time the Cortex is restarted.

Syntax:

```
storm> cron.list --help

List existing cron jobs in the cortex.

Usage: cron.list [options]

Options:

  --help                      : Display the command usage.
```

cron.stat

The `cron.stat` command displays statistics for an individual cron job and provides more detail on an individual job vs. `cron.list`, including any errors and the interval at which the job executes. To view the stats for a job, you must provide the first portion of the job's iden (i.e., enough of the iden that the job can be uniquely identified), which can be obtained using `cron.list` or by lifting the appropriate `syn:cron` node.

Syntax:

```
storm> cron.stat --help

Gives detailed information about a cron job.

Usage: cron.stat [options] <iden>
```

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```
Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
```

cron.mod

The `cron.mod` command modifies the Storm query associated with a specific cron job. To modify a job, you must provide the first portion of the job's iden (i.e., enough of the iden that the job can be uniquely identified), which can be obtained using `cron.list` or by lifting the appropriate `syn:cron` node.

Note

Other aspects of the cron job, such as its schedule for execution, cannot be modified once the job has been created. To change these aspects you must delete and re-add the job.

Syntax:

```
storm> cron.mod --help

Modify an existing cron job's query.

Usage: cron.mod [options] <iden> <query>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
  <query>                     : New storm query for the cron job.
```

cron.move

The `cron.move` command moves a cron job from one *View* to another.

Syntax:

```
storm> cron.move --help

Move a cron job from one view to another

Usage: cron.move [options] <iden> <view>
```

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```
Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
  <view>                      : View to move the cron job to.
```

cron.disable

The `cron.disable` command disables a job and prevents it from executing without removing it from the Cortex. To disable a job, you must provide the first portion of the job's iden (i.e., enough of the iden that the job can be uniquely identified), which can be obtained using `cron.list` or by lifting the appropriate `syn:cron` node.

Syntax:

```
storm> cron.disable --help

Disable a cron job in the cortex.

Usage: cron.disable [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
```

cron.enable

The `cron.enable` command enables a disabled cron job. To enable a job, you must provide the first portion of the job's iden (i.e., enough of the iden that the job can be uniquely identified), which can be obtained using `cron.list` or by lifting the appropriate `syn:cron` node.

> **Note**
>
> Cron jobs, including non-recurring jobs added with `cron.at`, are enabled by default upon creation.

Syntax:

```
storm> cron.enable --help

Enable a cron job in the cortex.

Usage: cron.enable [options] <iden>
```

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```
Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
```

cron.del

The `cron.del` command permanently removes a cron job from the Cortex. To delete a job, you must provide the first portion of the job's iden (i.e., enough of the iden that the job can be uniquely identified), which can be obtained using `cron.list` or by lifting the appropriate `syn:cron` node.

Syntax:

```
storm> cron.del --help

Delete a cron job from the cortex.

Usage: cron.del [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid cron job iden␣
↪is accepted.
```

delnode

The `delnode` command deletes a node or set of nodes from a Cortex.

> **Warning**
>
> The Storm `delnode` command includes some limited checks (see below) to try and prevent the accidental deletion of nodes that are still connected to other nodes in the knowledge graph. However, these checks are not foolproof, and `delnode` has the potential to be destructive if executed on an incorrect, badly formed, or mistyped query.
>
> Users are **strongly encouraged** to validate their query by first executing it on its own to confirm it returns the expected nodes before piping the query to the `delnode` command.
>
> In addition, use of the `--force` switch with `delnode` will override all safety checks and forcibly delete ALL nodes input to the command.
>
> **This parameter should be used with extreme caution as it may result in broken references (e.g., "holes" in the graph) within Synapse.**

Syntax:

```
storm> delnode --help


    Delete nodes produced by the previous query logic.

    (no nodes are returned)

    Example

        inet:fqdn=vertex.link | delnode


Usage: delnode [options]

Options:

  --help                      : Display the command usage.
  --force                     : Force delete even if it causes broken references␣
↪(requires admin).
  --delbytes                  : For file:bytes nodes, remove the bytes associated with␣
↪the sha256 property from the
                                axon as well if present.
  --deledges                  : Delete N2 light edges before deleting the node.
```

Examples:

- Delete the node for the domain woowoo.com:

```
storm> inet:fqdn=woowoo.com | delnode
```

- Forcibly delete all nodes with the #testing tag:

```
storm> #testing | delnode --force
```

Usage Notes:

- `delnode` operates on the output of a previous Storm query.
- `delnode` performs some basic sanity-checking to help prevent egregious mistakes, and will generate an error in cases such as:
  - attempting to delete a node (such as `inet:fqdn=woot.com`) that is still referenced by (i.e., is a secondary property of) another node (such as `inet:dns:a=(woot.com, 1.1.1.1)`.
  - attmpting to delete a `syn:tag` node where that tag still exists on other nodes.

  However, it is important to keep in mind that **delnode cannot prevent all mistakes.**

diff

The `diff` command generates a list of nodes with changes (i.e., newly created or modified nodes) present in the top *Layer* of the current *View*. The `diff` command may be useful before performing a *merge* operation.

Syntax:

```
storm> diff --help

```

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```
    Generate a list of nodes with changes in the top layer of the current view.

    Examples:

        // Lift all nodes with any changes

        diff

        // Lift ou:org nodes that were added in the top layer.

        diff --prop ou:org

        // Lift inet:ipv4 nodes with the :asn property modified in the top layer.

        diff --prop inet:ipv4:asn

        // Lift the nodes with the tag #cno.mal.redtree added in the top layer.

        diff --tag cno.mal.redtree

        // Lift nodes by multiple tags (results are uniqued)

        diff --tag cno.mal.redtree rep.vt


Usage: diff [options]

Options:

  --help                      : Display the command usage.
  --tag [<tag> ...]           : Lift only nodes with the given tag (or tags) in the top␣
↪layer. (default: None)
  --prop <prop>               : Lift nodes with changes to the given property the top␣
↪layer. (default: None)
```

divert

The `divert` command allows Storm to either consume a generator or yield its results based on a conditional.

Syntax:

```
storm> divert --help


    Either consume a generator or yield it's results based on a conditional.

    NOTE: This command is purpose built to facilitate the --yield convention
          common to storm commands.

    NOTE: The genr argument must not be a function that returns, else it will
          be invoked for each inbound node.
```

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```
    Example:
        divert $cmdopts.yield $fooBarBaz()


Usage: divert [options] <cond> <genr>

Options:

  --help                      : Display the command usage.
  --size <size>               : The max number of times to iterate the generator.␣
↪(default: None)

Arguments:

  <cond>                      : The conditional value for the yield option.
  <genr>                      : The generator function value that yields nodes.
```

dmon

Storm includes `dmon.*` commands that allow you to work with daemons (see *Daemon*).

- *dmon.list*

Help for individual `dmon.*` commands can be displayed using:

```
<command> --help
```

dmon.list

The `dmon.list` command displays the set of running dmon queries in the Cortex.

Syntax:

```
storm> dmon.list --help

List the storm daemon queries running in the cortex.

Usage: dmon.list [options]

Options:

  --help                      : Display the command usage.
```

edges

Storm includes `edges.*` commands that allow you to work with lightweight (light) edges. Also see the `lift.byverb` and `model.edge.*` commands under *lift* and *model* below.

- *edges.del*

Help for individual `edge.*` commands can be displayed using:

```
<command> --help
```

edges.del

The `edges.del` command is designed to delete multiple light edges to (or from) a set of nodes (contrast with using Storm edit syntax - see *Delete Light Edges*).

Syntax:

```
storm> edges.del --help


    Bulk delete light edges from input nodes.

    Examples:

        # Delete all "foo" light edges from an inet:ipv4
        inet:ipv4=1.2.3.4 | edges.del foo

        # Delete light edges with any verb from a node
        inet:ipv4=1.2.3.4 | edges.del *

        # Delete all "foo" light edges to an inet:ipv4
        inet:ipv4=1.2.3.4 | edges.del foo --n2


Usage: edges.del [options] <verb>

Options:

  --help                     : Display the command usage.
  --n2                       : Delete light edges where input node is N2 instead of N1.

Arguments:

  <verb>                     : The verb of light edges to delete.
```

feed

Storm includes `feed.*` commands that allow you to work with feeds (see *Feed*).

- *feed.list*

Help for individual `feed.*` commands can be displayed using:

```
<command> --help
```

feed.list

The `feed.list` command displays available feed functions in the Cortex.

Syntax:

```
storm> feed.list --help

List the feed functions available in the Cortex

Usage: feed.list [options]
```

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```
Options:

  --help                      : Display the command usage.
```

gen

Storm includes various `gen.*` ("generate") commands that allow you to easily query for common guid-based nodes (see *Form, GUID*) based on one or more "human friendly" secondary properties, and create (generate) the specified node if it does not already exist.

Because guid nodes have a primary property that may be arbitrary, `gen.*` commands simplify the process of **deconflicting on secondary properties** before creating certain guid nodes.

Note

See the *guid* section of the *Storm Reference - Type-Specific Storm Behavior* for a detailed discussion of guids, guid behavior, and deconfliction considerations for guid forms.

Nodes created using generate commands will have a limited subset of properties set (e.g., an organization node deconflicted and created based on a name will only have its `ou:org:name` property set). Users can set additional property values as they see fit.

- *gen.geo.place*
- *gen.it.av.scan.result*
- *gen.it.prod.soft*
- *gen.lang.language*
- *gen.ou.campaign*
- *gen.ou.id.number*
- *gen.ou.id.type*
- *gen.ou.industry*
- *gen.ou.org*
- *gen.ou.org.hq*
- *gen.pol.country*
- *gen.pol.country.government*
- *gen.ps.contact.email*
- *gen.risk.threat*
- *gen.risk.tool.software*
- *gen.risk.vuln*

Help for individual `gen.*` commands can be displayed using:

```
<command> --help
```

> **Note**
>
> New `gen.*` commands are added to Synapse on an ongoing basis as we identify new cases where such commands are helpful. Use the `help` command for the current list of `gen.*` commands available in your instance of Synapse.

gen.geo.place

The `gen.geo.place` command locates (lifts) or creates a `geo:place` node based on the place name (`geo:place:name` and / or `geo:place:names` properties).

Syntax:

```
storm> gen.geo.place --help


            Lift (or create) a geo:place node based on the name.


Usage: gen.geo.place [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the place.
```

gen.it.av.scan.result

The `gen.it.av.scan.result` command locates (lifts) or creates an `it:av:scan:result` node based on the form and value of the object scanned and the signature name used for the scan.

You can optionally include the name of the scanner / scan engine and/or the time the scan was performed for additional deconfliction.

> **Note**
>
> The command can be used to generate `it:av:scan:result` nodes from existing `it:av:filehit` nodes. The `it:av:filehit` form has been marked as deprecated and will be removed in a future version of Synapse. Some *Synapse Power-Ups* that previously created `it:av:filehit` nodes may include dedicated commands to assist with migration; if a migration tool exists, it will be documented in the Admin Guide section of the Power-Up's Help.

Syntax:

```
storm> gen.it.av.scan.result --help


            Lift (or create) the it:av:scan:result node by deconflicting the target and␣
↪signature name.

            The scan time and scanner name may also optionally be provided for␣
```

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```
↪deconfliction.

            Examples:

                // Yield the it:av:scan:result node for an FQDN and signature name
                gen.it.av.scan.result inet:fqdn vertex.link foosig

                // Also deconflict by scanner name and scan time
                gen.it.av.scan.result inet:fqdn fqdn vertex.link foosig --scanner-name␣
↪barscanner --time 2022-11-03

                // Generate an it:av:scan:result node from an it:av:filehit node
                it:av:filehit#foo | gen.it.av.scan.result file:bytes :file :sig:name


Usage: gen.it.av.scan.result [options] <form> <value> <signame>

Options:

  --help                      : Display the command usage.
  --scanner-name <scanner_name>: An optional scanner software name to include in␣
↪deconfliction.
  --time <time>               : An optional time when the scan was run to include in the␣
↪deconfliction.
  --try                       : Type normalization will fail silently instead of raising␣
↪an exception.

Arguments:

  <form>                      : The target form.
  <value>                     : The target value.
  <signame>                   : The signature name.
```

gen.it.prod.soft

The `gen.it.prod.soft` command locates (lifts) or creates an `it:prod:soft` node based on the software name (`it:prod:soft:name` and / or `it:prod:soft:names`).

Syntax:

```
storm> gen.it.prod.soft --help

Lift (or create) an it:prod:soft node based on the software name.

Usage: gen.it.prod.soft [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:
```

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```
  <name>                        : The name of the software.
```

gen.lang.language

The gen.lang.language command locates (lifts) or creates a lang:language node based on the language name (lang:language:name and / or lang:language:names).

Syntax:

```
storm> gen.lang.language --help

Lift (or create) a lang:language node based on the name.

Usage: gen.lang.language [options] <name>

Options:

  --help                        : Display the command usage.

Arguments:

  <name>                        : The name of the language.
```

gen.ou.campaign

The gen.ou.campaign command locates (lifts) or creates an ou:campaign node based on the campaign name (ou:campaign:name and / or ou:campaign:names) and the name of the reporting organization (ou:campaign:reporter:name).

Syntax:

```
storm> gen.ou.campaign --help

Lift (or create) an ou:campaign based on the name and reporting organization.

Usage: gen.ou.campaign [options] <name> <reporter>

Options:

  --help                        : Display the command usage.

Arguments:

  <name>                        : The name of the campaign.
  <reporter>                    : The name of the reporting organization.
```

gen.ou.id.number

The gen.ou.id.number command locates (lifts) or creates an ou:id:number node based on the organization ID type (ou:id:type) and organization ID value (ou:id:value).

Syntax:

```
storm> gen.ou.id.number --help

Lift (or create) an ou:id:number node based on the organization ID type and value.

Usage: gen.ou.id.number [options] <type> <value>

Options:

  --help                      : Display the command usage.

Arguments:

  <type>                      : The type of the organization ID.
  <value>                     : The value of the organization ID.
```

gen.ou.id.type

The `gen.ou.id.type` command locates (lifts) or creates an `ou:id:type` node based on the friendly name of the organization ID type (`ou:id:type:name`).

Syntax:

```
storm> gen.ou.id.type --help

Lift (or create) an ou:id:type node based on the name of the type.

Usage: gen.ou.id.type [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The friendly name of the organization ID type.
```

gen.ou.industry

The `gen.ou.industry` commands locates (lifts) or creates an `ou:industry` node based on the industry name (`ou:industry:name` and / or `ou:industry:names`).

Syntax:

```
storm> gen.ou.industry --help


            Lift (or create) an ou:industry node based on the industry name.


Usage: gen.ou.industry [options] <name>

Options:

```

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```
  --help                      : Display the command usage.

Arguments:

  <name>                      : The industry name.
```

gen.ou.org

The `gen.ou.org` command locates (lifts) or creates an `ou:org` node based on the organization name (`ou:org:name` and / or `ou:org:names`).

Syntax:

```
storm> gen.ou.org --help

Lift (or create) an ou:org node based on the organization name.

Usage: gen.ou.org [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the organization.
```

gen.ou.org.hq

The `gen.ou.org.hq` command locates (lifts) the primary `ps:contact` node for an organization (i.e., the contact set for the `ou:org:hq` property) or creates the contact node (and sets the `ou:org:hq` property) if it does not exist, based on the organization name (`ou:org:name` and / or `ou:org:names`).

Syntax:

```
storm> gen.ou.org.hq --help

Lift (or create) the primary ps:contact node for the ou:org based on the organization␣
↪name.

Usage: gen.ou.org.hq [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the organization.
```

gen.pol.country

The gen.pol.country command locates (lifts) or creates a pol:country node based on the two-letter ISO-3166 country code (pol:country:iso2) .

Syntax:

```
storm> gen.pol.country --help


            Lift (or create) a pol:country node based on the 2 letter ISO-3166 country␣
↪code.

            Examples:

                // Yield the pol:country node which represents the country of Ukraine.
                gen.pol.country ua


Usage: gen.pol.country [options] <iso2>

Options:

  --help                     : Display the command usage.
  --try                      : Type normalization will fail silently instead of raising␣
↪an exception.

Arguments:

  <iso2>                     : The 2 letter ISO-3166 country code.
```

gen.pol.country.government

The gen.pol.country.government command locates (lifts) the ou:org node representing a country's government (i.e., the organization set for the pol:country:government property) or creates the node (and sets the pol:country:government property) if it does not exist, based on the two-letter ISO-3166 country code (pol:country:iso2).

Syntax:

```
storm> gen.pol.country.government --help


            Lift (or create) the ou:org node representing a country's government based␣
↪on the 2 letter ISO-3166 country code.

            Examples:

                // Yield the ou:org node which represents the Government of Ukraine.
                gen.pol.country.government ua


Usage: gen.pol.country.government [options] <iso2>
```

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```
Options:

  --help                      : Display the command usage.
  --try                       : Type normalization will fail silently instead of raising␣
↪an exception.

Arguments:

  <iso2>                      : The 2 letter ISO-3166 country code.
```

gen.ps.contact.email

The `gen.ps.contact.email` command locates (lifts) or creates a `ps:contact` node using the contact's primary email address (`ps:contact:email`) and type (`ps:contact:type`).

Syntax:

```
storm> gen.ps.contact.email --help


            Lift (or create) the ps:contact node by deconflicting the email and type.

            Examples:

                // Yield the ps:contact node for the type and email
                gen.ps.contact.email vertex.employee visi@vertex.link


Usage: gen.ps.contact.email [options] <type> <email>

Options:

  --help                      : Display the command usage.
  --try                       : Type normalization will fail silently instead of raising␣
↪an exception.

Arguments:

  <type>                      : The contact type.
  <email>                     : The contact email address.
```

gen.risk.threat

The `gen.risk.threat` command locates (lifts) or creates a `risk:threat` node using the name of the threat group (`risk:threat:org:name` and / or `risk:threat:org:names`) and the name of the entity reporting on the threat (`risk:threat:reporter:name`).

Syntax:

```
storm> gen.risk.threat --help


```

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```
            Lift (or create) a risk:threat node based on the threat name and reporter␣
↪name.

            Examples:

                // Yield a risk:threat node for the threat cluster "APT1" reported by
↪"Mandiant".
                gen.risk.threat apt1 mandiant


Usage: gen.risk.threat [options] <name> <reporter>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the threat cluster. For example: APT1
  <reporter>                  : The name of the reporting organization. For example:␣
↪Mandiant
```

gen.risk.tool.software

The `gen.risk.tool.software` command locates (lifts) or creates a `risk:tool:software` node using the name of the software / malware (`risk:tool:software:soft:name` and / or `risk:software:soft:names`) and the name of the entity reporting on the software / malware (`risk:tool:software:reporter:name`).

Syntax:

```
storm> gen.risk.tool.software --help


            Lift (or create) a risk:tool:software node based on the tool name and␣
↪reporter name.

            Examples:

                // Yield a risk:tool:software node for the "redtree" tool reported by
↪"vertex".
                gen.risk.tool.software redtree vertex


Usage: gen.risk.tool.software [options] <name> <reporter>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The tool name.
```

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```
  <reporter>                  : The name of the reporting organization. For example:
↪"recorded future"
```

gen.risk.vuln

The `gen.risk.vuln` command locates (lifts) or creates a `risk:tool:vuln` node using the Common Vulnerabilities and Exposures (CVE) number associated with the vulnerability (`risk:vuln:cve`) and the name of the entity reporting on the vulnerability (`risk:vuln:reporter:name`).

Syntax:

```
storm> gen.risk.vuln --help


            Lift (or create) a risk:vuln node based on the CVE and reporter name.

            Examples:

                // Yield a risk:vuln node for CVE-2012-0157 reported by Mandiant.
                gen.risk.vuln CVE-2012-0157 Mandiant


Usage: gen.risk.vuln [options] <cve> <reporter>

Options:

  --help                      : Display the command usage.
  --try                       : Type normalization will fail silently instead of raising␣
↪an exception.

Arguments:

  <cve>                       : The CVE identifier.
  [reporter]                  : The name of the reporting organization.
```

graph

The `graph` command generates a subgraph based on a specified set of nodes and parameters.

Syntax:

```
storm> graph --help


    Generate a subgraph from the given input nodes and command line options.

    Example:

        Using the graph command::

            inet:fqdn | graph
                        --degrees 2
                        --filter { -#nope }
```

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```
                        --pivot { <(seen)- meta:source }
                        --form-pivot inet:fqdn {<- * | limit 20}
                        --form-pivot inet:fqdn {-> * | limit 20}
                        --form-filter inet:fqdn {-inet:fqdn:issuffix=1}
                        --form-pivot syn:tag {-> *}
                        --form-pivot * {-> #}



Usage: graph [options]

Options:

  --help                      : Display the command usage.
  --degrees <degrees>         : How many degrees to graph out. (default: 1)
  --pivot <pivot>             : Specify a storm pivot for all nodes. (must quote)␣
↪(default: [])
  --filter <filter>           : Specify a storm filter for all nodes. (must quote)␣
↪(default: [])
  --no-edges                  : Do not include light weight edges in the per-node output.
  --form-pivot <form_pivot>   : Specify a <form> <pivot> form specific pivot. (default:␣
↪[])
  --form-filter <form_filter> : Specify a <form> <filter> form specific filter.␣
↪(default: [])
  --refs                      : Do automatic in-model pivoting with node.getNodeRefs().
  --yield-filtered            : Yield nodes which would be filtered. This still performs␣
↪pivots to collect edge
                                data,but does not yield pivoted nodes.
  --no-filter-input           : Do not drop input nodes if they would match a filter.
```

iden

The `iden` command lifts one or more nodes by their node identifier (node ID / iden).

Syntax:

```
storm> iden --help


    Lift nodes by iden.

    Example:

        iden b25bc9eec7e159dce879f9ec85fb791f83b505ac55b346fcb64c3c51e98d1175 | count


Usage: iden [options] <iden>

Options:

  --help                      : Display the command usage.
```

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```
Arguments:

  [<iden> ...]                : Iden to lift nodes by. May be specified multiple times.
```

Example:

- Lift the node with node ID 20153b758f9d5eaaa38e4f4a65c36da797c3e59e549620fa7c4895e1a920991f:

```
storm> iden 20153b758f9d5eaaa38e4f4a65c36da797c3e59e549620fa7c4895e1a920991f
inet:ipv4=1.2.3.4
        :type = unicast
        .created = 2025/07/03 18:38:36.102
```

intersect

The `intersect` command returns the intersection of the results from performing a pivot and/or traversal operation on multiple inbound nodes. In other words, `intersect` will return the subset of results that are **common** to each of the inbound nodes.

Syntax:

```
storm> intersect --help


    Yield an intersection of the results of running inbound nodes through a pivot.

    NOTE:
        This command must consume the entire inbound stream to produce the intersection.
        This type of stream consuming before yielding results can cause the query to␣
↪appear
        laggy in comparison with normal incremental stream operations.

    Examples:

        // Show the it:mitre:attack:technique nodes common to several groups

        it:mitre:attack:group*in=(G0006, G0007) | intersect { ->␣
↪it:mitre:attack:technique }


Usage: intersect [options] <query>

Options:

  --help                      : Display the command usage.

Arguments:

  <query>                     : The pivot query to run each inbound node through.
```

layer

Storm includes `layer.*` commands that allow you to work with layers (see *Layer*).

- *layer.add*
- *layer.set*
- *layer.get*
- *layer.list*
- *layer.del*
- *layer.pull.add*
- *layer.pull.list*
- *layer.pull.del*
- *layer.push.add*
- *layer.push.list*
- *layer.push.del*

Help for individual `layer.*` commands can be displayed using:

```
<command> --help
```

layer.add

The `layer.add` command adds a layer to the Cortex.

Syntax

```
storm> layer.add --help

Add a layer to the cortex.

Usage: layer.add [options]

Options:

  --help                      : Display the command usage.
  --lockmemory                : Should the layer lock memory for performance.
  --readonly                  : Should the layer be readonly.
  --mirror <mirror>           : A telepath URL of an upstream layer/view to mirror.
  --growsize <growsize>       : Amount to grow the map size when necessary.
  --upstream <upstream>       : One or more telepath urls to receive updates from.
  --name <name>               : The name of the layer.
```

layer.set

The `layer.set` command sets an option for the specified layer.

Syntax

```
storm> layer.set --help

Set a layer option.
```

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```
Usage: layer.set [options] <iden> <name> <valu>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Iden of the layer to modify.
  <name>                      : The name of the layer property to set.
  <valu>                      : The value to set the layer property to.
```

layer.get

The `layer.get` command retrieves the specified layer from a Cortex.

Syntax

```
storm> layer.get --help

Get a layer from the cortex.

Usage: layer.get [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  [iden]                      : Iden of the layer to get. If no iden is provided, the␣
↪main layer will be returned.
```

layer.list

The `layer.list` command lists the available layers in a Cortex.

Syntax

```
storm> layer.list --help

List the layers in the cortex.

Usage: layer.list [options]

Options:

  --help                      : Display the command usage.
```

layer.del

The `layer.del` command deletes a layer from a Cortex.

Syntax

```
storm> layer.del --help

Delete a layer from the cortex.

Usage: layer.del [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Iden of the layer to delete.
```

layer.pull.add

The `layer.pull.add` command adds a pull configuration to a layer.

Syntax

```
storm> layer.pull.add --help

Add a pull configuration to a layer.

Usage: layer.pull.add [options] <layr> <src>

Options:

  --help                      : Display the command usage.
  --offset <offset>           : Layer offset to begin pulling from (default: 0)

Arguments:

  <layr>                      : Iden of the layer to pull to.
  <src>                       : Telepath url of the source layer to pull from.
```

layer.pull.list

The `layer.pull.list` command lists the pull configurations for a layer.

Syntax

```
storm> layer.pull.list --help

Get a list of the pull configurations for a layer.

Usage: layer.pull.list [options] <layr>

Options:
```

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```
  --help                      : Display the command usage.

Arguments:

  <layr>                      : Iden of the layer to retrieve pull configurations for.
```

layer.pull.del

The `layer.pull.del` command deletes a pull configuration from a layer.

Syntax

```
storm> layer.pull.del --help

Delete a pull configuration from a layer.

Usage: layer.pull.del [options] <layr> <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <layr>                      : Iden of the layer to modify.
  <iden>                      : Iden of the pull configuration to delete.
```

layer.push.add

The `layer.push.add` command adds a push configuration to a layer.

Syntax

```
storm> layer.push.add --help

Add a push configuration to a layer.

Usage: layer.push.add [options] <layr> <dest>

Options:

  --help                      : Display the command usage.
  --offset <offset>           : Layer offset to begin pushing from. (default: 0)

Arguments:

  <layr>                      : Iden of the layer to push from.
  <dest>                      : Telepath url of the layer to push to.
```

layer.push.list

The `layer.push.list` command lists the push configurations for a layer.

Syntax

```
storm> layer.push.list --help

Get a list of the push configurations for a layer.

Usage: layer.push.list [options] <layr>

Options:

  --help                      : Display the command usage.

Arguments:

  <layr>                      : Iden of the layer to retrieve push configurations for.
```

layer.push.del

The `layer.push.del` command deletes a push configuration from a layer.

Syntax

```
storm> layer.push.del --help

Delete a push configuration from a layer.

Usage: layer.push.del [options] <layr> <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <layr>                      : Iden of the layer to modify.
  <iden>                      : Iden of the push configuration to delete.
```

lift

Storm includes `lift.*` commands that allow you to perform specialized lift operations.

- *lift.byverb*

Help for individual `lift.*` commands can be displayed using:

```
<command> --help
```

lift.byverb

The `lift.byverb` command lifts nodes that are connected by the specified lightweight (light) edge. By default, the command lifts the N1 nodes (i.e., the nodes on the left side of the directional light edge relationship: `n1 -(<verb>)> n2`)

> **Note**
>
> For other commands associated with light edges, see `edges.del` and `model.edge.*` under *edges* and *model* respectively.

Syntax:

```
storm> lift.byverb --help


    Lift nodes from the current view by an light edge verb.

    Examples:

        # Lift all the n1 nodes for the light edge "foo"
        lift.byverb "foo"

        # Lift all the n2 nodes for the light edge "foo"
        lift.byverb --n2 "foo"

    Notes:

        Only a single instance of a node will be yielded from this command
        when that node is lifted via the light edge membership.


Usage: lift.byverb [options] <verb>

Options:

  --help                     : Display the command usage.
  --n2                       : Lift by the N2 value instead of N1 value.

Arguments:

  <verb>                     : The edge verb to lift nodes by.
```

limit

The `limit` command restricts the number of nodes returned from a given Storm query to the specified number of nodes.

Syntax:

```
storm> limit --help


    Limit the number of nodes generated by the query in the given position.

    Example:

        inet:ipv4 | limit 10
```

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```
Usage: limit [options] <count>

Options:

  --help                      : Display the command usage.

Arguments:

  <count>                     : The maximum number of nodes to yield.
```

Example:

- Lift a single IP address that FireEye associates with the threat group APT1:

```
storm> inet:ipv4#aka.feye.thr.apt1 | limit 1
```

Usage Notes:

- If the limit number specified (i.e., `limit 100`) is greater than the total number of nodes returned from the Storm query, no limit will be applied to the resultant nodes (i.e., all nodes will be returned).
- By design, `limit` imposes an artificial limit on the nodes returned by a query, which may impair effective analysis of data by restricting results. As such, `limit` is most useful for viewing a subset of a large result set or an exemplar node for a given form.
- While `limit` returns a sampling of nodes, it is not statistically random for the purposes of population sampling for algorithmic use.

macro

> **Note**
>
> See the *Storm Reference - Automation* guide for additional background on macros (as well as triggers and cron jobs), including examples.

Storm includes `macro.*` commands that allow you to work with macros (see *Macro*).

- *macro.list*
- *macro.set*
- *macro.get*
- *macro.exec*
- *macro.del*

Help for individual `macro.*` commands can be displayed using:

```
<command> --help
```

macro.list

The `macro.list` command lists the macros in a Cortex.

Syntax:

```
storm> macro.list --help


List the macros set on the cortex.


Usage: macro.list [options]

Options:

  --help                      : Display the command usage.
```

macro.set

The `macro.set` command creates (or modifies) a macro in a Cortex.

Syntax:

```
storm> macro.set --help


Set a macro definition in the cortex.

Variables can also be used that are defined outside the definition.

Examples:
    macro.set foobar ${ [+#foo] }

    # Use variable from parent scope
    macro.set bam ${ [ inet:ipv4=$val ] }
    $val=1.2.3.4 macro.exec bam


Usage: macro.set [options] <name> <storm>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the macro to set.
  <storm>                     : The storm command string or embedded query to set.
```

macro.get

The `macro.get` command retrieves and displays the specified macro.

Syntax:

```
storm> macro.get --help


```

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```
Display the storm query for a macro in the cortex.


Usage: macro.get [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the macro to display.
```

macro.exec

The `macro.exec` command executes the specified macro.

Syntax:

```
storm> macro.exec --help


    Execute a named macro.

    Example:

        inet:ipv4#cno.threat.t80 | macro.exec enrich_foo



Usage: macro.exec [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the macro to execute
```

macro.del

The `macro.del` command deletes the specified macro from a Cortex.

Syntax:

```
storm> macro.del --help


Remove a macro definition from the cortex.


```

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```
Usage: macro.del [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the macro to delete.
```

max

The `max` command returns the node from a given set that contains the highest value for a specified secondary property, tag interval, or variable.

Syntax:

```
storm> max --help


    Consume nodes and yield only the one node with the highest value for an expression.

    Examples:

        // Yield the file:bytes node with the highest :size property
        file:bytes#foo.bar | max :size

        // Yield the file:bytes node with the highest value for $tick
        file:bytes#foo.bar +.seen ($tick, $tock) = .seen | max $tick

        // Yield the it:dev:str node with the longest length
        it:dev:str | max $lib.len($node.value())



Usage: max [options] <valu>

Options:

  --help                      : Display the command usage.

Arguments:

  <valu>                      : The property or variable to use for comparison.
```

Examples:

- Return the DNS A record for woot.com with the most recent `.seen` value:

```
storm> inet:dns:a:fqdn=woot.com | max .seen
inet:dns:a=('woot.com', '107.21.53.159')
        :fqdn = woot.com
        :ipv4 = 107.21.53.159
```

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```
        .created = 2025/07/03 18:38:36.170
        .seen = ('2014/08/13 00:00:00.000', '2014/08/14 00:00:00.000')
```

- Return the most recent WHOIS record for domain woot.com:

```
storm> inet:whois:rec:fqdn=woot.com | max :asof
inet:whois:rec=('woot.com', '2018/05/22 00:00:00.000')
        :asof = 2018/05/22 00:00:00.000
        :fqdn = woot.com
        :text = domain name: woot.com
        .created = 2025/07/03 18:38:36.196
```

merge

The `merge` command takes a subset of nodes from a forked view and merges them down to the next layer. The nodes can optionally be reviewed without actually merging them.

Contrast with *view.merge* for merging the entire contents of a forked view.

See the *view* and *layer* commands for working with views and layers.

Syntax:

```
storm> merge --help


    Merge edits from the incoming nodes down to the next layer.

    NOTE: This command requires the current view to be a fork.

    NOTE: The arguments for including/excluding tags can accept tag glob
          expressions for specifying tags. For more information on tag glob
          expressions, check the Synapse documentation for $node.globtags().

    NOTE: If --wipe is specified, and there are nodes that cannot be merged,
          they will be skipped (with a warning printed) and removed when
          the top layer is replaced. This should occur infrequently, for example,
          when a form is locked due to deprecation, a form no longer exists,
          or the data at rest fails normalization.

    Examples:

        // Having tagged a new #cno.mal.redtree subgraph in a forked view...

        #cno.mal.redtree | merge --apply

        // Print out what the merge command *would* do but dont.

        #cno.mal.redtree | merge

        // Merge any org nodes with changes in the top layer.

        diff | +ou:org | merge --apply
```

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```
        // Merge all tags other than cno.* from ou:org nodes with edits in the
        // top layer.

        diff | +ou:org | merge --only-tags --exclude-tags cno.** --apply

        // Merge only tags rep.vt.* and rep.whoxy.* from ou:org nodes with edits
        // in the top layer.

        diff | +ou:org | merge --include-tags rep.vt.* rep.whoxy.* --apply

        // Lift only inet:ipv4 nodes with a changed :asn property in top layer
        // and merge all changes.

        diff --prop inet:ipv4:asn | merge --apply

        // Lift only nodes with an added #cno.mal.redtree tag in the top layer and merge␣
↪them.

        diff --tag cno.mal.redtree | merge --apply


Usage: merge [options]

Options:

  --help                     : Display the command usage.
  --apply                    : Execute the merge changes.
  --wipe                     : Replace the top layer in the view with a fresh layer.
  --no-tags                  : Do not merge tags/tagprops or syn:tag nodes.
  --only-tags                : Only merge tags/tagprops or syn:tag nodes.
  --include-tags [<include_tags> ...]: Include specific tags/tagprops or syn:tag nodes␣
↪when merging, others are ignored. Tag
                               glob expressions may be used to specify the tags.␣
↪(default: [])
  --exclude-tags [<exclude_tags> ...]: Exclude specific tags/tagprops or syn:tag nodes␣
↪from merge.Tag glob expressions may be
                               used to specify the tags. (default: [])
  --include-props [<include_props> ...]: Include specific props when merging, others are␣
↪ignored. (default: [])
  --exclude-props [<exclude_props> ...]: Exclude specific props from merge. (default: [])
  --diff                     : Enumerate all changes in the current layer.
```

min

The `min` command returns the node from a given set that contains the lowest value for a specified secondary property, tag interval, or variable.

Syntax:

```
storm> min --help
```

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```
    Consume nodes and yield only the one node with the lowest value for an expression.

    Examples:

        // Yield the file:bytes node with the lowest :size property
        file:bytes#foo.bar | min :size

        // Yield the file:bytes node with the lowest value for $tick
        file:bytes#foo.bar +.seen ($tick, $tock) = .seen | min $tick

        // Yield the it:dev:str node with the shortest length
        it:dev:str | min $lib.len($node.value())



Usage: min [options] <valu>

Options:

  --help                      : Display the command usage.

Arguments:

  <valu>                      : The property or variable to use for comparison.
```

Examples:

- Return the DNS A record for woot.com with the oldest `.seen` value:

```
storm> inet:dns:a:fqdn=woot.com | min .seen
inet:dns:a=('woot.com', '75.101.146.4')
        :fqdn = woot.com
        :ipv4 = 75.101.146.4
        .created = 2025/07/03 18:38:36.173
        .seen = ('2013/09/21 00:00:00.000', '2013/09/22 00:00:00.000')
```

- Return the oldest WHOIS record for domain woot.com:

```
storm> inet:whois:rec:fqdn=woot.com | min :asof
inet:whois:rec=('woot.com', '2018/05/22 00:00:00.000')
        :asof = 2018/05/22 00:00:00.000
        :fqdn = woot.com
        :text = domain name: woot.com
        .created = 2025/07/03 18:38:36.196
```

model

Storm includes `model.*` commands that allow you to work with model elements.

`model.deprecated.*` commands allow you to view model elements (forms or properties) that have been marked as "deprecated", determine whether your Cortex contains deprecated nodes / nodes with deprecated properties, and optionally lock / unlock those properties to prevent (or allow) continued creation of deprecated model elements.

`model.edge.*` commands allow you to work with lightweight (light) edges. (See also the `edges.del` and `lift.byverb` commands under *edges* and *lift*, respectively.)

- *model.deprecated.check*
- *model.deprecated.lock*
- *model.deprecated.locks*
- *model.edge.list*
- *model.edge.set*
- *model.edge.get*
- *model.edge.del*

Help for individual `model.*` commands can be displayed using:

```
<command> --help
```

model.deprecated.check

The `model.deprecated.check` command lists deprecated elements, their lock status, and whether deprecated elements exist in the Cortex.

Syntax:

```
storm> model.deprecated.check --help

Check for lock status and the existence of deprecated model elements

Usage: model.deprecated.check [options]

Options:

  --help                      : Display the command usage.
```

model.deprecated.lock

The `model.deprecated.lock` command allows you to lock or unlock (e.g., disallow or allow the use of) deprecated model elements in a Cortex.

Syntax:

```
storm> model.deprecated.lock --help

Edit lock status of deprecated model elements.

Usage: model.deprecated.lock [options] <name>

Options:

  --help                      : Display the command usage.
  --unlock                    : Unlock rather than lock the deprecated property.

Arguments:

  <name>                      : The deprecated form or property name to lock or * to␣
↪lock all.
```

model.deprecated.locks

The `model.deprecated.locks` command displays the lock status of all deprecated model elements.

Syntax:

```
storm> model.deprecated.locks --help

Display lock status of deprecated model elements.

Usage: model.deprecated.locks [options]

Options:

  --help                      : Display the command usage.
```

model.edge.list

The `model.edge.list` command displays the set of light edges currently defined in the Cortex and any `doc` values set on them.

Syntax:

```
storm> model.edge.list --help

List all edge verbs in the current view and their doc key (if set).

Usage: model.edge.list [options]

Options:

  --help                      : Display the command usage.
```

model.edge.set

The `model.edge.set` command allows you to set the value of a given key on a light edge (such as a `doc` value to specify a definition for the light edge). The current list of valid keys include the following:

- `doc`

Syntax:

```
storm> model.edge.set --help

Set a key-value for an edge verb that exists in the current view.

Usage: model.edge.set [options] <verb> <key> <valu>

Options:

  --help                      : Display the command usage.

Arguments:

  <verb>                      : The edge verb to add a key to.
```

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```
  <key>                         : The key name (e.g. doc).
  <valu>                        : The string value to set.
```

model.edge.get

The `model.edge.get` command allows you to retrieve all of the keys that have been set on a light edge.

Syntax:

```
storm> model.edge.get --help

Retrieve key-value pairs for an edge verb in the current view.

Usage: model.edge.get [options] <verb>

Options:

  --help                        : Display the command usage.

Arguments:

  <verb>                        : The edge verb to retrieve.
```

model.edge.del

The `model.edge.del` command allows you to delete the key from a light edge (such as a `doc` property to specify a definition for the light edge). Deleting a key from a specific light edge does not delete the key from Synapse (e.g., the property can be re-added to the light edge or to other light edges).

Syntax:

```
storm> model.edge.del --help

Delete a global key-value pair for an edge verb in the current view.

Usage: model.edge.del [options] <verb> <key>

Options:

  --help                        : Display the command usage.

Arguments:

  <verb>                        : The edge verb to delete documentation for.
  <key>                         : The key name (e.g. doc).
```

movenodes

The `movenodes` command allows you to move nodes between layers (*Layer*) in a Cortex.

The command will move the specified storage nodes (see *Node, Storage*) - "sodes" for short - to the target layer. If a sode is the "left hand" (`n1`) of two nodes joined by a light edge (`n1 -(*)> n2`), then the edge is also moved.

Sodes are fully removed from the source layer(s) and added to (or merged with existing nodes in) the target layer. The history of the node (i.e., changes to the node, timestamps, associated user) in the **source** layer is preserved; the changes written to the **target** layer are owned by the user executing the `movenodes` command.

By default (i.e., if you do not specify a source and / or target layer), `movenodes` will migrate sodes from the bottom layer in the view, through each intervening layer (if any), and finally into the top layer. If you explicitly specify a source and target layer, `movenodes` migrates the sodes **directly** from the source to the target, skipping any intervening layers (if any).

Similarly, by default as the node is moved "up", any data for that node (property values, tags) in the higher layer will take precedence over (overwrite) data from a lower layer. This precedence behavior can be modified with the appropriate command switch.

The `movenodes` command is intended for use in the same layer stack. See the *copyto* command to copy nodes from a view to the write layer in a specified target view.

Note

The *merge* command specifically moves (merges) nodes from the top layer in a *View* to the underlying layer. Merging is a common **user action** performed in a standard "fork and merge" workflow. The `merge` command should be used to move/merge nodes **down** from a higher layer/view to a lower/underlying one.

The `movenodes` command allows you to move nodes between arbitrary layers and is meant to be used by Synapse **administrators** in very specific use cases (e.g., data that was accidentally merged into a lower layer that should not be there). It can be used to move nodes "up" from a lower layer to a higher one.

Syntax:

```
storm> movenodes --help


    Move storage nodes between layers.

    Storage nodes will be removed from the source layers and the resulting
    storage node in the destination layer will contain the merged values (merged
    in bottom up layer order by default).

    Examples:

        // Move storage nodes for ou:org nodes to the top layer

        ou:org | movenodes --apply

        // Print out what the movenodes command *would* do but dont.

        ou:org | movenodes

        // In a view with many layers, only move storage nodes from the bottom layer
        // to the top layer.

        $layers = $lib.view.get().layers
        $top = $layers.0.iden
        $bot = $layers."-1".iden
```

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```
        ou:org | movenodes --srclayers $bot --destlayer $top

        // In a view with many layers, move storage nodes to the top layer and
        // prioritize values from the bottom layer over the other layers.

        $layers = $lib.view.get().layers
        $top = $layers.0.iden
        $mid = $layers.1.iden
        $bot = $layers.2.iden

        ou:org | movenodes --precedence $bot $top $mid


Usage: movenodes [options]

Options:

  --help                      : Display the command usage.
  --apply                     : Execute the move changes.
  --srclayers [<srclayers> ...]: Specify layers to move storage nodes from (defaults to␣
↪all below the top layer)
                                (default: None)
  --destlayer <destlayer>     : Layer to move storage nodes to (defaults to the top␣
↪layer) (default: None)
  --precedence [<precedence> ...]: Layer precedence for resolving conflicts (defaults to␣
↪bottom up) (default: None)
```

movetag

The `movetag` command moves a Synapse tag and its associated tag tree from one location in a tag hierarchy to another location. It is equivalent to "renaming" a given tag and all of its subtags. Moving a tag consists of:

- Creating the new `syn:tag` node(s).
- Copying the definitions (`:title` and `:doc` properties) from the old `syn:tag` node to the new `syn:tag` node.
- Applying the new tag(s) to the nodes with the old tag(s).
  - If the old tag(s) have associated timestamps / time intervals, they will be applied to the new tag(s).
- Deleting the old tag(s) from the nodes.
- Setting the `:isnow` property of the old `syn:tag` node(s) to reference the new `syn:tag` node.
  - The old `syn:tag` nodes are **not** deleted.
  - Once the `:isnow` property is set, attempts to apply the old tag will automatically result in the new tag being applied.

See also the *tag* command.

Syntax:

```
storm> movetag --help


    Rename an entire tag tree and preserve time intervals.
```

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```
    Example:

        movetag foo.bar baz.faz.bar


Usage: movetag [options] <oldtag> <newtag>

Options:

  --help                      : Display the command usage.

Arguments:

  <oldtag>                    : The tag tree to rename.
  <newtag>                    : The new tag tree name.
```

Examples:

- Move the tag named #research to #internal.research:

```
storm> movetag research internal.research
moved tags on 1 nodes.
```

- Move the tag tree #aka.fireeye.malware to #rep.feye.mal:

```
storm> movetag aka.fireeye.malware rep.feye.mal
moved tags on 1 nodes.
```

Usage Notes:

> **Warning**
>
> `movetag` should be used with caution as when used incorrectly it can result in "deleted" (inadvertently moved / removed) or orphaned (inadvertently retained) tags. For example, in the second example query above, all `aka.fireeye.malware` tags are renamed `rep.feye.mal`, but the tag `aka.fireeye` still exists and is still applied to all of the original nodes. In other words, the result of the above command will be that nodes previously tagged `aka.fireeye.malware` will now be tagged both `rep.feye.mal` **and** `aka.fireeye`. Users may wish to test the command on sample data first to understand its effects before applying it in a production Cortex.

nodes

Storm includes `nodes.*` commands that allow you to work with nodes and `.nodes` files.

- *nodes.import*

Help for individual `nodes.*` commands can be displayed using:

```
<command> --help
```

nodes.import

The `nodes.import` command will import a Synapse `.nodes` file (i.e., a file containing a set / subgraph of nodes, light edges, and / or tags exported from a Cortex) from a specified URL.

Syntax:

```
storm> nodes.import --help

Import a nodes file hosted at a URL into the cortex. Yields created nodes.

Usage: nodes.import [options] <urls>

Options:

  --help                      : Display the command usage.
  --no-ssl-verify             : Ignore SSL certificate validation errors.

Arguments:

  [<urls> ...]                : URL(s) to fetch nodes file from
```

note

Storm includes `note.*` commands that allow you to work with free form text notes (`meta:note` nodes).

- *note.add*

Help for individual `note.*` commands can be displayed using:

```
<command> --help
```

note.add

The `note.add` command will create a `meta:note` node containing the specified text and link it to the inbound node(s) via an `-(about)>` light edge (i.e., `meta:note=<guid> -(about)> <node(s)>`).

Syntax:

```
storm> note.add --help

Add a new meta:note node and link it to the inbound nodes using an -(about)> edge.

Usage: note.add [options] <text>

Options:

  --help                      : Display the command usage.
  --type <type>               : The note type.
  --yield                     : Yield the newly created meta:note node.

Arguments:

  <text>                      : The note text to add to the nodes.
```

Usage Notes:

> **Note**
>
> Synapse's data and analytical models are meant to represent a broad range of data and information in a structured (and therefore **queryable**) way. As free form notes are counter to this structured approach, we recommend using `meta:note` nodes as an exception rather than a regular practice.

once

The `once` command is used to ensure a given node is processed by the associated Storm command only once, even if the same command is executed in a different, independent Storm query. The `once` command uses *Node Data* to keep track of the associated Storm command's execution, so `once` is specific to the *View* in which it is executed. You can override the single-execution feature of `once` with the `--asof` parameter.

Syntax:

```
storm> once --help


    The once command is used to filter out nodes which have already been processed
    via the use of a named key. It includes an optional parameter to allow the node
    to pass the filter again after a given amount of time.

    For example, to run an enrichment command on a set of nodes just once:

        file:bytes#my.files | once enrich:foo | enrich.foo

    The once command filters out any nodes which have previously been through any other
    use of the "once" command using the same <name> (in this case "enrich:foo").

    You may also specify the --asof option to allow nodes to pass the filter after a␣
↪given
    amount of time. For example, the following command will allow any given node through
    every 2 days:

        file:bytes#my.files | once enrich:foo --asof "-2 days" | enrich.foo

    Use of "--asof now" or any future date or positive relative time offset will always
    allow the node to pass the filter.

    State tracking data for the once command is stored as nodedata which is stored in␣
↪your
    view's write layer, making it view-specific. So if you have two views, A and B, and␣
↪they
    do not share any layers between them, and you execute this query in view A:

        inet:ipv4=8.8.8.8 | once enrich:address | enrich.baz

    And then you run it in view B, the node will still pass through the once command to␣
↪the
    enrich.baz portion of the query because the tracking data for the once command does␣
↪not
    yet exist in view B.
```

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```
Usage: once [options] <name>

Options:

  --help                      : Display the command usage.
  --asof <asof>               : The associated time the name was updated/performed.␣
↪(default: None)

Arguments:

  <name>                      : Name of the action to only perform once.
```

parallel

The Storm `parallel` command allows you to execute a Storm query using a specified number of query pipelines. This can improve performance for some queries.

See also *background*.

Syntax:

```
storm> parallel --help


    Execute part of a query pipeline in parallel.
    This can be useful to minimize round-trip delay during enrichments.

    Examples:
        inet:ipv4#foo | parallel { $place = $lib.import(foobar).lookup(:latlong) [␣
↪:place=$place ] }

    NOTE: Storm variables set within the parallel query pipelines do not interact.

    NOTE: If there are inbound nodes to the parallel command, parallel pipelines will be␣
↪created as each node
          is processed, up to the number specified by --size. If the number of nodes in␣
↪the pipeline is less
          than the value specified by --size, additional pipelines with no inbound node␣
↪will not be created.
          If there are no inbound nodes to the parallel command, the number of pipelines␣
↪specified by --size
          will always be created.


Usage: parallel [options] <query>

Options:

  --help                      : Display the command usage.
  --size <size>               : The number of parallel Storm pipelines to execute.␣
↪(default: 8)
```

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```
Arguments:

  <query>                       : The query to execute in parallel.
```

pkg

Storm includes `pkg.*` commands that allow you to work with Storm packages (see *Package*).

- *pkg.list*
- *pkg.load*
- *pkg.del*
- *pkg.docs*
- *pkg.perms.list*

Help for individual `pkg.*` commands can be displayed using:

```
<command> --help
```

Packages typically contain Storm commands and Storm library code used to implement a Storm *Service*.

pkg.list

The `pkg.list` command lists each Storm package loaded in the Cortex. Output is displayed in tabular form and includes the package name and version information.

Syntax:

```
storm> pkg.list --help

List the storm packages loaded in the cortex.

Usage: pkg.list [options]

Options:

  --help                        : Display the command usage.
  --verbose                     : Display build time for each package.
```

pkg.load

The `pgk.load` command loads the specified package into the Cortex.

Syntax:

```
storm> pkg.load --help

Load a storm package from an HTTP URL.

Usage: pkg.load [options] <url>

Options:

  --help                        : Display the command usage.
```

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```
  --raw                         : Response JSON is a raw package definition without an␣
↪envelope.
  --verify                      : Enforce code signature verification on the storm package.
  --ssl-noverify                : Specify to disable SSL verification of the server.

Arguments:

  <url>                         : The HTTP URL to load the package from.
```

pkg.del

The `pkg.del` command removes a Storm package from the Cortex.

Syntax:

```
storm> pkg.del --help

Remove a storm package from the cortex.

Usage: pkg.del [options] <name>

Options:

  --help                        : Display the command usage.

Arguments:

  <name>                        : The name (or name prefix) of the package to remove.
```

pkg.docs

The `pkg.docs` command displays the documentation for a Storm package.

Syntax:

```
storm> pkg.docs --help

Display documentation included in a storm package.

Usage: pkg.docs [options] <name>

Options:

  --help                        : Display the command usage.

Arguments:

  <name>                        : The name (or name prefix) of the package.
```

pkg.perms.list

The `pkg.perms.list` command lists the permissions declared by a Storm package.

Syntax:

```
storm> pkg.perms.list --help

List any permissions declared by the package.

Usage: pkg.perms.list [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name (or name prefix) of the package.
```

ps

Storm includes `ps.*` commands that allow you to work with Storm tasks/queries.

- *ps.list*
- *ps.kill*

Help for individual `ps.*` commands can be displayed using:

```
<command> --help
```

ps.list

The `ps.list` command lists the currently executing tasks/queries. By default, the command displays the first 120 characters of the executing query. The `--verbose` option can be used to display the full query regardless of length.

Syntax:

```
storm> ps.list --help

List running tasks in the cortex.

Usage: ps.list [options]

Options:

  --help                      : Display the command usage.
  --verbose                   : Enable verbose output.
```

ps.kill

The `ps.kill` command can be used to terminate an executing task/query. The command requires the *Iden* of the task to be terminated, which can be obtained with *ps.list*.

Syntax:

```
storm> ps.kill --help

Kill a running task/query within the cortex.

Usage: ps.kill [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid process iden␣
↪is accepted.
```

queue

Storm includes `queue.*` commands that allow you to work with queues (see *Queue*).

- *queue.add*
- *queue.list*
- *queue.del*

Help for individual `queue.*` commands can be displayed using:

```
<command> --help
```

queue.add

The `queue.add` command adds a queue to the Cortex.

Syntax:

```
storm> queue.add --help

Add a queue to the cortex.

Usage: queue.add [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the new queue.
```

queue.list

The `queue.list` command lists each queue in the Cortex.

Syntax:

```
storm> queue.list --help

List the queues in the cortex.

Usage: queue.list [options]

Options:

  --help                      : Display the command usage.
```

queue.del

The `queue.del` command removes a queue from the Cortex.

Syntax:

```
storm> queue.del --help

Remove a queue from the cortex.

Usage: queue.del [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the queue to remove.
```

reindex

The `reindex` command is currently reserved for future use.

The intended purpose of this administrative command is to reindex a given node property. This may be necessary as part of a manual data migration.

> **Note**
>
> Any changes to the Synapse data model are noted in the changelog for the relevant Synapse release. Changes that require data migration are specifically noted and the data migration is typically performed automatically when deploying the new version. See the *Data Migration* section of the *Synapse Devops Guide* for additional detail.

Syntax:

```
storm> reindex --help


    Use admin privileges to re index/normalize node properties.

    NOTE: Currently does nothing but is reserved for future use.
```

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```
Usage: reindex [options]

Options:

  --help                      : Display the command usage.
```

runas

The `runas` command allows you to execute a Storm query as a specified user.

> **Note**
>
> The `runas` commmand requires **admin** permisisons.

Syntax:

```
storm> runas --help


    Execute a storm query as a specified user.

    NOTE: This command requires admin privileges.

    NOTE: Heavy objects (for example a View or Layer) are bound to the context which they
          are instantiated in and methods on them will be run using the user in that
          context. This means that executing a method on a variable containing a heavy
          object which was instantiated outside of the runas command and then used
          within the runas command will check the permissions of the outer user, not
          the one specified by the runas command.

    Examples:

        // Create a node as another user.
        runas someuser { [ inet:fqdn=foo.com ] }


Usage: runas [options] <user> <storm>

Options:

  --help                      : Display the command usage.
  --asroot                    : Propagate asroot to query subruntime.

Arguments:

  <user>                      : The user name or iden to execute the storm query as.
  <storm>                     : The storm query to execute.
```

scrape

The `scrape` command parses one or more secondary properties of the inbound node(s) and attempts to identify ("scrape") common forms from the content, creating the nodes if they do not already exist. This is useful (for example) for extracting forms such as email addresses, domains, URLs, hashes, etc. from unstructured text.

The `--refs` switch can be used to optionally link the source nodes(s) to the scraped forms via `refs` light edges.

By default, the `scrape` command will return the nodes that it received as input. The `--yield` option can be used to return the scraped nodes rather than the input nodes.

Syntax:

```
storm> scrape --help


    Use textual properties of existing nodes to find other easily recognizable nodes.

    Examples:

        # Scrape properties from inbound nodes and create standalone nodes.
        inet:search:query | scrape

        # Scrape properties from inbound nodes and make refs light edges to the scraped␣
↪nodes.
        inet:search:query | scrape --refs

        # Scrape only the :engine and :text props from the inbound nodes.
        inet:search:query | scrape :text :engine

        # Scrape the primary property from the inbound nodes.
        it:dev:str | scrape $node.repr()

        # Scrape properties inbound nodes and yield newly scraped nodes.
        inet:search:query | scrape --yield

        # Skip re-fanging text before scraping.
        inet:search:query | scrape --skiprefang

        # Limit scrape to specific forms.
        inet:search:query | scrape --forms (inet:fqdn, inet:ipv4)


Usage: scrape [options] <values>

Options:

  --help                     : Display the command usage.
  --refs                     : Create refs light edges to any scraped nodes from the␣
↪input node
  --yield                    : Include newly scraped nodes in the output
  --skiprefang               : Do not remove de-fanging from text before scraping
  --forms <forms>            : Only scrape values which match specific forms. (default:␣
↪[])
```

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```
Arguments:

  [<values> ...]              : Specific relative properties or variables to scrape
```

Example:

- Scrape the text of WHOIS records for the domain `woot.com` and create nodes for common forms found in the text:

```
storm> inet:whois:rec:fqdn=woot.com | scrape :text
inet:whois:rec=('woot.com', '2018/05/22 00:00:00.000')
        :asof = 2018/05/22 00:00:00.000
        :fqdn = woot.com
        :text = domain name: woot.com
        .created = 2025/07/03 18:38:36.196
```

Usage Notes:

- If no properties to scrape are specified, `scrape` will attempt to scrape **all** properties of the inbound nodes by default.
- `scrape` will only scrape node **properties**; it will not scrape files (this includes files that may be referenced by properties, such as `media:news:file`). In other words, `scrape` cannot be used to parse indicators from a file such as a PDF.
- `scrape` extracts the following forms / indicators (note that this list may change as the command is updated):
  - FQDNs
  - IPv4s
  - Servers (IPv4 / port combinations)
  - Hashes (MD5, SHA1, SHA256)
  - URLs
  - Email addresses
  - Cryptocurrency addresses
- `scrape` is able to recognize and account for common "defanging" techniques (such as `evildomain[.]com`, `myemail[@]somedomain.net`, or `hxxp://badwebsite.org/`), and will scrape "defanged" indicators by default. Use the `--skiprefang` switch to ignore defanged indicators.

service

Storm includes `service.*` commands that allow you to work with Storm services (see *Service*).

- *service.add*
- *service.list*
- *service.del*

Help for individual `service.*` commands can be displayed using:

```
<command> --help
```

service.add

The `service.add` command adds a Storm service to the Cortex.

Syntax:

```
storm> service.add --help

Add a storm service to the cortex.

Usage: service.add [options] <name> <url>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The name of the service.
  <url>                       : The telepath URL for the remote service.
```

service.list

The `service.list` command lists each Storm service in the Cortex.

Syntax:

```
storm> service.list --help

List the storm services configured in the cortex.

Usage: service.list [options]

Options:

  --help                      : Display the command usage.
```

service.del

The `service.del` command removes a Storm service from the Cortex.

Syntax:

```
storm> service.del --help

Remove a storm service from the cortex.

Usage: service.del [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:
```

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```
  <iden>                        : The service identifier or prefix.
```

sleep

The `sleep` command adds a delay in returning each result for a given Storm query. By default, query results are streamed back and displayed as soon as they arrive for optimal performance. A `sleep` delay effectively slows the display of results.

Syntax:

```
storm> sleep --help


    Introduce a delay between returning each result for the storm query.

    NOTE: This is mostly used for testing / debugging.

    Example:

        #foo.bar | sleep 0.5



Usage: sleep [options] <delay>

Options:

  --help                        : Display the command usage.

Arguments:

  <delay>                       : Delay in floating point seconds.
```

Example:

- Retrieve email nodes from a Cortex every second:

```
storm> inet:email | sleep 1.0
inet:email=bar@gmail.com
        :fqdn = gmail.com
        :user = bar
        .created = 2025/07/03 18:38:36.286
inet:email=baz@gmail.com
        :fqdn = gmail.com
        :user = baz
        .created = 2025/07/03 18:38:36.286
inet:email=foo@gmail.com
        :fqdn = gmail.com
        :user = foo
        .created = 2025/07/03 18:38:36.284
```

spin

The `spin` command is used to suppress the output of a Storm query. `Spin` simply consumes all nodes sent to the command, so no nodes are output to the CLI. This allows you to execute a Storm query and view messages and results without displaying the associated nodes.

Syntax:

```
storm> spin --help


    Iterate through all query results, but do not yield any.
    This can be used to operate on many nodes without returning any.

    Example:

        foo:bar:size=20 [ +#hehe ] | spin



Usage: spin [options]

Options:

  --help                      : Display the command usage.
```

Example:

- Add the tag #int.research to any domain containing the string "firefox" but do not display the nodes.

```
storm> inet:fqdn~=firefox [+#int.research] | spin
```

stats

Storm includes `stats.*` commands that allow you to query and work with statistics.

- *stats.countby*

Help for individual `stats.*` commands can be displayed using:

```
<command> --help
```

stats.countby

The `stats.countby` command allows you to query and display a bar chart of tallied data in the Storm CLI.

Syntax:

```
storm> stats.countby --help


    Tally occurrences of values and display a bar chart of the results.

    Examples:

        // Show counts of geo:name values referenced by media:news nodes.
        media:news -(refs)> geo:name | stats.countby
```

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```
        // Show counts of ASN values in a set of IPs.
        inet:ipv4#myips | stats.countby :asn

        // Show counts of attacker names for risk:compromise nodes.
        risk:compromise | stats.countby :attacker::name


Usage: stats.countby [options] <valu>

Options:

  --help                      : Display the command usage.
  --reverse                   : Display results in ascending instead of descending order.
  --size <size>               : Maximum number of bars to display. (default: None)
  --char <char>               : Character to use for bars. (default: #)
  --bar-width <bar_width>     : Width of the bars to display. (default: 50)
  --label-max-width <label_max_width>: Maximum width of the labels to display. (default:␣
↪None)
  --yield                     : Yield inbound nodes.
  --by-name                   : Print stats sorted by name instead of count.

Arguments:

  [valu]                      : A relative property or variable to tally.
```

tag

Storm includes `tag.*` commands that allow you to work with tags (see *Tag*).

- *tag.prune*

Help for individual `tag.*` commands can be displayed using:

```
<command> --help
```

See also the related *movetag* command.

tag.prune

The `tag.prune` command will delete the tags from incoming nodes, as well as all of their parent tags that don't have other tags as children.

Syntax:

```
storm> tag.prune --help


    Prune a tag (or tags) from nodes.

    This command will delete the tags specified as parameters from incoming nodes,
    as well as all of their parent tags that don't have other tags as children.

    For example, given a node with the tags:
```

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```
        #parent
        #parent.child
        #parent.child.grandchild

    Pruning the parent.child.grandchild tag would remove all tags. If the node had
    the tags:

        #parent
        #parent.child
        #parent.child.step
        #parent.child.grandchild

    Pruning the parent.child.grandchild tag will only remove the parent.child.grandchild
    tag as the parent tags still have other children.

    Examples:

        # Prune the parent.child.grandchild tag
        inet:ipv4=1.2.3.4 | tag.prune parent.child.grandchild


Usage: tag.prune [options] <tags>

Options:

  --help                      : Display the command usage.

Arguments:

  [<tags> ...]                : Names of tags to prune.
```

tee

The `tee` command executes multiple Storm queries on the inbound nodes and returns the combined result set.

Syntax:

```
storm> tee --help


    Execute multiple Storm queries on each node in the input stream, joining output␣
↪streams together.

    Commands are executed in order they are given; unless the ``--parallel`` switch is␣
↪provided.

    Examples:

        # Perform a pivot out and pivot in on a inet:ivp4 node
        inet:ipv4=1.2.3.4 | tee { -> * } { <- * }
```

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```
        # Also emit the inbound node
        inet:ipv4=1.2.3.4 | tee --join { -> * } { <- * }

        # Execute multiple enrichment queries in parallel.
        inet:ipv4=1.2.3.4 | tee -p { enrich.foo } { enrich.bar } { enrich.baz }



Usage: tee [options] <query>

Options:

  --help                      : Display the command usage.
  --join                      : Emit inbound nodes after processing storm queries.
  --parallel                  : Run the storm queries in parallel instead of sequence.␣
↪The node output order is not
                                guaranteed.

Arguments:

  [<query> ...]               : Specify a query to execute on the input nodes.
```

Examples:

- Return the set of domains and IP addresses associated with a set of DNS A records.

```
storm> inet:fqdn:zone=mydomain.com -> inet:dns:a | tee { -> inet:fqdn } { -> inet:ipv4 }
inet:fqdn=baz.mydomain.com
        :domain = mydomain.com
        :host = baz
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:39.320
inet:ipv4=127.0.0.2
        :type = loopback
        .created = 2025/07/03 18:38:39.320
inet:fqdn=foo.mydomain.com
        :domain = mydomain.com
        :host = foo
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:39.316
inet:ipv4=8.8.8.8
        :type = unicast
        .created = 2025/07/03 18:38:39.316
inet:fqdn=bar.mydomain.com
        :domain = mydomain.com
        :host = bar
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
```

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```
        .created = 2025/07/03 18:38:39.318
inet:ipv4=34.56.78.90
        :type = unicast
        .created = 2025/07/03 18:38:39.318
```

- Return the set of domains and IP addresses associated with a set of DNS A records along with the original DNS A records.

```
storm> inet:fqdn:zone=mydomain.com -> inet:dns:a | tee --join { -> inet:fqdn } { ->␣
↪inet:ipv4 }
inet:fqdn=baz.mydomain.com
        :domain = mydomain.com
        :host = baz
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:39.320
inet:ipv4=127.0.0.2
        :type = loopback
        .created = 2025/07/03 18:38:39.320
inet:dns:a=('baz.mydomain.com', '127.0.0.2')
        :fqdn = baz.mydomain.com
        :ipv4 = 127.0.0.2
        .created = 2025/07/03 18:38:39.320
inet:fqdn=foo.mydomain.com
        :domain = mydomain.com
        :host = foo
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:39.316
inet:ipv4=8.8.8.8
        :type = unicast
        .created = 2025/07/03 18:38:39.316
inet:dns:a=('foo.mydomain.com', '8.8.8.8')
        :fqdn = foo.mydomain.com
        :ipv4 = 8.8.8.8
        .created = 2025/07/03 18:38:39.316
inet:fqdn=bar.mydomain.com
        :domain = mydomain.com
        :host = bar
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:39.318
inet:ipv4=34.56.78.90
        :type = unicast
        .created = 2025/07/03 18:38:39.318
inet:dns:a=('bar.mydomain.com', '34.56.78.90')
        :fqdn = bar.mydomain.com
        :ipv4 = 34.56.78.90
        .created = 2025/07/03 18:38:39.318
```

Usage Notes:

- `tee` can take an arbitrary number of Storm queries (i.e., 1 to n queries) as arguments.

tree

The `tree` command recursively performs the specified pivot until no additional nodes are returned.

Syntax:

```
storm> tree --help


    Walk elements of a tree using a recursive pivot.

    Examples:

        # pivot upward yielding each FQDN
        inet:fqdn=www.vertex.link | tree { :domain -> inet:fqdn }


Usage: tree [options] <query>

Options:

  --help                      : Display the command usage.

Arguments:

  <query>                     : The pivot query
```

Example:

- List the full set of tags in the "TTP" tag hierarchy.

```
storm> syn:tag=ttp | tree { $node.value() -> syn:tag:up }
syn:tag=ttp
        :base = ttp
        :depth = 0
        .created = 2025/07/03 18:38:39.345
syn:tag=ttp.phish
        :base = phish
        :depth = 1
        :up = ttp
        .created = 2025/07/03 18:38:39.347
syn:tag=ttp.phish.payload
        :base = payload
        :depth = 2
        :up = ttp.phish
        .created = 2025/07/03 18:38:39.347
syn:tag=ttp.opsec
        :base = opsec
        :depth = 1
        :up = ttp
        .created = 2025/07/03 18:38:39.345
```

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```
syn:tag=ttp.opsec.anon
        :base = anon
        :depth = 2
        :up = ttp.opsec
        .created = 2025/07/03 18:38:39.345
syn:tag=ttp.se
        :base = se
        :depth = 1
        :up = ttp
        .created = 2025/07/03 18:38:39.346
syn:tag=ttp.se.masq
        :base = masq
        :depth = 2
        :up = ttp.se
        .created = 2025/07/03 18:38:39.346
```

Usage Notes:

- `tree` is useful for "walking" a set of properties with a single command vs. performing an arbitrary number of pivots until the end of the data is reached.

trigger

Note

See the *Storm Reference - Automation* guide for additional background on triggers (as well as cron jobs and macros), including examples.

Storm includes `trigger.*` commands that allow you to create automated event-driven triggers (see *Trigger*) using the Storm query syntax.

- *trigger.add*
- *trigger.list*
- *trigger.mod*
- *trigger.disable*
- *trigger.enable*
- *trigger.del*

Help for individual `trigger.*` commands can be displayed using:

```
<command> --help
```

Triggers are added to the Cortex as **runtime nodes** ("runt nodes" - see *Node, Runt*) of the form `syn:trigger`. These runt nodes can be lifted and filtered just like standard nodes in Synapse.

trigger.add

The `trigger.add` command adds a trigger to a Cortex.

Syntax:

```
storm> trigger.add --help


Add a trigger to the cortex.

Notes:
    Valid values for condition are:
        * tag:add
        * tag:del
        * node:add
        * node:del
        * prop:set
        * edge:add
        * edge:del

When condition is tag:add or tag:del, you may optionally provide a form name
to restrict the trigger to fire only on tags added or deleted from nodes of
those forms.

The added tag is provided to the query in the ``$auto`` dictionary variable under
``$auto.opts.tag``. Usage of the ``$tag`` variable is deprecated and it will no longer
be populated in Synapse v3.0.0.

Simple one level tag globbing is supported, only at the end after a period,
that is aka.* matches aka.foo and aka.bar but not aka.foo.bar. aka* is not
supported.

When the condition is edge:add or edge:del, you may optionally provide a
form name or a destination form name to only fire on edges added or deleted
from nodes of those forms.

Examples:
    # Adds a tag to every inet:ipv4 added
    trigger.add node:add --form inet:ipv4 --query {[ +#mytag ]}

    # Adds a tag #todo to every node as it is tagged #aka
    trigger.add tag:add --tag aka --query {[ +#todo ]}

    # Adds a tag #todo to every inet:ipv4 as it is tagged #aka
    trigger.add tag:add --form inet:ipv4 --tag aka --query {[ +#todo ]}

    # Adds a tag #todo to the N1 node of every refs edge add
    trigger.add edge:add --verb refs --query {[ +#todo ]}

    # Adds a tag #todo to the N1 node of every seen edge delete, provided that
    # both nodes are of form file:bytes
    trigger.add edge:del --verb seen --form file:bytes --n2form file:bytes --query {[ +
↪#todo ]}


Usage: trigger.add [options] <condition>

Options:
```

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```
  --help                      : Display the command usage.
  --form <form>               : Form to fire on.
  --tag <tag>                 : Tag to fire on.
  --prop <prop>               : Property to fire on.
  --verb <verb>               : Edge verb to fire on.
  --n2form <n2form>           : The form of the n2 node to fire on.
  --query <storm>             : Query for the trigger to execute.
  --async                     : Make the trigger run in the background.
  --disabled                  : Create the trigger in disabled state.
  --name <name>               : Human friendly name of the trigger.
  --view <view>               : The view to add the trigger to.

Arguments:

  <condition>                 : Condition for the trigger.
```

trigger.list

The `trigger-list` command displays the set of triggers in the Cortex that the current user can view / modify based on their permissions. Triggers are displayed at the Storm CLI in tabular format, with columns including the user who created the trigger, the *Iden* of the trigger, the condition that fires the trigger (i.e., `node:add`), and the Storm query associated with the trigger.

Triggers are displayed in alphanumeric order by iden. Triggers are sorted upon Cortex initialization, so newly-created triggers will be displayed at the bottom of the list until the list is re-sorted the next time the Cortex is restarted.

Note

Triggers can also be viewed in runt node form as `syn:trigger` nodes.

Syntax:

```
storm> trigger.list --help

List existing triggers in the cortex.

Usage: trigger.list [options]

Options:

  --help                      : Display the command usage.
  --all                       : List every trigger in every readable view, rather than␣
↪just the current view.
```

trigger.mod

The `trigger.mod` command modifies the Storm query associated with a specific trigger. To modify a trigger, you must provide the first portion of the trigger's iden (i.e., enough of the iden that the trigger can be uniquely identified), which can be obtained using `trigger.list` or by lifting the appropriate `syn:trigger` node.

> **Note**
>
> Other aspects of the trigger, such as the condition used to fire the trigger or the tag or property associated with the trigger, cannot be modified once the trigger has been created. To change these aspects, you must delete and re-add the trigger.

Syntax:

```
storm> trigger.mod --help

Modify an existing trigger's query.

Usage: trigger.mod [options] <iden> <query>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid trigger iden␣
↪is accepted.
  <query>                     : New storm query for the trigger.
```

trigger.disable

The `trigger.disable` command disables a trigger and prevents it from firing without removing it from the Cortex. To disable a trigger, you must provide the first portion of the trigger's iden (i.e., enough of the iden that the trigger can be uniquely identified), which can be obtained using `trigger.list` or by lifting the appropriate `syn:trigger` node.

Syntax:

```
storm> trigger.disable --help

Disable a trigger in the cortex.

Usage: trigger.disable [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid trigger iden␣
↪is accepted.
```

trigger.enable

The `trigger.enable` command enables a disabled trigger. To enable a trigger, you must provide the first portion of the trigger's iden (i.e., enough of the iden that the trigger can be uniquely identified), which can be obtained using `trigger.list` or by lifting the appropriate `syn:trigger` node.

> **Note**
>
> Triggers are enabled by default upon creation.

Syntax:

```
storm> trigger.enable --help

Enable a trigger in the cortex.

Usage: trigger.enable [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid trigger iden␣
↪is accepted.
```

trigger.del

The `trigger.del` command permanently removes a trigger from the Cortex. To delete a trigger, you must provide the first portion of the trigger's iden (i.e., enough of the iden that the trigger can be uniquely identified), which can be obtained using `trigger.list` or by lifting the appropriate `syn:trigger` node.

Syntax:

```
storm> trigger.del --help

Delete a trigger from the cortex.

Usage: trigger.del [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Any prefix that matches exactly one valid trigger iden␣
↪is accepted.
```

uniq

The `uniq` command removes duplicate results from a Storm query. By default, results are uniqued based on each node's node identifier (node ID / iden) so that only the first node with a given node ID is returned. (You can think of this as effectively deconflicting on a node's primary property.)

You can optionally specify a property, set of properties, or a variable as a parameter to unique the results based on that value / set of values instead of the node ID. Synapse will return the first node with the specified value or combination of values.

Syntax:

```
storm> uniq --help


    Filter nodes by their uniq iden values.
    When this is used a Storm pipeline, only the first instance of a
    given node is allowed through the pipeline.

    A relative property or variable may also be specified, which will cause
    this command to only allow through the first node with a given value for
    that property or value rather than checking the node iden.

    Examples:

        # Filter duplicate nodes after pivoting from inet:ipv4 nodes tagged with
↪#badstuff
        #badstuff +inet:ipv4 ->* | uniq

        # Unique inet:ipv4 nodes by their :asn property
        #badstuff +inet:ipv4 | uniq :asn


Usage: uniq [options] <value>

Options:

  --help                      : Display the command usage.

Arguments:

  [value]                     : A relative property or variable to uniq by.
```

Examples:

- Lift all of the unique IP addresses that domains associated with the Fancy Bear threat group have resolved to:

```
inet:fqdn#rep.threatconnect.fancybear -> inet:dns:a -> inet:ipv4 | uniq
```

- Lift a set of network flow (`inet:flow`) nodes and unique (de-duplicate) them based on the source IPv4 address:

```
inet:flow | uniq :src:ipv4
```

- Lift a set of network flow (`inet:flow`) nodes and de-duplicate them based on each unique combination of source and destination IPv4 addresses:

```
inet:flow | uniq (:src:ipv4, :dst:ipv4)
```

- Nodes can be uniqued based on variables. Alert (`risk:alert`) nodes can be categorized in various ways. This includes `:priority` and `:severity` properties, both of which use a set of fixed text values (e.g., "low" vs. "highest") that correspond to integers (e.g., 20 vs. 50). These integer values could be joined together in a variable to provide a sample of alerts which have unique combinations of those values:

```
risk:alert:priority +:severity $pri=:priority $sev=:severity $value=($pri, $sev) | uniq
↪$value
```

uptime

The `uptime` command displays the uptime for the Cortex or specified service.

Syntax:

```
storm> uptime --help

Print the uptime for the Cortex or a connected service.

Usage: uptime [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  [name]                      : The name, or iden, of the service (if not provided␣
↪defaults to the Cortex).
```

vault

Storm includes `vault.*` commands that allow you to create and manage vaults (see *Vault*).

- *vault.add*
- *vault.list*
- *vault.set.configs*
- *vault.set.perm*
- *vault.set.secrets*
- *vault.del*

Help for individual `vault.*` commands can be displayed using:

```
<command> --help
```

vault.add

The `vault.add` command creates a new vault.

Syntax:

```
storm> vault.add --help


            Add a vault.

            Examples:

                // Add a global vault with type `synapse-test`
                vault.add "shared-global-vault" synapse-test ({'apikey': 'foobar'}) ({})␣
↪--global

                // Add a user vault with type `synapse-test`
```

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```
                vault.add "visi-user-vault" synapse-test ({'apikey': 'barbaz'}) ({}) --
↪user visi

                // Add a role vault with type `synapse-test`
                vault.add "contributor-role-vault" synapse-test ({'apikey': 'bazquux'}) (
↪{}) --role contributor

                // Add an unscoped vault with type `synapse-test`
                vault.add "unscoped-vault" synapse-test ({'apikey': 'quuxquo'}) ({'server
↪': 'api.foobar.com'}) --unscoped visi


Usage: vault.add [options] <name> <type> <secrets> <configs>

Options:

  --help                      : Display the command usage.
  --user <user>               : This vault is a user-scoped vault, for the specified␣
↪user name.
  --role <role>               : This vault is a role-scoped vault, for the specified␣
↪role name.
  --unscoped <unscoped>       : This vault is an unscoped vault, for the specified user␣
↪name.
  --global                    : This vault is a global-scoped vault.

Arguments:

  <name>                      : The vault name.
  <type>                      : The vault type.
  <secrets>                   : The secrets to store in the new vault.
  <configs>                   : The configs to store in the new vault.
```

vault.list

The `vault.list` command displays the available vaults.

Syntax:

```
storm> vault.list --help


            List available vaults.


Usage: vault.list [options]

Options:

  --help                      : Display the command usage.
  --name <name>               : Only list vaults with the specified name or iden.
  --type <type>               : Only list vaults with the specified type.
  --showsecrets               : Print vault secrets.
```

vault.set.configs

The `vault.set.configs` sets configuration options for the specified vault.

Syntax:

```
storm> vault.set.configs --help


            Set vault config data.

            Examples:

                // Set data to visi's user vault configs
                vault.set.configs "visi-user-vault" color --value orange

                // Set data to contributor's role vault configs
                vault.set.configs "contributor-role-vault" color --value blue

                // Remove apikey from a global vault configs
                vault.set.configs "some-global-vault" color --delete


Usage: vault.set.configs [options] <name> <key>

Options:

  --help                      : Display the command usage.
  --value <value>             : The config value to store in the vault.
  --delete                    : Specify this flag to remove the config from the vault.

Arguments:

  <name>                      : The vault name or iden.
  <key>                       : The key for the config value.
```

vault.set.perm

The `vault.set.perm` command grants or revokes permissions to a vault.

Syntax:

```
storm> vault.set.perm --help


            Set permissions on a vault.

            Examples:

                // Give blackout read permissions to visi's user vault
                vault.set.perm "my-user-vault" blackout --level read

                // Give the contributor role read permissions to visi's user vault
                vault.set.perm "my-user-vault" --role contributor --level read
```

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```
                // Revoke blackout's permissions from visi's user vault
                vault.set.perm "my-user-vault" blackout --revoke

                // Give visi read permissions to the contributor role vault. (Assume
                // visi is not a member of the contributor role).
                vault.set.perm "contributor-role-vault" visi read


Usage: vault.set.perm [options] <name>

Options:

  --help                      : Display the command usage.
  --user <user>               : The user name or role name to update in the vault.
  --role <role>               : Specified when `user` is a role name.
  --level <level>             : The permission level to grant.
  --revoke                    : Specify this flag when revoking an existing permission.

Arguments:

  <name>                      : The vault name or iden to set permissions on.
```

vault.set.secrets

The `vault.set.secrets` command sets the specified secret for the vault.

Syntax:

```
storm> vault.set.secrets --help


            Set vault secret data.

            Examples:

                // Set data to visi's user vault secrets
                vault.set.secrets "visi-user-vault" apikey --value foobar

                // Set data to contributor's role vault secrets
                vault.set.secrets "contributor-role-vault" apikey --value barbaz

                // Remove apikey from a global vault secrets
                vault.set.secrets "some-global-vault" apikey --delete


Usage: vault.set.secrets [options] <name> <key>

Options:

  --help                      : Display the command usage.
  --value <value>             : The secret value to store in the vault.
```

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```
  --delete                    : Specify this flag to remove the secret from the vault.

Arguments:

  <name>                      : The vault name or iden.
  <key>                       : The key for the secret value.
```

vault.del

The `vault.del` command deletes a vault.

Syntax:

```
storm> vault.del --help


            Delete a vault.

            Examples:

                // Delete visi's user vault
                vault.del "visi-user-vault"

                // Delete contributor's role vault
                vault.del "contributor-role-vault"


Usage: vault.del [options] <name>

Options:

  --help                      : Display the command usage.

Arguments:

  <name>                      : The vault name or iden.
```

version

The `version` command displays the current version of Synapse and associated metadata.

Syntax:

```
storm> version --help

Show version metadata relating to Synapse.

Usage: version [options]

Options:

  --help                      : Display the command usage.
```

view

Storm includes `view.*` commands that allow you to work with views (see *View*).

- *view.add*
- *view.fork*
- *view.set*
- *view.get*
- *view.list*
- *view.exec*
- *view.merge*
- *view.del*

Help for individual `view.*` commands can be displayed using:

```
<command> --help
```

view.add

The `view.add` command adds a view to the Cortex.

Syntax:

```
storm> view.add --help

Add a view to the cortex.

Usage: view.add [options]

Options:

  --help                      : Display the command usage.
  --name <name>               : The name of the new view. (default: None)
  --worldreadable <worldreadable>: Grant read access to the `all` role. (default: False)
  --layers [<layers> ...]     : Layers for the view. (default: [])
```

view.fork

The `view.fork` command forks an existing view from the Cortex. Forking a view creates a new view with a new writeable layer on top of the set of layers from the previous (forked) view.

Syntax:

```
storm> view.fork --help

Fork a view in the cortex.

Usage: view.fork [options] <iden>

Options:

  --help                      : Display the command usage.
  --name <name>               : Name for the newly forked view. (default: None)
```

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```
Arguments:

  <iden>                        : Iden of the view to fork.
```

view.set

The `view.set` command sets a property on the specified view.

Syntax:

```
storm> view.set --help

Set a view option.

Usage: view.set [options] <iden> <name> <valu>

Options:

  --help                        : Display the command usage.

Arguments:

  <iden>                        : Iden of the view to modify.
  <name>                        : The name of the view property to set.
  <valu>                        : The value to set the view property to.
```

view.get

The `view.get` command retrieves an existing view from the Cortex.

Syntax:

```
storm> view.get --help

Get a view from the cortex.

Usage: view.get [options] <iden>

Options:

  --help                        : Display the command usage.

Arguments:

  [iden]                        : Iden of the view to get. If no iden is provided, the␣
↪main view will be returned.
```

view.list

The `view.list` command lists the views in the Cortex.

Syntax:

```
storm> view.list --help

List the views in the cortex.

Usage: view.list [options]

Options:

  --help                      : Display the command usage.
```

view.exec

The `view.exec` command executes a Storm query in the specified view.

Behavior and Limitations

The `view.exec` command creates its own execution environment (sub-runtime) to execute a Storm query in a different view. This results in a firm separation boundary between the source view and the destination view where nodes do not pass in or out across the `view.exec` boundary. Pipelines, events, messages, etc will NOT pass from the destination view to the source view or vice-versa. This includes `$lib.print(...)`, `$lib.warn(...)`, and other functions that may print to the CLI.

Variables declared before the `view.exec` are accessible in the destination view (including assignment). The interactive help example demonstrates this behavior:

```
// Move some tagged nodes to another view
inet:fqdn#foo.bar $fqdn=$node.value() | view.exec 95d5f31f0fb414d2b00069d3b1ee64c6 { [␣
↪inet:fqdn=$fqdn ] }
```

Here we have `inet:fqdn` nodes with the tag `#foo.bar` being lifted and their value (not the node) is saved into the `$fqdn` variable. This variable is later accessible in the `view.exec` sub-query and used to create an `inet:fqdn` node in the destination view. If more than one `inet:fqdn` node with the tag `#foo.bar` exists, the `view.exec` command would be executed once for each node in the pipeline as expected. Again, the actual nodes will not be accessible in the `view.exec` query. Also note the sub-query executed in the `view.exec` may assign a different value back to `$fqdn` to be accessed by the source view (that doesn't happen in this example though).

Inline functions are bound to the scope they are declared in, and heavy objects (for example `View` or `Layer` objects) are bound to the scope they are instantiated in. For `view.exec`, this means that a function declared outside the `view.exec` command will still run in the original scope/view, not the view specified to `view.exec`.

Syntax:

```
storm> view.exec --help


    Execute a storm query in a different view.

    NOTE: Variables are passed through but nodes are not. The behavior of this command␣
↪may be
    non-intuitive in relation to the way storm normally operates. For further␣
```

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```
↪information on
    behavior and limitations when using `view.exec`, reference the `view.exec` section␣
↪of the
    Synapse User Guide: https://v.vtx.lk/view-exec.

    Examples:

        // Move some tagged nodes to another view
        inet:fqdn#foo.bar $fqdn=$node.value() | view.exec␣
↪95d5f31f0fb414d2b00069d3b1ee64c6 { [ inet:fqdn=$fqdn ] }


Usage: view.exec [options] <view> <storm>

Options:

  --help                      : Display the command usage.

Arguments:

  <view>                      : The GUID of the view in which the query will execute.
  <storm>                     : The storm query to execute on the view.
```

view.merge

The `view.merge` command merges **all** data from a forked view into its parent view.

Contrast with *merge* which can merge a subset of nodes.

Syntax:

```
storm> view.merge --help

Merge a forked view into its parent view.

Usage: view.merge [options] <iden>

Options:

  --help                      : Display the command usage.
  --delete                    : Once the merge is complete, delete the layer and view.

Arguments:

  <iden>                      : Iden of the view to merge.
```

view.del

The `view.del` command permanently deletes a view from the Cortex.

Syntax:

```
storm> view.del --help


Delete a view from the cortex.

Notes:
    Deleting a view with the `view.del` command does not delete any of the layers in the␣
↪view.
    To delete layers, you must use the `layer.del` command separately.


Usage: view.del [options] <iden>

Options:

  --help                      : Display the command usage.

Arguments:

  <iden>                      : Iden of the view to delete.
```

wget

The `wget` command retrieves content from one or more specified URLs. The command creates and yields `inet:urlfile` nodes and the retrieved content (`file:bytes`) is stored in the *Axon*.

Syntax:

```
storm> wget --help

Retrieve bytes from a URL and store them in the axon. Yields inet:urlfile nodes.

Examples:

    # Specify custom headers and parameters
    inet:url=https://vertex.link/foo.bar.txt | wget --headers ({"User-Agent": "Foo/Bar"}
↪) --params ({"clientid": "42"})

    # Download multiple URL targets without inbound nodes
    wget https://vertex.link https://vtx.lk


Usage: wget [options] <urls>

Options:

  --help                      : Display the command usage.
  --no-ssl-verify             : Ignore SSL certificate validation errors.
  --timeout <timeout>         : Configure the timeout for the download operation.␣
↪(default: 300)
  --params <params>           : Provide a dict containing url parameters. (default: None)
  --headers <headers>         : Provide a Storm dict containing custom request headers.␣
↪(default:
```

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```
                                {'Accept': '*/*',
                                'Accept-Encoding': 'gzip, deflate',
                                'Accept-Language': 'en-US,en;q=0.9',
                                'User-Agent': 'Mozilla/5.0 (X11; Linux x86_64)␣
↪AppleWebKit/537.36 (KHTML, like Gecko)
                                Chrome/92.0.4515.131 '
                                'Safari/537.36'})
  --no-headers                : Do NOT use any default headers.

Arguments:

  [<urls> ...]                : URLs to download.
```

3.6.11 Storm Reference - Automation

Background

Synapse supports large-scale analysis over a broad range of data with speed and efficiency. Many features that support this analysis are built into Synapse's architecture, from performance-optimized indexing and storage to an extensible data model that allows you to reason over data in a structured manner.

Synapse also supports large-scale analysis through the use of **automation.** Synapse's automation features include:

- *Triggers and Cron*
- *Macros*
- *Dmons*

Automation frees analysts from performing tedious work and allows them to focus on more detailed analysis and complex tasks. You can also scale analytical operations by limiting the amount of work that must be performed manually.

Automation in Synapse uses the Storm query language: **anything that can be written in Storm can be automated,** from the simple to the more advanced. Actions performed through automation are limited only by imagination and Storm proficiency. Automation can be basic: "if X occurs, do Y" or "once a week, update Z". However, automation can also take advantage of all available Storm features (including subqueries, variables, libraries, and control flow logic), to support highly customized tasks and workflows.

Considerations

The following items should be taken into account when planning the use of automation in your environment.

Permissions

Permissions impact the use of automation in Synapse in various ways. In some cases, you must explicitly grant permission for users to create and manage automation. In other cases, the permissions that an automated task runs under may vary based on the type of automation used. See the relevant sections below for additional detail.

> **Tip**
>
> For a detailed discussion of permissions in Synapse, refer to the Synapse Admin Guide.

Scope

Automation components vary with respect to where they reside and execute within Synapse; some elements are global (within a Cortex) while some reside and execute within a specific *View*. Organizations that leverage multiple views for their Synapse architecture or that make use of Synapse's fork and merge capabilities should refer to the sections below for information on how views and layers may impact automation.

> **Tip**
>
> For a more general discussion of views and layers, including a discussion of forking and merging views, see the *Views and Layers* section of the Synapse User Guide.

Testing

Always test your automation before putting it into production. Storm used in automation can be syntactically correct (that is, the query uses proper Storm), but contain logical errors (the query does not actually do what you want it to do). In addition, new automation may interact with existing automation in unexpected ways. Test your automation in a development environment (either a separate development instance, or a separate fork of your production view) before implementing it in production.

Use Cases

Organizations can implement automation as they see fit. Some automation may be enterprise-wide, used to support an organization's overall mission or analysis efforts. Other automation may be put in place by individual analysts to support their own research efforts, either on an ongoing or temporary basis.

Design

There are varying approaches for "how" to write and implement automation. For example:

- **Location of automation code.** The Storm code run by individual triggers and cron jobs can be written and stored as part of the automation itself. This approach helps keep automation "self-contained". However, it may provide less flexibility in executing the associated Storm compared with the use of macros.

  Alternatively, tasks such as triggers and cron jobs can be written to execute minimal Storm queries whose purpose is to call more extensive Storm stored centrally in macros. This approach consolidates much of the associated Storm, which may make it easier to manage and maintain. Storm placed in macros also provides flexibility as the macro can be called by a trigger, a cron job, or a user as part of a Storm query.

- **Size of automation.** Automation can be written as many small, individual elements. Each element can perform a relatively simple task, but the elements can work together like building blocks to orchestrate larger-scale operations. This approach keeps tasks "bite sized" and the Storm executed by a given piece of automation generally simpler. However it may result in a larger number of automation elements to maintain, and may make it more challenging to understand the potential interactions of so many different elements.

  Alternatively, automation can be implemented using fewer elements that perform larger, more unified tasks (or that consolidate numerous smaller tasks into a larger set of Storm code). This approach results in fewer automation elements overall, but typically requires you to write and maintain more advanced Storm (e.g., to create a small number of macros with switch or if/else statements to each manage a variety of tasks). However, the Storm is consolidated in a few locations, which may make managing and troubleshooting easier.

Each approach has its pros and cons; there is no single "right" way. In addition, you do not have to take an "either / or" approach; what works best in your environment or for a particular task will depend on your needs (and possibly some trial and error).

Governance / Management

Consider any review or approval processes that you may need in order to manage automation effectively in your environment. Organization-wide automation requires coordination and oversight:

- If multiple users have the ability to create automated tasks, it is possible for them to create duplicative or even conflicting automation. Consider who should be responsible for deconflicting and approving automation that will be deployed in your production environment.
- Automation is often used to enrich indicators (i.e., query various third-party APIs to pull in more data related to a node). Some third-party APIs may impose query limits, may be subject to a license or subscription fee, or both. Consider how to balance effective use of automation without overusing or exceeding any applicable quotas.
- Some automation may be used to apply tags to nodes or "push" tags from one node to related nodes - effectively automating the process of making an analytical assertion. Consider carefully under what circumstances this should be automated, and who should review or approve the analysis logic used to make the assertion.

Automation and Error Handling

If the Storm executed by a piece of automation encounters an error condition, the automation will cease execution and exit. For automation that operates over large numbers of nodes or performs a long-running task, an unexpected error can cause the automation to halt in the middle and fail to complete.

In addition to general testing of your Storm code (and Storm logic!), using the *"Try" Operator* when adding or modifying data will ensure your Storm code will "warn and continue" if it encounters bad data vs. generating an error and halting.

We also encourage you to build additional error-checking and error-handling into your automation as appropriate.

Users should keep the *Storm Operating Concepts* in mind when writing automation. Automation frequently operates on nodes or other Synapse data; knowing what nodes are in the Storm pipeline for your automation will help significantly with troubleshooting any issues.

Triggers and Cron

Triggers and cron are similar in terms of how they are implemented and managed.

- **Permissions.** Synapse uses permissions to determine who can create, modify, and delete triggers and cron jobs. These permissions must be explicitly granted to users and/or roles. See the Cortex permissions section of the Synapse Admin Guide for a list of `cron.*` and `trigger.*` permissions.
- **Execution.** Both triggers and cron jobs execute with the permissions of a designated user associated with the individual trigger or cron job. By default, this is the user who creates the trigger or cron job. The user can be changed (e.g., for organizations that wish to use a dedicated account for automation tasks) using the `set()` method of the *trigger* or *cronjob* primitives, respectively.
- **Scope.** Both triggers and cron jobs run **within a specific view**; any changes made to Synapse's data by the trigger or cron job are made (written) to the topmost (writeable) layer of the view. This view-specific behavior is transparent when using a simple Synapse implementation consisting of a single Cortex with a single layer and a single view (Synapse's default configuration). Organizations using multiple views or that frequently fork views should consider the impact of your view architecture on automation deployment and behavior.

Note

The use of sensitive information (e.g., credentials, API keys, etc.) in the Storm that is executed by a trigger or cron job is **strongly discouraged**. If your automation needs to make use of any sensitive information, we recommend creating a Power-Up with associated Storm commands. The Power-Up architecture allows users to run commands

that make use of sensitive information while ensuring that information is not exposed. See the Rapid Power-Up Development section of the Synapse Developer Guide for details.

Cron

Cron in Synapse is similar to the well-known cron utility. Cron jobs execute their associated Storm on a specified schedule. Jobs can be written to execute once (using the *cron.at* command) or on a recurring basis (using *cron.add*).

Tip

When scheduling cron jobs, Synapse interprets all times as UTC.

Configuration and Management

- **Storage.** Cron jobs are stored **globally** (within the Cortex). When **viewing** cron jobs, (e.g., with the *cron.list* command), Synapse returns all cron jobs in the Cortex, regardless of the view the `cron.list` command is executed in.
- **Execution.** Cron jobs must be assigned to a specific **view** where they execute. By default, this is the view where the cron job is created. If the view that a cron job runs in is deleted, the cron job **remains** (within the Cortex) but is effectively orphaned until it is assigned to a new view (i.e., using the *$lib.cron.move(prefix, view)* library) or deleted if no longer needed.
- **Permissions.** Cron jobs execute with the privileges of a designated user (by default, the user who creates the cron job). We strongly encourage the use of least privilege; the cron job's account should have the permissions required to execute the associated Storm, but no more. One option is for organizations to create a dedicated account for use with automation in Synapse.

  The owner (creator) of a cron job can be modified using the Storm *$lib.cron.get(prefix)* library and the `set()` method of the *cronjob* primitive. For example:

```
$mycron=$lib.cron.get(<cron_iden>) $mycron.set(creator, <new_creator_iden>)
```

  Users (and roles) cannot create or manage cron jobs by default. The various `cron.*` permissions must be granted to users or roles that should be allowed to work with cron jobs in your environment. See the Cortex permissions section of the Synapse Admin Guide for details on the `cron.*` permissions and associated gates.

  Note

  Where a user has **admin** privileges, all permissions checks are bypassed. This means that users can create and manage cron jobs in views that they fork.

- **Managing Cron Jobs.** Cron jobs can be created, viewed, and managed using the various Storm *cron* commands, the *cronjob* primitive, or the *$lib.cron* libraries. In *Optic*, cron jobs can also be created and managed using the *Admin Tool*.

Use Cases

Because cron jobs are scheduled, they are most appropriate for automating routine tasks, non-urgent tasks, or resource-intensive tasks that should be scheduled to minimize impact on operations.

"What" a cron job does is limited only by your imagination (and your Storm skills). Examples of common cron use cases include:

- **Data ingest.** Periodically ingest / synchronize data that you want to load into Synapse on a regular basis.
- **Housekeeping.** Perform one-time or periodic "maintenance" tasks. These may include a one-time sweep to "backfill" missing data (like IP geolocation data) or a periodic sweep to check and set missing properties (such as tag definitions).
- **Process intensive jobs.** Data enrichment may be resource intensive if it generates a significant number of write operations. If you regularly perform routine (non-urgent) enrichment, it can be scheduled to run when it will have less impact on users.
- **Periodic hunting.** New data and annotations (tags) are continually added to Synapse. Encoding "hunt" logic in Storm and periodically running hunts can help ensure you are continually reviewing new data for updated indicators or activity.

Tip

A cron job can use Storm to call a macro, which may provide greater flexibility in storing and managing the Storm code executed by the cron job.

Syntax

In Storm, cron jobs are primarily created and managed using the Storm *cron* commands.

Once a cron job is created, you can modify many of its properties (such as its name and description, or the Storm associated with the job). However, you cannot modify other aspects of the job, such as its schedule. To change those conditions, you must disable (or delete) and re-create the cron job.

Variables

Every cron job has an associated Storm variable `$auto` that is automatically populated when the job runs. The `$auto` variable is a dictionary which contains the following keys:

`$auto.iden`
: The identifier of the cron job.

`$auto.type`
: The type of automation. For a cron job this value will be `cron`.

These job-specific variables can be referenced by the Storm code executed by the cron job. See *Storm Reference - Advanced - Variables* for information on the use of variables in Storm.

Examples

The examples below illustrate using the Storm *cron* commands (`cron.at`, `cron.add`) to create new cron jobs. See the help for each command for options and additional details.

One-time (non-recurring) cron job example

You want to use a one-time cron job that runs during off hours to perform some data cleanup. Specifically, you want a job that will lift all existing `media:news` nodes and remove (delete) the deprecated `:author` property at 0200 UTC.

```
storm> cron.at --hour 2 { media:news:author [ -:author ] }
Created cron job: 457332b75af7e0c7b394c28faa57d618
```

We can view the details of this cron job using the `cron.list` command:

```
storm> cron.list
 user                    iden        view        en?  rpt?  now?  err?  # start  last␣
↪start        last end          query
##############################################################################################
↪###################################
 root                    457332b7..  603133c7..  Y    N     N           0        Never␣
↪            Never             media:news:author [ -:author ]
```

The output of `cron.list` includes the following columns:

- **user** - the user that the job runs as (typically the user who created the job).
- **iden** - the first eight characters of the cron job's identifier (iden).
- **view** - the first eight characters of the iden of the view the job executes in. For "orphaned" cron jobs, this will be the job's last view (before it was orphaned).
- **en?** - whether the job is currently enabled or disabled (Y/N).
- **rpt?** - whether the job is scheduled to repeat (Y/N).
- **now?** - whether the job is currently executing (Y/N).
- **err?** - whether the last job execution encountered an error (X or empty).
- **# start** - the number of times the job has started / executed (since the last restart of Synapse).
- **last start** - the date and time the job last started (or attempted to start).
- **last end** - the date and time the job last finished (or exited).
- **query** - the Storm query executed by the cron job.

> **Tip**
>
> Detailed information about individual cron jobs can be retrieved with the *cron.stat* command.

Hourly cron job example

You want to create a cron job that will run every hour to download the latest MISP data using the `misp.sync` command.

```
cron.add --hour +1 { misp.sync }
```

> **Tip**
>
> The `misp.sync` command is added by the Synapse-MISP Power-Up.

Custom schedule example

Because Synapse is continually updated with new data, you want to periodically check for any new files of interest that have not yet been identified by an analyst. Specifically, you want to look for files (`file:bytes` nodes) that make DNS queries (`inet:dns:request`) for "known bad" FQDNs (e.g., tagged `#cno.mal`) where the files have not yet been tagged. You want to run the job three times a week (every Tuesday, Thursday, and Saturday at 2000 UTC) and tag the files for review (`#int.review.malware`).

```
cron.add --day Tue,Thu,Sat --hour 20 { inet:fqdn#cno.mal -> inet:dns:request ->␣
↪file:bytes -#cno.mal [ +#int.review.malware ] }
```

Triggers

Triggers are "event-driven" automation. As their name implies, they trigger ("fire") their associated Storm when specific events occur in Synapse's data store. Triggers can fire on the following events:

- Adding a node (`node:add`)
- Deleting a node (`node:del`)
- Setting (or modifying) a property (`prop:set`)
- Adding a tag to a node (`tag:add`)
- Deleting a tag from a node (`tag:del`)
- Adding a light edge (`edge:add`)
- Deleting a light edge (`edge:del`).

When creating a trigger, you must specify the type of event the trigger should fire on. In addition, each event requires a specific object (a form, property, tag, or edge) to act upon. For example, if you write a trigger to fire on a `node:add` event, you must specify the type of node (form) associated with the event; you cannot create a `node:add` trigger that fires on "any / all nodes". For `tag:*` and `edge:*` triggers, you have the option to limit the trigger to tags or edges associated with specific forms, or have the trigger apply to any / all forms.

Note

The node(s) that cause a trigger to fire are considered **inbound** to the Storm code executed by the trigger.

Proper trigger execution may depend on the timing and order of events with respect to creating nodes, setting properties, and so on. For example, you may write a trigger based on a `node:add` action that fails to perform as expected because you actually need the trigger to fire on a `prop:set` operation for that node. As always, we recommend that you test triggers (and any other automation) before putting them into production.

Configuration and Management

- **Storage.** Triggers are stored within a **view**. If the view that a trigger resides in is deleted, **the trigger is also deleted**. Triggers can be moved to another view using the `move()` method of the *trigger* primitive. (In *Optic*, when using the View Task Bar to merge a view, you are prompted to also merge any triggers in the view.)

  Because triggers are stored within individual views, when **viewing** triggers (e.g., with the *trigger.list* command), Synapse returns only those triggers within the current view.

- **Execution.** Triggers "fire" when a change occurs within Synapse - that is, when a **write** operation occurs. As triggers reside (and execute) within a **view**, they fire on changes to the view's writable (topmost) **layer.** A trigger will **not** fire on changes made in an underlying layer (i.e., of a parent view).

  Similarly, a trigger that resides in a **parent** view will **not** fire on changes made in a fork of that view. However, when data from the forked view is merged into the parent view, merging (writing) the data will cause any relevant triggers to fire.

  Triggers fire immediately when their associated event occurs; but they **only** execute when that event occurs. If the Storm executed by the trigger depends on a resource (process, service, etc.) that is not available when the trigger fires, execution will simply fail; Synapse will not "try again" later. (Whether the trigger fails silently or by logging an error will depend on the Storm and / or any additional resources used or called by the trigger.)

  Similarly, triggers do not operate "retroactively" on existing data. If you write a new trigger to fire when the tag `my.tag` is applied to a `hash:md5` node, the trigger will have no effect on existing `hash:md5` nodes that already have the tag.

- **Permissions.** Triggers execute with the privileges of a designated user (by default, the user who creates the trigger). We strongly encourage the use of least privilege; the trigger's account should have the permissions required to execute the associated Storm, but no more. One option is for organizations to create a dedicated account for use with automation in Synapse.

  The owner (user) of a trigger can be modified using the Storm *$lib.trigger.get(iden)* library and the `set()` method of the *trigger* primitive. For example:

```
$mytrigger=$lib.trigger.get(<trigger_iden>) $mytrigger.set(user, <new_user_iden>)
```

  Triggers run as a specified user, but they execute based on particular changes to data in Synapse. This means that a lower-privileged user could make a change (such as creating a node) that causes a higher-privileged trigger to execute and perform actions that the user would not be able to do themselves.

  Users (and roles) cannot create or manage triggers by default. The various `trigger.*` permissions must be granted to users or roles that should be allowed to work with triggers in your environment. See the Cortex permissions section of the Synapse Admin Guide for details on the `trigger.*` permissions and associated gates.

  Note

  Where a user has **admin** privileges, all permissions checks are bypassed. This means that users can create and manage triggers in views that they fork.

- **Managing Triggers.** Triggers can be created, viewed, and managed using the various Storm *trigger* commands, the *trigger* primitive, or the *$lib.trigger* libraries. In *Optic*, triggers can be created and managed using the *Admin Tool* or the VIEWS tab of the *Workspaces Tool*.

Use Cases

Triggers are "event driven" and execute their Storm **immediately** when their associated event (change) occurs. As such, triggers are most appropriate for automating tasks that should occur right away (e.g., based on efficiency or importance). Example use cases for triggers include:

- **Performing enrichment.** There may be circumstances where you **always** want to retrieve additional information about an object (node) within Synapse. For example, whenever a unicast IPv4 (`inet:ipv4` node) is added to Synapse, you want to automatically look up Autonomous System (AS), geolocation, and network whois data. You can use a trigger to enrich the `inet:ipv4` using the appropriate Power-Ups as soon as the IPv4 is created (e.g., by firing on a `node:add` event).

  Similarly, when a node is assessed to be malicious (e.g., associated with a threat cluster or malware family, and tagged appropriately), you may wish to immediately collect additional information about that node. A trigger that fires on a `tag:add` event could be used to call multiple Power-Ups using a more extensive "enrichment" query (or macro).

- **Encoding analytical logic.** You can use Storm to encode your analysis logic, such as the criteria or decision process used to apply a tag. As a simplified example, assume you have identified an IPv4 address as a DNS sinkhole. You assess that any FQDN resolving to the IPv4 is highly likely to be a sinkholed domain. When a DNS A node (`inet:dns:a`) is created where the associated IPv4 (`:ipv4` property) is the IP of the sinkhole (a `prop:set` event), a trigger can automatically tag the associated FQDN as sinkholed. If you want an analyst to confirm the assessment (vs. applying it in a fully automated fashion), you can apply a "review" tag instead. Alternatively, if additional criteria would better support your assessment (e.g., if the DNS A resolution occurred during a particular time window when the sinkhole IP was known to be in use, or if the resolution was based on a live/active DNS lookup vs. a passively observed response), you could modify your trigger's Storm to reflect these additional "checks" or criteria.

You can similarly encode logic in Storm to support retrohunting, threat clustering, or other workflows.

- **Automating repetitive tasks.** Any process that analysts identify as repetitive may benefit from automation. Analysts may identify cases where, when they perform a specific action in Synapse, they always perform several additional actions. For example, when an analyst tags a particular node (such as a `file:bytes` node), they always want to apply the same tag to a set of "related" nodes (such as the `hash:md5`, `hash:sha1`, etc. that represent the file's hashes). Similarly, if a `file:bytes` node queries a "known bad" FQDN (via an `inet:dns:request` node), analysts also want to apply the tag from the FQDN to both the DNS request and the file. Using a trigger (on a `tag:add` event) saves manual work by the analyst and ensures the additional tags are applied consistently.

Tip

A trigger can use Storm to call a macro, which may provide greater flexibility in storing and managing the Storm code executed by the trigger.

Syntax

In Storm, triggers are created, modified, viewed, enabled, disabled, and deleted using the Storm *trigger* commands. In *Optic*, triggers can also be managed through the *Admin Tool* or the *Workspaces Tool*.

Once a trigger is created, you can modify many of its properties (such as its name and description, or the Storm associated with the trigger). However, you cannot modify the conditions that cause the trigger to fire. To change those conditions, you must disable (or delete) and re-create the trigger.

Variables

Every trigger has an associated Storm variable `$auto` that is automatically populated when the trigger executes. The `$auto` variable is a dictionary which contains the following keys:

$auto.iden
The identifier of the Trigger.

$auto.type
The type of automation. For a trigger this value will be `trigger`.

$auto.opts
Dictionary containing trigger-specific runtime information. This includes the following keys:

$auto.opts.form
The form of the triggering node.

$auto.opts.propfull
The full name of the property that was set on the node. Only present on `prop:set` triggers.

$auto.opts.propname
The relative name of the property that was set on the node. Does not include a leading `:`. Only present on `prop:set` triggers.

$auto.opts.tag
The tag which caused the trigger to fire. Only present on `tag:add` and `tag:del` triggers.

$auto.opts.valu
The value of the triggering node.

$auto.opts.verb
The name of the light edge. Only present on `edge:add` and `edge:del` triggers.

`$auto.opts.n2iden`
: The iden of the node on the other end of the edge. Only present on `edge:add` and `edge:del` triggers.

These trigger-specific variables can be referenced by the Storm code executed by the trigger. See *Storm Reference - Advanced - Variables* for information on the use of variables in Storm.

Examples

The examples below illustrate using the Storm *trigger.add* command to create new triggers. See the command help for options and additional details.

Recall from the *Storm Operating Concepts* that Storm operations are "chained" together to act as a pipeline through which nodes are "sent" and acted upon. Regardless of the type of trigger (`prop:set`, `tag:add`), the **node** associated with the trigger event is sent **inbound** to the Storm executed by the trigger.

Tip

By default, the Storm code executed by a trigger runs **inline**. In other words, when a process (typically a Storm operation or Storm query) causes a trigger to fire, the Storm associated with the trigger will run **immediately and in full**. Conceptually, it is as though all of the trigger's Storm code and any additional Storm that the trigger calls (such as a macro) or causes to run (such as another trigger) are inserted into the middle of the original Storm query that fired the trigger, and executed as part of that query.

This inline execution can impact the original query's performance, depending on the Storm executed by the trigger and the number of nodes causing the trigger to fire. Specifically, if a trigger (and associated Storm) is fired based on an interactive Storm query from a user, Synapse's interface (the Storm CLI or the Optic UI) will "block" until the Storm executes in full.

The `--async` option can be used when creating a trigger to specify that the trigger should run **in the background** as opposed to inline. This will cause the trigger event to be stored in a persistent queue, which will then be consumed automatically by the Cortex.

Executing the trigger asynchronously means that changes made by the trigger (e.g., such as data enrichment) will not be available to the user until the associated Storm finishes running. However, the user can continue working in the meantime because the Synapse interface will not "block".

To change whether or not an **existing** trigger runs asynchronously, use the Storm *$lib.trigger.get(iden)* library and the `set()` method of the *trigger* primitive. For example:

```
$mytrigger=$lib.trigger.get(<trigger_iden>) $mytrigger.set(async, $lib.true)
```

Or:

```
$mytrigger=$lib.trigger.get(<trigger_iden>) $mytrigger.set(async, $lib.false)
```

prop:set example

You have identified a handful of email addresses that are consistently used by various sinkhole organizations to register their sinkholed FQDNs, and tagged the email addresses `#cno.infra.dns.sink.hole` to show they are associated with sinkhole infrastructure. You want to add a trigger that will fire when any of these email addresses is set as the `:email` property of an `inet:whois:contact` node and tag the associated FQDN as sinkholed (`#cno.infra.dns.sink.holed`). Because the trigger is a simple one, you want it to run inline (i.e., you do not need the `--async` option).

```
storm> trigger.add prop:set --name 'Tag sinkholed FQDNs based on known sinkholer email' -
↪-prop inet:whois:contact:email --query { +{ :email-> inet:email +#cno.infra.dns.sink.
```

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```
↪hole } -> inet:whois:rec -> inet:fqdn [ +#cno.infra.dns.sink.holed ] }
Added trigger: 0558cc07143186bd8c612175aeccd5ce
```

Tip

For `prop:set` and `prop:del` triggers, the node whose property caused the trigger to fire is sent inbound to the trigger's Storm.

We can view the newly created trigger using `trigger.list`:

```
storm> trigger.list
user       iden                             view                             en?   ␣
↪async? cond      object                    storm query
root       0558cc07143186bd8c612175aeccd5ce 603133c7d6b4be19ad5fd720ffebd3d6 true  ␣
↪false  prop:set  inet:whois:contact:email           +{ :email-> inet:email +#cno.
↪infra.dns.sink.hole } -> inet:whois:rec -> inet:fqdn [ +#cno.infra.dns.sink.holed ]
```

The output of `trigger.list` includes the following columns:

- **user** - the user that the trigger runs as (typically the user who created the trigger).
- **iden** - the trigger's identifier (iden).
- **view** - the iden of the view in which the trigger resides / runs.
- **en?** - whether the trigger is currently enabled or disabled.
- **async?** - whether the trigger will run asynchronously / in the background.
- **cond** - the condition that causes the trigger to fire.
- **object** - the object the trigger operates on (in this case, the `:email` property of an `inet:whois:contact` node). May reference multiple objects (e.g., if a `tag:add` trigger only fires when the tag is added to a specific form, both the tag and form will be listed).
- **storm query** - the Storm to be executed when the trigger fires.

node:add example

Whenever an IPv4 node is added to Synapse, you want to immediately retrieve the associated Autonomous System (AS), geolocation, and DNS PTR data using various Storm commands.

```
storm> trigger.add node:add --name 'Basic IPv4 enrichment' --form inet:ipv4 --query {␣
↪maxmind | nettools.dns }
Added trigger: e994399bdb9e95e3ef98e8bfc1137bba
```

Tip

For `node:add` and `node:del` triggers, the node that caused the trigger to fire is sent inbound to the trigger's Storm.

The `maxmind` and `nettools.dns` commands are added to Synapse by the Synapse-Maxmind and Synapse-Nettools Power-Ups, respectively.

edge:add example

You are using `risk:attack` nodes in Synapse to represent attacks, and linking the attack to key objects used in the attack with a `-(uses)>` light edge. (For example, a `risk:attack` representing a phishing attempt can be linked to the relevant email message (`file:bytes` node) or email metadata nodes (such as `inet:email:message`, `inet:email:message:attachment`, or `inet:email:message:link`).

If the object "used" in the attack has an associated TTP tag (such as `#cno.ttp.phish.attach` to represent a malicious attachment used in a phishing attack), you want to pivot to the technique (`ou:technique`) represented by the tag (e.g., "Spear phishing attachment"), and create another `uses` edge to show the attack uses the specified technique.

```
storm> trigger.add edge:add --name 'Link technique with attack'--verb uses --form␣
↪risk:attack --query { $attack=$node { -(uses)> * +$auto.opts.n2iden -> # ->␣
↪ou:technique:tag [ <(uses)+ { yield $attack } ] } }
Added trigger: 59a058111e7285ff8c93a62377d32692
```

Tip

Recall that edges have a direction, regardless of whether the edge relationship is specified "left to right" or "right to left" in Storm (e.g., `n1 -(uses)> n2` or `n2 <(uses)- n1`).

For `edge:add` and `edge:del` triggers, the `n1` node (source node) for the edge that caused the trigger to fire is sent inbound to the trigger's Storm.

The Storm for this trigger is broken down below (with comments) for clarity:

```
// Set the variable $attack to the risk:attack node for later use
$attack=$node

// Use a subquery to traverse all 'uses' edges to any / all forms
{
   -(uses)> *

   // Filter to the n2 node that was just linked, as referenced by the
   // trigger-specific $auto.opts.n2iden variable
   +$auto.opts.n2iden

   // Pivot to the syn:tag nodes associated with any tags on n2
   -> #

   // Pivot to any techniques associated with any tags
   -> ou:technique:tag

   // Create a 'uses' edge between the technique(s) and the risk:attack node
   [ <(uses)+ { yield $attack } ]
}
```

tag:add example

When you associate a file with a malware family, you record that assessment on the `file:bytes` node with a tag (e.g., `#cno.mal.redtree` to represent the 'redtree' malware family). When you tag the file, you want to automatically copy the tag to the file's MD5, SHA1, SHA256, and SHA512 hashes for situational awareness.

```
storm> trigger.add tag:add --name 'Push malware tags from file to hashes' --form␣
↪file:bytes --tag cno.mal.** --query { tee { :md5 -> hash:md5 } { :sha1 -> hash:sha1 }
```

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```
↪{ :sha256 -> hash:sha256 } { :sha512 -> hash:sha512 } | [ +#$auto.opts.tag ] }
Added trigger: 547cb2816d2c1bb7ce72160ea5902d69
```

> **Tip**
>
> For `tag:add` and `tag:del` triggers, the node that was tagged (or untagged) to cause the trigger to fire is sent inbound to the trigger's Storm.
>
> The trigger above uses the trigger-specific `$auto.opts.tag` variable to reference the tag that caused the trigger to fire.

tag:del example

Similar to the example above, when your assessment changes and you want to **remove** a tag from a file (`file:bytes` node), you want to automatically remove that same tag from the file's associated hashes.

```
storm> trigger.add tag:add --name 'Untag hashes when untagging a file' --form file:bytes␣
↪--tag cno.mal.** --query { tee { :md5 -> hash:md5 } { :sha1 -> hash:sha1 } { :sha256 ->
↪ hash:sha256 } { :sha512 -> hash:sha512 } | [ -#$auto.opts.tag ] }
Added trigger: 4734ddc27a1cb39109ee66c9b11661f7
```

> **Tip**
>
> The trigger above uses the trigger-specific `$auto.opts.tag` variable to reference the tag that caused the trigger to fire.

Macros

A macro is a stored Storm query / set of Storm code that can be executed on demand. Strictly speaking, macros are not automation - they do not execute on their own. However, they do provide a means to "automate" tasks by allowing an analyst to easily and consistently run Storm that would otherwise need to be manually entered as a query. Anything that assists an analyst's workflow - from executing a commonly used pivot to performing a detailed set of data enrichment and operations - is a candidate for a macro if it simplifies analysts' work.

> **Tip**
>
> In addition to macros, *Optic* includes features such as Node Actions and Bookmarks that can be used to save and execute Storm on demand.

Macros are also commonly used with (called by) triggers or cron jobs. In particular, where a trigger or cron job executes longer or more detailed Storm, it may be easier to store and maintain that Storm within a macro instead of within the trigger or cron job itself.

As a stored Storm query, a macro is meant to operate on nodes. You must either specify (lift) the nodes to be operated on within the macro itself, or provide the nodes as input to the macro (i.e., by sending the results of an existing Storm query to the *macro.exec* command that runs the macro).

A macro will error if it receives nodes that cannot be processed by the associated Storm code. A "best practice" when writing macros that take nodes as input is to include a Storm filter operation within the macro to allow only those nodes that the macro expects and can operate on; any nodes not allowed by the filter are dropped from the Storm pipeline.

Similarly, if you execute additional Storm inline after the macro runs, that Storm must be appropriate for any nodes that exit the macro.

Note

The use of sensitive information (e.g., credentials, API keys, etc.) in the Storm that is executed by a macro is **strongly discouraged**. If your automation needs to make use of any sensitive information, we recommend creating a Power-Up with associated Storm commands. The Power-Up architecture allows users to run commands that make use of sensitive information while ensuring that information is not exposed. See the Rapid Power-Up Development section of the Synapse Developer Guide for details.

Configuration and Management

- **Storage.** Macros are stored within (global to) a Cortex. Macros are differentiated by **name** (as opposed to triggers and cron jobs, which are differentiated by a unique identifier (iden)). You can change the name of a macro using the *$lib.macro.mod(name, info)* library:

  ```
  $lib.macro.mod('my old poorly chosen macro name',({'name': 'new.name'}))
  ```

  Attempting to rename a macro to a name that already exists will result in a `DupName` error.

- **Execution.** Macros are not restricted to a particular view; they can be called from and executed within any view. Any changes made by the macro's Storm code will be made to the topmost / writeable layer of the view in which the macro is executed.

- **Permissions.** Macros execute with the privileges of the **user who calls the macro**. If a macro is called by a trigger or cron job, the macro executes with the privileges of the associated trigger or cron user.

  By default:

  - **Any user can create a macro**; you do not need to explicitly grant permissions for users to create them.
  - The user who creates a macro is the owner / admin of the macro, and is the only user who can edit, delete, or modify permissions on the macro.
  - All users can see (read) and execute any macro. If a user attempts to execute a macro that performs actions for which the user does not have permissions, the macro will fail with an `AuthDeny` error.

  Tip

  Macro permissions can be modified / managed by using the *$lib.macro.grant(name, scope, iden, level)* library. (In Optic, individual macro permissions can be managed through the Storm Editor Tool.) Macros support Synapse's easy permissions ("easy perms") convention for setting simplified permissions on objects. You must be **admin** of a macro to modify its permissions. See the *Examples* section below for examples of modifying macro permissions.

- **Managing Macros.** Macros can be created, viewed, and managed using the various Storm *macro* commands or the *$lib.macro* libraries. In *Optic*, macros can be created and edited using the Storm Editor Tool.

Use Cases

Macros are a convenient way to save and run frequently used Storm without having to create or type that Storm each time. The Storm can be as simple or advanced as you like.

- **Organizational use.** Macros can be developed for use across entire teams or organizations to support common tasks or workflows such as enrichment or threat hunting. Using a macro makes it easier to perform the task (by

calling it with a single Storm command) and also ensures that the task is performed consistently (i.e., in the same way each time) by each user.

- **Personal use.** Users can create macros to store frequently-used or lengthy Storm queries specific to their personal workflow that can be executed easily on demand.
- **Automation.** For triggers or cron jobs that execute longer Storm queries, saving the Storm in a macro may make it easier to set, view, edit, and manage vs. storing the Storm directly as part of the trigger or cron job.
- **Flexibility.** Because macros are composed in Storm and executed via a Storm command, they can be executed any way Storm can be executed (e.g., on demand or called as part of a trigger or cron job). Macros are ideal for Storm that performs a task or set of tasks that you may want to execute in a variety of ways.

Syntax

In Storm, macros are created, modified, viewed, and deleted using the Storm *macro* commands. Permissions for macros are managed using the *$lib.macro.grant(name, scope, iden, level)* library.

In *Optic*, macros and their permissions can also be managed through the Storm Editor Tool.

Examples

As "stored Storm", macros can contain any Storm that simplifies your analysis workflow - from the very simple to longer, more detailed queries. The command `macro.exec <macro_name>` is much simpler to type than Storm that you have to recreate each time. The examples below are relatively simple for illustrative purposes; that said, any Storm that you want to easily and consistently run on a regular basis, no matter how simple or complex, is a candidate for a macro (or potentially for other automation).

The examples below show creating macros using the `macro.set` command.

Self-contained macro - example

You have a set of IPv4 addresses that you have identified as sinkholes (tagged `#cno.infra.dns.sink.hole`). By analyzing associated DNS and domain whois data, you have tagged several FQDNs resolving to the IPv4s as sinkholed domains (`#cno.infra.dns.sink.holed`). You want to periodically check the sinkhole IPv4s for newly sinkholed FQDNs. To do this, you create a macro called `sinkhole.check` that will:

- query a passive DNS data source to check for new FQDNs resolving to the various sinkhole IPv4s;
- perform a live DNS A lookup on the FQDNs to double-check against the passive DNS results;
- retrieve the domains' current whois records; and
- tag the FQDNs for review, including a timestamp so the reviewer knows when the FQDN was added to the set of domains for review.

```
storm> macro.set sinkhole.check { $now=$lib.time.now() inet:ipv4#cno.infra.dns.sink.hole␣
↪| alienvault.otx.pdns --yield | -> inet:fqdn :zone -> inet:fqdn -#cno.infra.dns.sink.
↪holed | uniq | nettools.dns | nettools.whois | [ +#int.review.sinkhole=$now ] }
Set macro: sinkhole.check
```

The Storm for this macro is broken down below (with comments) for clarity. (You can include comments within a macro; Synapse will ignore comment lines during execution.)

```
// Get the current time (in UTC) to use for the tag timestamp
$now=$lib.time.now()

// Lift IPv4 nodes tagged as sinkholes
inet:ipv4#cno.infra.dns.sink.hole
```

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```
// Obtain PDNS information from AlienVault and yield the resulting inet:dns:a nodes
alienvault.otx.pdns --yield |

// Pivot to the FQDNs and then to the FQDN zones
-> inet:fqdn :zone -> inet:fqdn

// Filter out FQDNs that have already been identified as sinkholed
-#cno.infra.dns.sink.holed |

// De-duplicate results
uniq |

// Obtain the current / live DNS A and whois data for the FQDNs
nettools.dns | nettools.whois |

// Tag the FQDNs for review and set the current timestamp
[ +#int.review.sinkhole=$now ]
```

An analyst can now lift the FQDNs that need to be reviewed using the `#int.review.sinkhole` tag and review the associated data. If the FQDN is confirmed to be sinkholed, the analyst can apply the `#cno.infra.dns.sink.holed` tag and remove the `#int` tag once the FQDN has been reviewed.

If additional criteria would allow you to confirm that the FQDNs were sinkholed (e.g., some additional information in the whois data, or use of a particular DNS name server / DNS NS record), you could encode this logic using Storm and simply tag the relevant FQDNs as sinkholed vs. requiring analyst review.

Tip

This macro is "self-contained" (does not expect inbound ndoes); the macro's Storm lifts the nodes that the macro operates on. (This does not prevent a user from "sending" nodes to the macro - which may cause unexpected effects - but as written, the macro can execute on its own.)

This macro can be executed "on demand" with the `macro.exec` command, or could be configured to run automatically as a cron job.

The `alienvault.otx.pdns` command is installed by the Synapse-AlienVault Power-Up. The `nettools.*` commands are installed by the Synapse-Nettools Power-Up.

Macro that takes nodes as input - example

One of Synapse's strengths is the ability to retrieve data from a wide range of external sources, typically by using a Storm command provided by a Power-Up. The Storm commands allow an analyst to ingest data into Synpase and represent disparate data in a consistent manner for review and analysis. An analyst who wants to investigate an object (such as an indicator) in Synapse will commonly run multiple Storm commands to retrieve data from any / all data sources (a process commonly known as "enrichment").

Instead of requiring the analyst to remember and run multiple individual Storm commands for enrichment, you want to create a macro called `enrich` that can take a variety of different nodes as input, and automatically run the appropriate Storm commands to call the data sources that can enrich the input node(s).

Once again, we create the macro with the `macro.set` command. Because of the length of the associated Storm, the full <storm_query> is provided below for readability.

```
macro.set enrich { <storm_query> }
```

The content of the macro (the <storm_query>, with comments):

```
// Filter inbound nodes to supported forms only
+(hash:md5 or hash:sha1 or hash:sha256 or inet:fqdn or inet:ipv4)

// Switch statement to handle different forms
switch $node.form() {

  ("hash:md5","hash:sha1"): {
      { | virustotal.file.enrich | virustotal.file.behavior }
  }

  "hash:sha256": {
      { | virustotal.file.enrich | virustotal.file.behavior | alienvault.otx.files }
  }

  "inet:fqdn": {

      // For FQDN zones
      {
          +:iszone=1 +:issuffix=0
          { | nettools.dns --type A AAAA CNAME MX NS SOA TXT | nettools.whois |␣
↪virustotal.pdns | virustotal.commfiles | alienvault.otx.domain | alienvault.otx.pdns }
      }

      // For FQDN subdomains
      {
          +:iszone=0 +:issuffix=0
          { | nettools.dns --type A AAAA CNAME | virustotal.pdns | virustotal.commfiles␣
↪| alienvault.otx.domain | alienvault.otx.pdns }
      }
  }

  "inet:ipv4": {

      +:type=unicast
      { | maxmind | nettools.dns | nettools.whois | virustotal.pdns | virustotal.
↪commfiles | censys.hosts.enrich | alienvault.otx.ip | alienvault.otx.pdns }
  }

  // Default case for any forms not specified above
  *: {
      // Do nothing
  }
}
```

Instead of running multiple Storm commands, an analyst can now run a single macro that will perform enrichment by "intelligently" querying all available data sources that can provide information about a particular kind of indicator.

Tip

This macro requires nodes as input; the macro's Storm does not lift any nodes to operate on. The initial filter statement is provided as basic error checking to ensure only nodes that the macro knows how to process are sent to the remaining macro code. (Technically, the final "default" switch option (`*: { }`) will handle any unknown forms; using the filter simply "drops" the nodes earlier in the pipeline. If you **want** any unhandled forms to pass through the macro (so they are available for additional Storm operations after the macro finishes), the filter should be removed.)

This macro can be executed "on demand" with the `macro.exec` command. If some condition should cause enrichment to occur automatically (e.g., applying a particular tag to a node), the macro could be configured to run as a trigger.

The example commands used in the macro are all installed by various Synapse Power-Ups.

The macro makes use of a *Switch Statement* (part of Storm's control flow features) to handle different kinds of nodes (forms).

Macros run inline by default; when a user calls a macro, the full macro code executes to completion. For enrichment-type macros, depending on the number of data sources queried and nodes created, enrichment can take some time to run, which can cause the Synapse interface (the Storm CLI or the Optic UI) to "block" for the user until the Storm executes in full. The macro code can be run asynchronously using the Storm *background* command. This "unblocks" the CLI / UI, but the full set of results from enrichment will not be available until the macro finishes executing.

Modify macro permissions - examples

You can modify permissions on a macro using the *$lib.macro.grant(name, scope, iden, level)* library to grant (or revoke) access. (In *Optic*, individual macro permissions can be managed through the Storm Editor Tool.) Use the *$lib.auth.users.byname(name)* and *$lib.auth.roles.byname(name)* libraries to obtain a user or role object and retrieve the associated identifier (iden).

Make user "ron the cat" co-admin of the "sinkhole.check" macro:

```
storm> $user=$lib.auth.users.byname('ron the cat') $iden=$user.iden $lib.macro.
↪grant(sinkhole.check,users,$iden,3)
```

Allow the "cattribution analysts" role to edit the "enrich" macro:

```
storm> $role=$lib.auth.roles.byname('cattribution analysts') $iden=$role.iden $lib.macro.
↪grant(enrich,roles,$iden,2)
```

Deny the "interns" role access to the "enrich" macro:

```
storm> $role=$lib.auth.roles.byname(interns) $iden=$role.iden $lib.macro.grant(enrich,
↪roles,$iden,0)
```

Tip

Easy permissions allow you to assign common permissions based on a corresponding integer value:

- 0 - Deny
- 1 - Read (including execute)
- 2 - Edit (modify content; includes Read)

- 3 - Admin (delete the object and modify its permissions; includes Edit)

See the Synapse Admin Guide for a detailed discussion of permissions, including easy permissions ("easy perms").

Dmons

A *Dmon* is a long-running or recurring query or process that runs continuously in the background, similar to a traditional Linux or Unix daemon.

Variables

Dmons will have the storm variable `$auto` populated when they run. The `$auto` variable is a dictionary which contains the following keys:

`$auto.iden`
: The identifier of the Dmon.

`$auto.type`
: The type of automation. For a Dmon this value will be `dmon`.

Note

If the variable `$auto` was captured during the creation of the Dmon, the variable will **not** be mapped in.

Syntax

Users can interact with dmons using the Storm *dmon* commands and the *$lib.dmon* Storm libraries.

3.7 Storm Advanced

The are several more advanced Storm language language concepts which are documented in the following sections.

3.7.1 Storm Reference - Advanced - Variables

Storm supports the use of **variables.** A *Variable* is a value that can change depending on conditions or on information passed to the Storm query. (Contrast this with a *Constant*, which is a value that is fixed and does not change.)

Variables can be used in a variety of ways, such as providing more efficient ways to reference node properties; facilitating bulk operations; or writing extensions to Synapse (such as Power-Ups) in Storm.

These documents approach variables and their use from a **user** standpoint and aim to provide sufficient background for users to understand and begin to use variables. They do not provide an in-depth discussion of variables and their use. See the *Synapse Developer Guide* for more developer-focused topics.

Note

It is important to keep the high-level *Storm Operating Concepts* in mind when writing Storm queries or code. This is especially true when working with variables, control flow, and other more advanced concepts.

Variable Concepts

Variable Scope

A variable's **scope** is its lifetime and under what conditions it may be accessed. There are two dimensions that impact a variable's scope: its **call frame** and its **runtime safety** ("runtsafety").

Call Frame

A variable's **call frame** is where the variable is used. The main Storm query starts with its own call frame, and each call to a "pure" Storm command, function, or subquery creates a new call frame. The new call frame gets a copy of all the variables from the calling call frame. Changes to existing variables or the creation of new variables within the new call frame do not impact the calling scope.

Runtsafe vs. Non-Runtsafe

An important distinction to keep in mind when using variables in Storm is whether the variable is runtime-safe (*Runtsafe*) or non-runtime safe (*Non-Runtsafe*).

A variable that is **runtsafe** has a value independent of any nodes passing through the Storm pipeline. For example, a variable whose value is explicitly set, such as `$string = mystring` or `$ipv4 = 8.8.8.8` is considered runtsafe because the value does not change / is not affected by the specific node passing through the Storm pipeline (i.e., by the Storm runtime).

A variable that is **non-runtsafe** has a value derived from a node passing through the Storm pipeline. For example, a variable whose value is set to a node property value may change based on the specific node passing through the Storm pipeline at the time. In other words, if your Storm query is operating on a set of DNS A nodes (`inet:dns:a`) and you define the variable `$fqdn = :fqdn` to set the variable to the value of the `:fqdn` property, the value of the variable will change based on the value of that property for the current `inet:dns:a` node.

All non-runtsafe variables are **scoped** to an individual node as it passes through the Storm pipeline. This means that a variable's value based on a given node is not available when processing a different node (at least not without using special commands, methods, or libraries). In other words, the path of a particular node as it passes through the Storm pipeline is its own scope.

> **Note**
>
> The "safe" in non-runtsafe should **not** be interpreted to mean that the use of non-runtsafe variables is somehow "risky" or involves insecure programming or processing of data. It simply means the value of the variable is not safe from changing (i.e., it may change) as the Storm pipeline progresses.

Types of Variables

Storm supports two types of variables:

- **Built-in variables.** Built-in variables facilitate many common Storm operations. They may vary in their scope and in the context in which they can be used.
- **User-defined variables** User-defined variables are named and defined by the user. They are most often limited in scope and facilitate operations within a specific Storm query.

Built-In Variables

Storm includes a set of built-in variables and associated variable methods and libraries that facilitate Cortex-wide, node-specific, and context-specific operations.

Built-in variables differ from user-defined variables in that built-in variable names:

- are initialized at Cortex start,
- are reserved,
- can be accessed automatically (i.e., without needing to define them) from within Storm, and
- persist across user sessions and Cortex reboots.

Tip

We cover a few of the **most common** built-in variables here. For additional detail on Synapse's Storm types (objects) and libraries, see the *Storm Library Documentation*.

Global Variables

Global variables operate independently of any node. That is, they can be invoked in a Storm query in the absence of any nodes in the Storm execution pipeline (though they can also be used when performing operations on nodes).

$lib

The library variable (`$lib`) is a built-in variable that provides access to the global Storm library. In Storm, libraries are accessed using built-in variable names (e.g., `$lib.print()`).

Libraries provide access to a wide range of additional functionality with Storm. See the *Storm Libraries* technical documentation for descriptions of the libraries available within Storm.

Node-Specific Variables

Storm includes node-specific variables that are designed to operate on or in conjunction with nodes and require one or more nodes in the Storm pipeline.

Note

Node-specific variables are always non-runtsafe.

$node

The node variable (`$node`) is a built-in Storm variable that **references the current node in the Storm pipeline.** Specifically, this variable contains the inbound node's node object, and provides access to the node's attributes, properties, and associated attribute and property values.

Invoking this variable during a Storm query is useful when you want to:

- access the entire raw node object,
- store the value of the current node before pivoting to another node, or
- use an aspect of the current node in subsequent query operations.

The `$node` variable supports a number of built-in **methods** that can be used to access specific data or properties associated with a node. See the technical documentation for the *node* object or the *$node* section of the *Storm Reference - Advanced - Methods* user documentation for additional detail and examples.

$path

The path variable (`$path`) is a built-in Storm variable that **references the path of a node as it travels through the pipeline of a Storm query.**

The `$path` variable is not used on its own, but in conjunction with its methods. See the technical documentation for the *node:path* object or the *$path* section of the *Storm Reference - Advanced - Methods* user documentation for additional detail and examples.

Trigger-Specific Variables

A *Trigger* is used to support automation within a Cortex. Triggers use events (such as creating a node, setting a node's property value, or applying a tag to a node) to fire ("trigger") the execution of a predefined Storm query. Storm uses a built-in variable specifically within the context of trigger-initiated Storm queries.

$tag

> **Warning**
>
> The `$tag` variable is deprecated and will be removed in Synapse `v3.0.0`. See the *Variables* documentation for details on using the `$auto` variable instead.

For triggers that fire on `tag:add` events, the `$tag` variable represents the name of the tag that caused the trigger to fire.

For example:

You write a trigger to fire when any tag matching the expression `#foo.bar.*` is added to a `file:bytes` node. The trigger executes the following Storm command:

```
-> hash:md5 [ +#$tag ]
```

Because the trigger uses a tag glob ("wildcard") expression, it will fire on any tag that matches that expression (e.g., `#foo.bar.hurr`, `#foo.bar.derp`, etc.). The Storm snippet above will take the inbound `file:bytes` node, pivot to the file's associated MD5 node (`hash:md5`), and apply the same tag that fired the trigger to the MD5.

See the *Triggers* section of the *Storm Reference - Automation* document and the Storm *trigger* command for a more detailed discussion of triggers and associated Storm commands.

Ingest Variables

Synapse's *csvtool* can be used to ingest (import) data into Synapse from a comma-separated value (CSV) file. Storm includes a built-in variable to facilitate bulk data ingest using CSV.

$rows

The `$rows` variable refers to the set of rows in a CSV file. When ingesting data into Synapse, CSVTool (or the Optic Ingest Tool) reads a CSV file and a file containing a Storm query that tells Synapse how to process the CSV data. The Storm query is typically constructed to iterate over the set of rows (`$rows`) using a *For Loop* that uses user-defined variables to reference each field (column) in the CSV data.

For example:

```
for ($var1, $var2, $var3, $var4) in $rows { <do stuff> }
```

Tip

The commercial Synapse UI (*Optic*) includes an Ingest Tool that can ingest data in CSV, JSONL, or JSON format. The `$rows` variable is used in the Ingest Tool to refer to either the set of rows in a CSV file or the set of lines ("rows") in a JSONL file. In addition, the `$blob` variable is used to refer to the entire JSON blob when ingesting JSON data. See the ingest examples section of the Ingest Tool documentation for additional detail.

User-Defined Variables

User-defined variables can be defined in one of two ways:

- At runtime (i.e., within the scope of a specific Storm query). This is the most common use for user-defined variables.
- Mapped via options passed to the Storm runtime (for example, when using the *Cortex* API). This method is less common for everyday users. When defined in this manner, user-defined variables will behave as though they are built-in variables that are runtsafe.

Variable Names

All variable names in Storm (including built-in variables) begin with a dollar sign (`$`). A variable name can be any alphanumeric string, **except for** the name of a built-in variable (see *Built-In Variables*), as those names are reserved. Variable names are case-sensitive; the variable `$MyVar` is different from `$myvar`.

Note

Storm will not **prevent** you from using the name of a built-in variable to define a variable (such as `$node = 7`). However, doing so may result in undesired effects or unexpected errors due to the variable name collision.

Defining Variables

Within Storm, a user-defined variable is defined using the syntax:

```
$<varname> = <value>
```

The variable name must be specified first, followed by the equals sign and the value of the variable itself.

`<value>` can be:

- an explicit value (literal),
- a node property (secondary or universal),
- a built-in variable or method (e.g., can allow you to access a node's primary property, form name, or other elements),
- a tag (allows you to access timestamps associated with a tag),
- a library function,
- an expression, or
- an embedded Storm query.

Examples

The examples below use the `$lib.print()` library function to display the **value** of the user-defined variable being set. (This is done for illustrative purposes only; `$lib.print()` is not required in order to use variables or methods.)

In some instances we include a second example to illustrate how a particular kind of variable assignment might be used in a real-world scenario. While we have attempted to use relatively simple examples for clarity, some examples may leverage additional Storm features such as subqueries, subquery filters, or control flow elements such as for loops or switch statements.

Tip

Keep Storm's operation chaining, pipeline, and node consumption aspects in mind when reviewing the following examples. When using `$lib.print()` to display the value of a variable, the queries below will:

- Lift the specified node(s).
- Assign the variable. Note that assigning a variable has no impact on the nodes themselves.
- Print the variable's value using `$lib.print()`.
- Return any nodes still in the pipeline. Because variable assignment doesn't impact the node(s) or transform the working set, the nodes remain in the pipeline and are returned (displayed) at the CLI.

The effect of this process is that for each node in the Storm query pipeline, the output of `$lib.print()` is displayed, followed by the relevant node.

In some examples the Storm *spin* command is used to suppress display of the node itself. We do this for cases where displaying the node detracts from illustrating the value of the variable.

Explicit values / literals

You can assign an explicit, unchanging value to a variable.

- Assign the value 5 to the variable `$threshold`:

```
storm> $threshold=5 $lib.print($threshold)
5
```

Example:

- Tag `file:bytes` nodes that have a number of AV scanner results higher than a given threshold for review:

```
storm> $threshold=5 file:bytes +{ -> it:av:scan:result } >= $threshold [ +#review ]
file:bytes=sha256:00007694135237ec8dc52340070438146O8f239befdfc8a61b992e4d09e0cf3f
        :sha256 = 00007694135237ec8dc52340070438146O8f239befdfc8a61b992e4d09e0cf3f
        .created = 2025/07/03 18:38:51.960
        #review
```

Tip

The example above uses a subquery filter (*Subquery Filters*) to pivot to the `it:av:scan:result` nodes associated with the `file:bytes` node, and compares the number of AV results to the value of the `$threshold` variable.

Node properties

You can assign the value of a particular node property (secondary or universal) to a variable.

- **Secondary property:** Assign the `:user` property from an Internet-based account (`inet:web:acct`) to the variable `$user`:

```
storm> inet:web:acct=(twitter.com,hacks4cats) $user=:user $lib.print($user)
hacks4cats
inet:web:acct=twitter.com/hacks4cats
        :email = ron@protonmail.com
        :site = twitter.com
        :user = hacks4cats
        .created = 2025/07/03 18:38:51.996
```

- **Universal property:** Assign the `.seen` universal property from a DNS A node to the variable `$time`:

```
storm> inet:dns:a=(woot.com,1.2.3.4) $time=.seen $lib.print($time)
(1543289294000, 1565893967000)
inet:dns:a=('woot.com', '1.2.3.4')
        :fqdn = woot.com
        :ipv4 = 1.2.3.4
        .created = 2025/07/03 18:38:52.013
        .seen = ('2018/11/27 03:28:14.000', '2019/08/15 18:32:47.000')
```

Note

In the output above, the variable value is displayed as a pair of epoch milliseconds, which is how Synapse stores date/time values.

Example:

- Given a DNS A record observed within a specific time period, find other DNS A records that pointed to the same IP address in the same time window:

```
storm> inet:dns:a=(woot.com,1.2.3.4) $time=.seen -> inet:ipv4 -> inet:dns:a +.seen@=$time
inet:dns:a=('woot.com', '1.2.3.4')
        :fqdn = woot.com
        :ipv4 = 1.2.3.4
        .created = 2025/07/03 18:38:52.013
        .seen = ('2018/11/27 03:28:14.000', '2019/08/15 18:32:47.000')
inet:dns:a=('hurr.net', '1.2.3.4')
        :fqdn = hurr.net
        :ipv4 = 1.2.3.4
        .created = 2025/07/03 18:38:52.022
        .seen = ('2018/12/09 06:02:53.000', '2019/01/03 11:27:01.000')
```

Tip

An interval (such as a `.seen` property) consists of a **pair** of date/time values. In the example above, the value of the variable `$time` is the combined pair (min / max) of times.

To access the "first seen" (minimum) or "last seen" (maximum) time values separately, use a pair of variables in the assignment:

```
($min, $max) = .seen
```

Built-in variables and methods

Built-In Variables (including *Node-Specific Variables*) allow you to reference common Synapse objects and their associated components. For many common user-facing tasks, the `$node` variable and its methods are the most useful.

- **Node object:** Assign an entire FQDN node to the variable `$fqdn` using the `$node` built-in variable:

```
storm> inet:fqdn=mail.mydomain.com $fqdn=$node $lib.print($fqdn)
Node{(('inet:fqdn', 'mail.mydomain.com'), {'iden':
↪'6511121afd61bf42cb4d14aed4f61daf62ebfc76042dba12d95a6506dd8b6cc4', 'tags': {}, 'props
↪': {'.created': 1751567932030, 'host': 'mail', 'domain': 'mydomain.com', 'issuffix': 0,
↪ 'iszone': 0, 'zone': 'mydomain.com'}, 'tagprops': {}, 'nodedata': {}})}
inet:fqdn=mail.mydomain.com
        :domain = mydomain.com
        :host = mail
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:52.030
```

Note

When you use the built-in variable `$node` to assign a value to a variable, the value is set to the **entire node object** (refer to the output above). For common user-facing tasks, it is less likely that users will need "the entire node"; more often, they need to refer to a **component** of the node, such as its primary property value, form name, or associated tags.

For some use cases, Synapse and Storm can "understand" which component of the node you want when referring to the full `$node` object. However, you can always be explicit by using the appropriate **method** to access the component you want (such as `$node.value()` or `$node.form()`).

See the technical documentation for the *node* object or the *$node* section of the *Storm Reference - Advanced - Methods* user documentation for additional detail and examples when using methods associated with the `$node` built-in variable.

- **Node method:** Assign the **primary property value** of a domain node to the variable `$fqdn` using the `$node.value()` method:

```
storm> inet:fqdn=mail.mydomain.com $fqdn=$node.value() $lib.print($fqdn)
mail.mydomain.com
inet:fqdn=mail.mydomain.com
        :domain = mydomain.com
        :host = mail
        :issuffix = false
        :iszone = false
        :zone = mydomain.com
        .created = 2025/07/03 18:38:52.030
```

- Find the DNS A records associated with a given domain where the PTR record for the IP matches the FQDN:

```
storm> inet:fqdn=mail.mydomain.com $fqdn=$node.value() -> inet:dns:a +{ -> inet:ipv4␣
↪+:dns:rev=$fqdn }
inet:dns:a=('mail.mydomain.com', '25.25.25.25')
        :fqdn = mail.mydomain.com
```

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```
        :ipv4 = 25.25.25.25
        .created = 2025/07/03 18:38:52.037
```

Tip

The example above uses a subquery filter (see *Subquery Filters*) to pivot from the DNS A records to associated IPv4 nodes (`inet:ipv4`) and checks whether the `:dns:rev` property matches the FQDN in the variable `$fqdn`.

Tags

Recall that tags are both **nodes** (`syn:tag=my.tag`) and **labels** that can be applied to other nodes (`#my.tag`). Tags can also have optional timestamps (a time interval) associated with them.

There are various ways to assign tags as variables, depending on what part of the tag you want to access. Many of these use cases are covered above so are briefly illustrated here.

- **Tag value:** Assign an explicit tag value (literal) to the variable `$mytag`:

```
storm> $mytag=cno.infra.dns.sinkhole
```

- **Tag on a node:** Given a `hash:md5` node, assign any malware tags (tags matching the glob pattern `cno.mal.*`) to the variable `$mytags` using the `$node.tags()` method:

```
storm> hash:md5=d41d8cd98f00b204e9800998ecf8427e $mytags=$node.tags(cno.mal.*) $lib.
↪print($mytags)
['cno.mal.foo', 'cno.mal.bar']
hash:md5=d41d8cd98f00b204e9800998ecf8427e
        .created = 2025/07/03 18:38:52.050
        #cno.mal.bar
        #cno.mal.foo
        #cno.threat.baz
```

Tip

In the example above, the value of the variable `$mytags` is the **set** of two tags, `cno.mal.foo` and `cno.mal.bar`, because the MD5 hash node has two tags that match the pattern `cno.mal.*`.

To assign the set of any / all tags on a node to a variable, simply use `$mytags=$node.tags()`.

Note that you can also use `$node.tags()` directly (this method **always** refers to the full set of tags on the current node) without explicitly assigning a separate variable.)

Where the value of a variable is a **set**, a *For Loop* is often used to "do something" based on each value in the set.

Example

- Given an MD5 hash, copy any `cno.mal.*` tags from the hash to the associated file (`file:bytes` node):

```
storm> hash:md5=d41d8cd98f00b204e9800998ecf8427e $mytags=$node.tags(cno.mal.*) for $tag␣
↪in $mytags { -> file:bytes [ +#$tag ] }
file:bytes=sha256:e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
        :md5 = d41d8cd98f00b204e9800998ecf8427e
        :sha1 = da39a3ee5e6b4b0d3255bfef95601890afd80709
```

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```
        :sha256 = e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
        :size = 0
        .created = 2025/07/03 18:38:52.058
        #cno.mal.foo
file:bytes=sha256:e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
        :md5 = d41d8cd98f00b204e9800998ecf8427e
        :sha1 = da39a3ee5e6b4b0d3255bfef95601890afd80709
        :sha256 = e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855
        :size = 0
        .created = 2025/07/03 18:38:52.058
        #cno.mal.bar
        #cno.mal.foo
```

The output above includes two "copies" of the `file:bytes` node because the node is output twice - once for each iteration of the for loop. The first iteration copies / applies the `cno.mal.foo` tag; the second iteration applies the `cno.mal.bar` tag. For a detailed explanation of this behavior, see *Advanced Storm - Example*.

Tip

The above example explicitly creates and assigns the variable `$mytags` and then uses that variable in a *For Loop*. In this case you can shorten the syntax by skipping the explicit variable assignment and using the `$node.tags()` method directly:

```
hash:md5=d41d8cd98f00b204e9800998ecf8427e for $tag in $node.tags(cno.mal.*) { ->␣
↪file:bytes [ +#$tag ] }
```

- **Tag timestamps:** Assign the times associated with Threat Group 20's control of a malicious domain to the variable `$time`:

```
storm> inet:fqdn=evildomain.com $time=#cno.threat.t20.own $lib.print($time)
(1567900800000, 1631059200000)
inet:fqdn=evildomain.com
        :domain = com
        :host = evildomain
        :issuffix = false
        :iszone = true
        :zone = evildomain.com
        .created = 2025/07/03 18:38:52.065
        #cno.threat.t20.own = (2019/09/08 00:00:00.000, 2021/09/08 00:00:00.000)
```

Example

- Find DNS A records for any subdomain associated with a Threat Group 20 FQDN (zone) during the time they controlled the domain:

```
storm> inet:fqdn#cno.threat.t20.own $time=#cno.threat.t20.own -> inet:fqdn:zone ->␣
↪inet:dns:a +.seen@=$time
inet:dns:a=('www.evildomain.com', '1.2.3.4')
        :fqdn = www.evildomain.com
        :ipv4 = 1.2.3.4
        .created = 2025/07/03 18:38:52.073
        .seen = ('2020/07/12 00:00:00.000', '2020/12/13 00:00:00.000')
```

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```
inet:dns:a=('smtp.evildomain.com', '5.6.7.8')
        :fqdn = smtp.evildomain.com
        :ipv4 = 5.6.7.8
        .created = 2025/07/03 18:38:52.075
        .seen = ('2020/04/04 00:00:00.000', '2020/08/02 00:00:00.000')
```

Library Functions

Storm types (Storm objects) and Storm libraries allow you to inspect, edit, and otherwise work with data in Synapse in various ways. You can assign a value to a variable based on the output of a method or library.

A full discussion of this topic is outside of the scope of this user guide. See *Storm Library Documentation* for additional details.

- Assign the current time to the variable `$now` using `$lib.time.now()`:

```
storm> $now=$lib.time.now() $lib.print($now)
1751567932083
```

- Convert an epoch milliseconds integer into a human-readable date/time string using `$lib.time.format()`:

```
storm> $now=$lib.time.now() $time=$lib.time.format($now, '%Y/%m/%d %H:%M:%S') $lib.print(
↪$time)
2025/07/03 18:38:52
```

Expressions

You can assign a value to a variable based on the computed value of an expression:

- Use an expression to increment the variable `$x`:

```
storm> $x=5 $x=($x + 1) $lib.print($x)
6
```

Embedded Storm query

You can assign a value to a variable based on the output of a Storm query. To denote the Storm query to be evaluated, enclose the query in curly braces (`{ <storm query> }`).

- Assign an `ou:org` node's guid value to the variable `$org` by lifting the associated org node using its `:name` property:

```
storm> $org={ ou:org:name=vertex } $lib.print($org)
Node{(('ou:org', 'e729575279cd20b8f653b68ec6d90f23'), {'iden':
↪'e271b95402b53bcdaf120406959b75e9473eb2934898cda960275f2e5074a3e9', 'tags': {}, 'props
↪': {'.created': 1751567932112, 'name': 'vertex', 'loc': 'us.va', 'url': 'https://
↪vertex.link/'}, 'tagprops': {}, 'nodedata': {}})}
```

3.7.2 Storm Reference - Advanced - Methods

Some of Storm's *Built-In Variables* support **methods** used to perform various actions on the object represented by the variable.

A **subset** of the built-in variables / objects that support methods, along with a few commonly used methods and examples, are listed below. For full detail, refer to the *Storm Types* technical reference.

The built-in *$lib* variable is used to access Storm libraries. See the *Storm Libraries* technical reference for additional detail on available libraries.

> **Note**
>
> In the examples below, the `$lib.print()` library function is used to display the value returned when a specific built-in variable or method is called. This is done for illustrative purposes only; `$lib.print()` is not required in order to use variables or methods.
>
> In some examples the Storm *spin* command is used to suppress display of the node itself. We do this for cases where displaying the node detracts from illustrating the value of the variable.

In some instances we have included "use-case" examples, where the variable or method is used in a sample query to illustrate a possible practical use. These represent exemplar Storm queries for how a variable or method might be used in practice. While we have attempted to use relatively simple examples for clarity, some examples may leverage additional Storm features such as subqueries, subquery filters, or control flow elements such as for loops or switch statements.

$node

$node is a built-in Storm variable that references **the current node in the Storm query pipeline.** `$node` can be used as a variable on its own or with the example methods listed below. See the *node* section of the *Storm Types* technical documentation for a full list.

> **Note**
>
> As the `$node` variable and related methods reference the current node in the Storm pipeline, any Storm logic referencing `$node` will fail to execute if the pipeline does not contain a node (i.e., based on previously executing Storm logic).

Examples

- Print the value of `$node` for an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node) | spin
Node{(('inet:dns:a', ('woot.com', 917309932)), {'iden':
↪'01235b5877954084e798f09ba3fd3f1cda2e7b41d79b752b80acbed1b609cbaa', 'tags': {}, 'props
↪': {'.created': 1751567979684, 'fqdn': 'woot.com', 'ipv4': 917309932, '.seen':␣
↪(1482957991000, 1482957991001)}, 'tagprops': {}, 'nodedata': {}})}
```

- Print the value of `$node` for an `inet:fqdn` node with tags present:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node) | spin
Node{(('inet:fqdn', 'aunewsonline.com'), {'iden':
↪'53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4', 'tags': {'rep':␣
↪(None, None), 'rep.mandiant': (None, None), 'rep.mandiant.apt1': (None, None), 'cno':␣
↪(None, None), 'cno.infra': (None, None), 'cno.infra.dns': (None, None), 'cno.infra.dns.
↪sink': (None, None), 'cno.infra.dns.sink.hole': (None, None), 'cno.infra.dns.sink.hole.
↪kleissner': (1385424000000, 1480118400000)}, 'props': {'.created': 1751567979751, 'host
↪': 'aunewsonline', 'domain': 'com', 'issuffix': 0, 'iszone': 1, 'zone': 'aunewsonline.
↪com'}, 'tagprops': {}, 'nodedata': {}})}
```

> **Note**
>
> The value of `$node` is the entire node object and associated properties and tags, as opposed to a specific aspect of

the node, such as its iden or primary property value.

As demonstrated below, some node constructors can "intelligently" leverage the relevant aspects of the full node object (the value of the `$node` variable) when creating new nodes.

- Use the `$node` variable to create multiple whois name server records (`inet:whois:recns`) for the name server `ns1.somedomain.com` from a set of inbound whois record nodes for the domain `woot.com`:

```
storm> inet:whois:rec:fqdn=woot.com [ inet:whois:recns=(ns1.somedomain.com,$node) ]
inet:whois:recns=('ns1.somedomain.com', ('woot.com', '2019/06/13 00:00:00.000'))
        :ns = ns1.somedomain.com
        :rec = ('woot.com', '2019/06/13 00:00:00.000')
        :rec:asof = 2019/06/13 00:00:00.000
        :rec:fqdn = woot.com
        .created = 2025/07/03 18:39:39.778
inet:whois:rec=('woot.com', '2019/06/13 00:00:00.000')
        :asof = 2019/06/13 00:00:00.000
        :fqdn = woot.com
        :text = ns1.somedomain.com
        .created = 2025/07/03 18:39:39.771
inet:whois:recns=('ns1.somedomain.com', ('woot.com', '2019/09/12 00:00:00.000'))
        :ns = ns1.somedomain.com
        :rec = ('woot.com', '2019/09/12 00:00:00.000')
        :rec:asof = 2019/09/12 00:00:00.000
        :rec:fqdn = woot.com
        .created = 2025/07/03 18:39:39.780
inet:whois:rec=('woot.com', '2019/09/12 00:00:00.000')
        :asof = 2019/09/12 00:00:00.000
        :fqdn = woot.com
        :text = ns1.somedomain.com
        .created = 2025/07/03 18:39:39.772
```

In the example above, the *$node.value()* method could have been used instead of `$node` to create the `inet:whois:recns` nodes. In this case, the node constructor knows to use the primary property value from the `inet:whois:rec` nodes to create the `inet:whois:recns` nodes.

$node.form()

The `$node.form()` method returns the **form** of the current node in the Storm pipeline.

The method takes no arguments.

Examples

- Print the form of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.form()) | spin
inet:dns:a
```

$node.globtags()

The `$node.globtags()` method returns a **list of string matches from the set of tags applied to the current node** in the Storm pipeline.

The method takes a single argument consisting of a wildcard expression for the substring to match.

- The argument requires at least one wildcard (*) representing the substring(s) to match.
- The method performs an **exclusive match** and returns **only** the matched substring(s), not the entire tag containing the substring match.
- The wildcard (*) character can be used to match full or partial tag elements.
- Single wildcards are constrained by tag element boundaries (i.e., the dot (.) character). Single wildcards can match an entire tag element or a partial string within an element.
- The double wildcard (**) can be used to match across any number of tag elements; that is, the double wildcard is not constrained by the dot boundary.
- If the string expression starts with a wildcard, it must be enclosed in quotes in accordance with the use of *Entering Literals*.

See *$node.tags()* to access full tags (vs. tag substrings).

Examples

- Print the set of top-level (root) tags from any tags applied to the current node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.globtags("*")) | spin
['rep', 'cno']
```

- Print the list of numbers associated with any threat group tags (e.g., such as `cno.threat.t42.own` or `cno.threat.t127.use`) applied to the current node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.globtags(cno.threat.t*)) | spin
['83']
```

In the example above, `$node.globtags()` returns the matching substring only ("83"), which is the portion matching the wildcard; it does not return the "t" character.

- Print the list of organizations and associated names (e.g., threat group or malware family names) from any third-party ("rep") tags applied to the current node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.globtags(rep.*.*)) | spin
[('mandiant', 'apt1'), ('symantec', 'commentcrew'), ('mcafee', 'commentcrew'), (
↪'crowdstrike', 'commentpanda')]
```

- Print all sub-tags for any tags starting with "foo" applied to the current node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.globtags(foo.**)) | spin
['bar', 'bar.baz', 'derp']
```

$node.iden()

The `$node.iden()` method returns the *Iden* of the current node in the Storm pipeline.

The method takes no arguments.

Examples

- Print the iden of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.iden()) | spin
01235b5877954084e798f09ba3fd3f1cda2e7b41d79b752b80acbed1b609cbaa
```

$node.isform()

The `$node.isform()` method returns a Boolean value (true / false) for whether the current node in the Storm pipeline is of a specified form.

The method takes a single argument of a form name.

Examples

- Print the Boolean value for whether a node is an `inet:dns:a` form:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.isform(inet:dns:a)) | spin
true
```

- Print the Boolean value for whether a node is an `inet:fqdn` form:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.isform(inet:fqdn))  | spin
false
```

$node.ndef()

The `$node.ndef()` method returns the *Ndef* ("node definition") of the current node in the Storm pipeline.

The method takes no arguments.

Examples

- Print the ndef of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.ndef()) | spin
('inet:dns:a', ('woot.com', 917309932))
```

$node.repr()

The `$node.repr()` method returns the human-friendly *Repr* ("representation") of the specified property of the current node in the Storm pipeline (as opposed to the raw value stored by Synapse).

The method can optionally take one argument.

- If no arguments are provided, the method returns the repr of the node's primary property value.
- If an argument is provided, it should be the string of the secondary property name (i.e., without the leading colon (`:`) from relative property syntax).
- If a universal property string is provided, it must be preceded by the dot / period (`.`) and enclosed in quotes in accordance with the use of *Entering Literals*.

See *$node.value()* to return the raw value of a property.

Examples

- Print the repr of the primary property value of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.repr())  | spin
('woot.com', '54.173.9.236')
```

- Print the repr of the `:ipv4` secondary property value of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.repr(ipv4)) | spin
54.173.9.236
```

- Print the repr of the `.seen` universal property value of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.repr(".seen")) | spin
('2016/12/28 20:46:31.000', '2016/12/28 20:46:31.001')
```

$node.tags()

The `$node.tags()` method returns a **list of the tags applied to the current node** in the Storm pipeline.

The method can optionally take one argument.

- If no arguments are provided, the method returns the full list of all tags applied to the node.
- An optional argument consisting of a wildcard string expression can be used to match a subset of tags.
  - If a string is used with no wildcards, the string must be an exact match for the tag element.
  - The wildcard (`*`) character can be used to match full or partial tag elements.
  - The method performs an **inclusive match** and returns the full tag for all tags that match the provided expression.
  - Single wildcards are constrained by tag element boundaries (i.e., the dot (`.`) character). Single wildcards can match an entire tag element or a partial string within an element.
  - The double wildcard (`**`) can be used to match across any number of tag elements; that is, the double wildcard is not constrained by the dot boundary.
  - If the string expression starts with a wildcard, it must be enclosed in quotes in accordance with the use of *Entering Literals*.

See *$node.globtags()* to access tag substrings (vs. full tags).

Examples

- Print the list of all tags associated with an `inet:fqdn` node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.tags()) | spin
['rep', 'rep.mandiant', 'rep.mandiant.apt1', 'cno', 'cno.infra', 'cno.infra.dns', 'cno.
↪infra.dns.sink', 'cno.infra.dns.sink.hole', 'cno.infra.dns.sink.hole.kleissner', 'rep.
↪symantec', 'rep.symantec.commentcrew', 'rep.mcafee', 'rep.mcafee.commentcrew', 'rep.
↪crowdstrike', 'rep.crowdstrike.commentpanda', 'cno.threat', 'cno.threat.t83', 'cno.
↪threat.t83.own', 'foo', 'foo.bar', 'foo.bar.baz', 'faz', 'faz.baz', 'foo.derp']
```

- Print the tag that exactly matches the string "cno" if present on an `inet:fqdn` node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.tags(cno)) | spin
['cno']
```

- Print the list of all tags two elements in length that start with "foo":

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.tags(foo.*)) | spin
['foo.bar', 'foo.derp']
```

- Print the list of all tags of any length that start with "f":

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.tags(f**)) | spin
['foo', 'foo.bar', 'foo.bar.baz', 'faz', 'faz.baz', 'foo.derp']
```

- Print the list of all tags of any length whose first element is "rep" and whose third element starts with "comment":

```
storm> inet:fqdn=aunewsonline.com $lib.print($node.tags(rep.*.comment*)) | spin
['rep.symantec.commentcrew', 'rep.mcafee.commentcrew', 'rep.crowdstrike.commentpanda']
```

$node.value()

The `$node.value()` method returns the raw value of the primary property of the current node in the Storm pipeline.

The method takes no arguments.

See *$node.repr()* to return the human-friendly value of a property.

Note

The `$node.value()` method is only used to return the primary property value of a node. Secondary property values can be accessed via a user-defined variable (i.e., `$myvar = :<prop>`).

Examples

- Print the value of the primary property value of an `inet:dns:a` node:

```
storm> inet:dns:a=(woot.com,54.173.9.236) $lib.print($node.value()) | spin
('woot.com', 917309932)
```

$path

$path is a built-in Storm variable that **references the path of a node as it travels through the pipeline of a Storm query.**

The `$path` variable is generally not used on its own, but in conjunction with its methods. See the *node:path* section of the *Storm Types* technical documentation for a full list.

$path.idens()

The `$path.idens()` method returns the list of idens (*Iden*) of each node in a node's path through a Storm query.

The method takes no arguments.

Examples

- Print the list of iden(s) for the path of a single lifted node:

```
storm> inet:fqdn=aunewsonline.com $lib.print($path.idens()) | spin
['53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4']
```

Note

A lift operation contains no pivots (i.e., no "path"), so the method returns only the iden of the lifted node.

- Print the list of idens for the path of a single node through two pivots to a single end node:

```
storm> inet:fqdn=aunewsonline.com -> inet:dns:a +:ipv4=67.215.66.149 -> inet:ipv4 $lib.
↪print($path.idens())
['53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4',
↪'07c79039d00b4391699c9328dc6ccaf864d84d0b38545ded117d1d7ccc6e366c',
```

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```
↪'9596f5253f25ee74689157706ddf3b459874a6d3cb0adfce4e07018ec8162fc1']
inet:ipv4=67.215.66.149
        :type = unicast
        .created = 2025/07/03 18:39:39.839
```

The example above returns the idens of the original `inet:fqdn` node, the `inet:dns:a` node with the specified IP, and the `inet:ipv4` node.

- Print the list of idens for the path of a single node through two pivots to three different end nodes (i.e., three paths):

```
storm> inet:fqdn=aunewsonline.com -> inet:dns:a -> inet:ipv4 $lib.print($path.idens())
['53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4',
↪'07c79039d00b4391699c9328dc6ccaf864d84d0b38545ded117d1d7ccc6e366c',
↪'9596f5253f25ee74689157706ddf3b459874a6d3cb0adfce4e07018ec8162fc1']
inet:ipv4=67.215.66.149
        :type = unicast
        .created = 2025/07/03 18:39:39.839
['53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4',
↪'0dde48198d3bcc58b40ab82155b218ecd48b533b964d5d2fa3e7453d990541f5',
↪'5af9ae36456988c24edecafa739da75231c067ba3d104a2746e9616ea7a312d6']
inet:ipv4=184.168.221.92
        :type = unicast
        .created = 2025/07/03 18:39:39.840
['53aa7a2f7125392302c36247b97569dd84a7f3fe9e92eb99abd984349dc53fe4',
↪'1c53655a7f3bc67be338cde70d6565d4bc84d343d37513679d4efcd0ec59d3fe',
↪'acecd1f87d1dfc31148bf0ed417b69fde1c77eb2e7effdea434765fe8b759351']
inet:ipv4=104.239.213.7
        :type = unicast
        .created = 2025/07/03 18:39:39.841
```

In the example above, the FQDN has three DNS A records, thus there are three different paths that the original node takes through the query.

3.7.3 Storm Reference - Advanced - Control Flow

Storm includes a number of common programming control flow structures to facilitate more advanced Storm queries. These include:

- *Init Block*
- *Fini Block*
- *Empty Block*
- *If-Else Statement*
- *Switch Statement*
- *For Loop*
- *While Loop*
- *Try… Catch Statement*

The examples below are for illustrative purposes. This guide is **not** meant as a Storm programming tutorial. The intent is to introduce Storm users who may not be familiar with programming concepts (or programmers who are learning to program in Storm) to possible use cases and simple examples for these structures. We've included some *Advanced*

Storm - Tips and an *Advanced Storm - Example* to provide some pointers and an illustration of how Storm's "pipeline" behavior and control flow structures may interact.

See the following User Guide and Reference sections for additional information:

- *Storm Reference - Advanced - Variables*
- *Storm Reference - Advanced - Methods*
- *Storm Reference - Advanced - Functions*
- *Storm Libraries*
- *Storm Types*

Storm Developers may also wish to refer to the *Synapse Developer Guide*.

Advanced Storm - Tips

Storm Operating Concepts

It is important to keep the high-level *Storm Operating Concepts* in mind when writing Storm queries or code. These concepts are **critical** to writing more advanced Storm - remembering these fundamentals can save you time and headaches trying to debug a Storm query that is not behaving the way you think it should.

> **Tip**
>
> See the *Advanced Storm - Example* below for an illustration of how these concepts may impact your Storm in unexpected ways.

Storm Debugging Tips

A few helpful tips when writing and debugging advanced Storm:

Be aware of your pipeline. That is, understand what node or nodes are in your **current working set** at any point in your query. A significant part of Storm troubleshooting comes down to figuring out that the current working set is not what you think it is.

Be aware of your variables. Storm supports both runtime-safe ("runtsafe") and non-runtime-safe ("non-runtsafe") variables. Non-runtsafe variables have values that may **change** based on the current node in the Storm pipeline. Another significant part of Storm troubleshooting involves understanding the values of any variables at any given point in your Storm code. (See *Variable Concepts* for additional information.)

Operations may execute multiple times. Because each node passes through each operation in a Storm query individually, operations execute more than once (typically once for each node in the pipeline as it passes through that operation). This includes control flow operations, such as for loops! If you don't account for this behavior with control flow operations in particular, it can result in behavior such as:

- An exponentially increasing working set (if each node passing through an operation generates multiple results, and the results are not deduplicated / uniq'ed appropriately).
- A variable that is set by an operation being consistently changed (re-set) for each node passing through the operation (commonly resulting in "last node wins" with respect to variable assignment).
- A variable that **fails** to be set for a node that does **not** pass through the operation where the variable is assigned (resulting in a `NoSuchVar` error).

Use subqueries…but understand how they work. Unlike most Storm operations and commands, subqueries **do not consume** nodes - by default, what goes into a subquery comes out of a subquery, regardless of what happens inside the subquery itself. This means you can use subqueries with advanced Storm to isolate certain operations and keep the

"primary" nodes passing through the Storm pipeline consistent. That said, a node still has to pass **into** a subquery for the Storm inside a subquery to run. If your subquery **fails** to execute, it may be because nothing is going in to it.

Use functions to encapsulate operations. As Storm increases in length or complexity, it can become increasingly challenging to keep track of your pipeline and working set. Functions can be used to simplify your Storm by isolating specific Storm logic within a function.

Start small and add to your Storm incrementally. It's easier to verify that smaller Storm queries execute correctly and then build on that code than to try and write a more advanced query all at once and try to figure out where things aren't working.

As with all debugging, print statements are your friend. Scatter $lib.print() or $lib.pprint() statements generously throughout your Storm during testing. You can print message strings at various points during execution:

```
$lib.print("Hey! This worked!")
```

You can print the value of a variable, to check its value at a given point in your query:

```
inet:ipv4=1.2.3.4
$asn=:asn
$lib.print($asn)
```

You can also print values associated with the node(s) in the current working set, using the various methods associated with the $node Storm type. (See *Storm Reference - Advanced - Methods* for a user-focused introduction to methods, or *node* in the detailed Storm Libraries / Storm Types documentation for a more technical discussion.)

```
$lib.print($node.ndef())
```

Control Flow Operations

> **Tip**
>
> The examples below are Storm excerpts used to illustrate specific concepts, but do not represent complete Storm queries / Storm code.

Init Block

An **init block** allows you to execute the specified Storm **once** at the beginning of your Storm query, before nodes enter the Storm pipeline. This allows you to use Storm to perform a set of operations a **single** time only.

See also *Fini Block*.

Syntax:

```
init { <storm> }
```

Example:

You want to use an init block to initialize a set of variables that will be used later in the Storm query. Initializing the variables to default values can:

- Explicitly set a variable value up front.
- Specify default values for variables in the event they are **not** set during subsequent execution (e.g., due to a missing node, property, or tag that the variable depends on).
- Initialize variables that will be modified during execution (e.g., lists, sets, tallies, or other 'count' values you expect to change or increment).

```
init {

    $url=https://www.example.com/my_data/
    $threatname=''
    $fqdns=$lib.set()
    $fqdn_count=0
}
```

Fini Block

A **fini block** allows you to execute the specified Storm **once** after all nodes have passed through the Storm pipeline. This allows you to use Storm to perform a set of operations a **single** time at the end of a Storm query.

See also *Init Block*.

Syntax:

```
fini { <storm> }
```

Example:

You have a Storm query that processes a series of `inet:fqdn` nodes, adding nodes that meet certain criteria to a set (specified with the variable `$fqdns`). After processing the nodes, you want to print a message with the total number of nodes in your set (which you stored in the variable `$fqdn_count`) and return the set of nodes.

```
fini {

    $lib.print(`Total count is {$fqdn_count}`)
    return($fqdns)
}
```

Empty Block

An **empty block** allows you to execute the specified Storm when there are no nodes in the pipeline. If there are nodes in the pipeline, the associated Storm will not be executed.

Syntax:

```
empty { <storm> }
```

Example:

You have a function that conditionally creates a set of nodes and you wish to be warned if no nodes have been made.

```
yield $makeSomeNodes()
empty {
    $lib.print("No nodes created")
}
```

If-Else Statement

An **if-else statement** matches inbound objects against a specified condition. If that condition is met, a set of Storm operations are performed. If the condition is not met, a different set of Storm operations are performed. Storm supports the use of `if` by itself; `if-else`; or `if-elif-else`.

Note that the "Storm operations" performed can include **no** operations / "do nothing" if no Storm is provided (e.g., if the associated curly braces are left empty).

If

Syntax:

```
if <condition> { <storm> }
```

If <condition> is met, execute the Storm query in the curly braces. If <condition> is not met, do nothing. (Note that this is equivalent to an `if` statement followed by an empty `else` statement.)

Note

If <condition> is an expression to be evaluated, it must be enclosed in parentheses `( )`. If the expression includes strings, they must be enclosed in single or double quotes.

```
if ( $str = 'Oh hai!' ) { <storm> }
```

Or:

```
if ( :time > $date ) { <storm> }
```

(Where `:time` represents a property on an inbound node.)

If-Else

Syntax:

```
if <condition> { <storm> }
else { <storm> }
```

If <condition> is met, execute the associated Storm; otherwise, execute the alternate Storm.

Similar to the `if` example above with no `else` option (or an empty query for `else`), you can have an empty `if` query:

```
if <condition> { }
else { <storm> }
```

If <condition> is met, do nothing; otherwise, execute the alternate Storm query.

If-Elif-Else

Syntax:

```
if <condition> { <storm> }
elif <condition> { <storm> }
else { <storm> }
```

If <condition> is met, execute the associated Storm; otherwise, if (else if) the second <condition> is met, execute the associated Storm; otherwise (else) execute the final Storm query.

You can use multiple `elif` statements before the final `else`. `If-elif-else` is helpful because it allows you to handle multiple conditions differently while avoiding "nested" `if-else` statements.

Example:

You have a subscription to a third-party malware service that allows you to download malware binaries via the service's API. However, the service has a query limit, so you don't want to make any unnecessary API requests that might exhaust your limit.

You can use a simple if-else statement to check whether you already have a copy of the binary in your storage Axon before attempting to download it.

```
<inbound file:bytes node(s)>

if $lib.axon.has(:sha256) { }

else { | malware.download }
```

The Storm query above:

- takes an inbound `file:bytes` node;
- checks for the file in the Axon (*$lib.axon.has(sha256)*) using the `:sha256` value of the inbound file;
- if `$lib.axon.has(:sha256)` returns `true` (i.e., we have the file), do nothing (`{ }`);
- otherwise call the `malware.download` service to attempt to download the file.

Note: In the above example, `malware.download` is used as an example Storm command; it does not exist in the base Synapse code.

Switch Statement

A **switch statement** matches inbound objects against a set of specified constants. Depending on which constant is matched, a set of Storm operations is performed. The switch statement can include an optional **default case** to perform a set of Storm operations in the case where none of the explicitly defined constants are matched.

Syntax:

```
<inbound nodes>

switch <constant> {

  <case1>: { <storm> }
  <case2>: { <storm> }
  <case3>: { <storm> }
  (<case4>, <case5>): { <storm> }
  *: { <storm for optional default case> }
}
```

Switch statements can match either a single value or multiple values to a query. To specify multiple values, enclose all of the values in parentheses. An example of matching multiple values is shown below and the general syntax can be seen above.

> **Note**
>
> The default case is optional but if one is specified, there can only be one. Specifying multiple default cases will raise a syntax error. Additionally, the default case cannot be specified within a multi-value switch case.

Example:

You want to write a macro (see *Macros*) to automatically enrich a set of indicators (i.e., query third-party data sources for additional data). Instead of writing separate macros for each type of indicator, you want a single macro that can take any type of indicator and send it to the appropriate Storm commands.

A switch statement can send your indicators to the correct services based on the kind of inbound node (e.g., the node's form).

```
<inbound nodes>

switch $node.form() {

    ("hash:md5", "hash:sha1", "hash:sha256"): { | malware.service }

    "inet:fqdn": { | pdns.service | whois.service }

    "inet:ipv4": { | pdns.service }

    "inet:email": { | whois.service }

    *: { $lib.print("{form} is not supported.", form=$node.form()) }
}
```

The Storm query above:

- takes a set of inbound nodes;
- checks the switch conditions based on the form of the node (see *$node.form()*);
- matches the form name against the list of forms;
- handles each form differently (e.g., hashes are submitted to a malware service, domains are submitted to passive DNS and whois services, etc.)
- if the inbound form does not match any of the specified cases, print (*$lib.print(mesg, **kwargs)*) the specified statement (e.g., `"file:bytes is not supported."`).

The default case above is not strictly necessary - any inbound nodes that fail to match a condition will simply pass through the switch statement with no action taken. It is used above to illustrate the optional use of a default case for any non-matching nodes.

Note: the Storm command names used above are examples only and do not exist in the base Synapse code.

For Loop

A **for loop** will iterate over a set of objects, performing the specified Storm operations on each object in the set.

Syntax:

```
for $<var> in $<vars> {

    <storm>
}
```

Note: The user documentation for the Synapse *csvtool* and the Optic Ingest Tool include additional examples of using for loops.

Example:

You routinely apply tags to files (`file:bytes` nodes) to annotate things such as whether the file is associated with a particular malware family (`cno.mal.redtree`) or threat group (`cno.threat.viciouswombat`). When you apply any

of these tags to a file, you want to automatically apply those same tags to the file's associated hashes (e.g., `hash:md5`, etc.)

You can use a for loop to iterate over the relevant tags on the file and apply ("push") the same set of tags to the file's hashes. (**Note:** this code could be executed by a **trigger** (see *Triggers*) that fires when the relevant tag(s) are applied.)

```
<inbound file:bytes node(s)>

{ for $tag in $node.tags(cno.**) {

    { :md5 -> hash:md5 [ +#$tag ] }
    { :sha1 -> hash:sha1 [ +#$tag ] }
    { :sha256 -> hash:sha256 [ +#$tag ] }
    { :sha512 -> hash:sha512 [ +#$tag ] }
}}
```

For each inbound node, the for loop:

- Looks for tags on the node that match the specified pattern (`cno.**`)
- For **each** tag that matches the pattern, execute the Storm code to:
  - Pivot from each of the file's hash properties to the associated hash node.
  - Apply the tag to the node.

Because each "pivot and tag" operation is isolated in a *Subquery*, the original `file:bytes` node remains in our Storm pipeline throughout the set of operations.

Note

A for loop will iterate over "all the things" as defined by the for loop syntax. In the example above, a single inbound node may have multiple tags that match the pattern defined by the for loop. This means that the for loop operations will execute once **per matching tag per node** and yield the inbound node (the `file:bytes` node) to the pipeline for each iteration of the for loop.

In other words, for **each** inbound node:

- the first matching tag causes the for loop to execute;
- the loop operations are performed for that tag (i.e., the tag is applied to the associated hashes);
- the `file:bytes` node is yielded from the for loop;
- if there are additional matching tags to process from the inbound node, **repeat the for loop for each tag.**

Recall that a "single" multi-element tag (such as `cno.mal.redtree`) actually represents three tags (`cno`, `cno.mal`, and `cno.mal.redtree`). If an inbound `file:bytes` node has the tag `#cno.mal.redtree`, the for loop will execute **twice** (for the matching tags `cno.mal` and `cno.mal.redtree`) and yield **two** copies of the `file:bytes` node (one for each match / each iteration of the for loop).

This is by design, and is the way Storm variables (specifically, non-runtime safe variables (*Non-Runtsafe*)) and the Storm execution pipeline (see *Storm Operating Concepts*) are intended to work.

See the *Advanced Storm - Example* below for an illustration of how for loops in particular are impacted by Storm's pipeline behavior.

While Loop

A **while loop** checks inbound nodes against a specified condition and performs the specified Storm operations for as long as the condition is met.

Syntax:

```
while <condition> {

    <storm>
}
```

While loops are more frequently used for developer tasks, such as consuming from Queues; and are less common for day-to-day user use cases.

Try...Catch Statement

A **try...catch statement** allows you to attempt (try) a Storm operation and handle (catch) any errors if they occur. Because Storm's default behavior is to halt execution when an error occurs, try...catch statements allow for more graceful error handling within Storm. "Catching" an error allows the remainder of your Storm to continue executing.

> **Tip**
>
> Storm supports some basic error handling (allowing you to "warn and continue" vs "error and halt") specifically when creating nodes and setting properties or tags through the use of the *"Try" Operator*.

Syntax:

```
try {

    <storm>

} catch <name> as err {

    <storm>
}
```

If the Storm in the try block runs without error, the catch block (or blocks) are ignored. If an error occurs, execution of the try block halts (any remaining Storm in the try block is ignored) and flow passes to the appropriate catch block to handle the error. Multiple catch blocks can be used to handle different kinds of errors.

Because the catch block handles the error, any additional Storm (i.e., after the catch block) will continue to execute.

In the catch block above, `<name>` can be the name of a single error type, a set of error types, or the asterisk (`*`) to represent any error. When using multiple catch blocks, the asterisk can be used in the final block as a default case to catch any error not explicitly handled by a previous catch block.

The catch block can return a status (e.g., `return((1))`) or output a warning message (e.g., using `$lib.warn()` - see *$lib.warn(mesg, **kwargs)*).

Example:

You have an "enrich" macro used to send various kinds of nodes to Storm commands that connect to third-party data sources. There is a particular data source that occasionally returns malformed data, which throws an error and causes the entire macro to halt. You want to isolate the Storm command for that vendor within a try...catch block so the macro will continue to run if an error is encountered.

```
try {

    | enrich.badvendor

} catch * as err {

   $lib.warn("BadVendor blew up again!")
}
```

Tip

`$lib.raise()` may also be useful for explicitly raising exceptions (see *$lib.raise(name, mesg, **info)*).

Advanced Storm - Example

The example below is meant to provide a more concrete illustration of some of Storm's pipeline behavior when combined with certain control flow operations - specifically, with for loops. Control flow operations such as if-else or switch statements allow you to perform more advanced Storm operations, but still typically represent a single "path" through the pipeline for any given node - even though the **specific** path for a given node may vary depending on the if-else or switch conditions.

With for loops, however, we may execute the same Storm multiple times, which may have unexpected results if you don't keep Storm's pipeline concept in mind.

For Loop - No Subquery

Consider the following query:

```
inet:fqdn=vertex.link
$list = ('foo','bar','baz')

for $item in $list {

    $lib.print($item)
}

$lib.print('And we're done!')
```

The query:

- lifts a single FQDN node;
- defines a list containing three elements, `foo`, `bar`, and `baz`;
- uses a `for` loop to iterate over the list, printing each element;
- prints `And we're done!`

When executed, the query generates the following output:

```
storm> inet:fqdn=vertex.link
  $list = ('foo', 'bar', 'baz')

  for $item in $list {
```

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```
    $lib.print($item)
  }

  $lib.print("And we're done!")


foo
And we're done!
inet:fqdn=vertex.link
        :domain = link
        :host = vertex
        :issuffix = false
        :iszone = true
        :zone = vertex.link
        .created = 2025/07/03 18:39:16.814
bar
And we're done!
inet:fqdn=vertex.link
        :domain = link
        :host = vertex
        :issuffix = false
        :iszone = true
        :zone = vertex.link
        .created = 2025/07/03 18:39:16.814
baz
And we're done!
inet:fqdn=vertex.link
        :domain = link
        :host = vertex
        :issuffix = false
        :iszone = true
        :zone = vertex.link
        .created = 2025/07/03 18:39:16.814
```

What's going on here? Why does `And we're done!` print three times? Why do we apparently have three copies of our FQDN node? The reason has to do with Storm's pipeline behavior, and how our FQDN node travels through the pipeline when the pipeline loops.

Our query starts with a single `inet:fqdn` node in our initial working set. Setting the `$list` variable does not change our working set of nodes.

When we reach the for loop, the loop needs to execute multiple times (three times in this case, once for each item in `$list`). Anything currently in our pipeline (any nodes that are inbound to the for loop, as well as any variables that are currently set) is passed into **each** iteration of the for loop.

In this case, because the for loop is part of our **main** Storm pipeline (it is not isolated in any way, such as by being placed inside a subquery), **each iteration** of the loop outputs our original FQDN node…which then continues its passage through the remainder of the Storm pipeline, causing the `$lib.print('And we're done!')` statement to print (remember, each node travels through the pipeline one by one). Storm then executes the second iteration of the for loop, and the FQDN that exits from this second iteration continues through the pipeline, and so on.

It may help to think of this process as the for loop effectively "splitting" the main Storm pipeline into multiple pipelines that then each continue to execute in full, one after the other.

> **Note**
>
> Each pipeline still executes **sequentially** - not in parallel. So the first iteration of the for loop (where `$item=foo`) will execute and the remainder of the Storm pipeline will run to completion; followed by the second iteration of the for loop and the remainder of the Storm pipeline, and so on. (This is why one instance of `And we're done!` prints before the messages associated with the second iteration of the loop where `$item=bar`, etc.).

For Loop - With Subquery

In this variation on our original query, we isolate the for loop within a subquery (*Storm Reference - Subqueries*):

```
inet:fqdn=vertex.link
$list = ('foo','bar','baz')

{
    for $item in $list {

        $lib.print($item)
    }
}

$lib.print('And we're done!')
```

The query performs the same actions as described above, but thanks to the subquery, the behavior of this query is different, as we can see from the query's output:

```
storm> inet:fqdn=vertex.link
  $list = ('foo', 'bar', 'baz')

  {
      for $item in $list {
          $lib.print($item)
      }
  }

  $lib.print("And we're done!")


foo
bar
baz
And we're done!
inet:fqdn=vertex.link
        :domain = link
        :host = vertex
        :issuffix = false
        :iszone = true
        :zone = vertex.link
        .created = 2025/07/03 18:39:16.814
```

In this case, the query behaves more "as expected" - the strings within the for loop print once for each item / iteration of the loop, `And we're done!` prints once, and a single FQDN node exits our pipeline when our query completes. So what's different?

One of the key features of a subquery is that by default (i.e., unless the `yield` option is used), **the nodes that go into a subquery also come out of a subquery,** regardless of what occurs inside the subquery itself. In other words, **subqueries do not "consume" nodes**.

We still have our single FQDN inbound to the subquery. Inside the subquery, our for loop still executes, effectively "splitting" the Storm pipeline into three pipelines that execute in sequence. But once we complete the for loop and exit the subquery, those pipelines are "discarded". The single FQDN that went into the subquery exits the subquery. We are back to our single node in the main pipeline. That single node causes our print statement to print `And we're done!` only once, and we are left with our single node at the end of the query.

3.7.4 Storm Reference - Advanced - Functions

This section provides an overview of the types of functions available in Storm, along with some tips, caveats, and basic examples. It is meant to introduce the concepts around functions in Storm; it is **not** meant as a Storm programming tutorial.

Storm Developers can refer to the *Synapse Developer Guide* for additional information.

Overview

Functions can be used to encapsulate a set of Storm logic that executes when the function is invoked. Functions are declared and then invoked within a Storm query using the function name and any required parameters. Separating the function's logic from the logic of your "executing" Storm query makes your Storm cleaner and easier to read (and also allows for easier code reuse).

Functions and the Storm Pipeline

We regularly emphasize the *Storm Operating Concepts*, especially when writing more complex Storm queries and Storm logic. In particular, it is important to pay attention to Storm's **pipeline** behavior and the way the pipeline affects your **working set.**

A function in Storm has its **own node pipeline,** independent of any Storm logic that invokes the function. Functions **do not** inherit the pipeline of the invoking query, and **do not** modify the invoking pipeline by default.

Because the function **itself** is a Storm pipeline, all caveats about pipelines and awareness of your working set still apply to the Storm **within** the function.

All of Storm's features and capabilities are available for use within a function. This includes Storm operations, commands, variables, methods, control flow, libraries, etc.

You can use an init block or a fini block within a function to execute a subset of Storm logic a single time before operating on any nodes in the functions's pipeline or after any nodes have exited the function's pipeline, respectively.

There are two subtle but important aspects of function behavior to keep in mind:

- Nodes are not "sent inbound" to a function to "cause" it to execute; a function runs when it is **invoked** as part of a Storm query (i.e., by an invoking Storm pipeline). This means that:
  - an invoked function can execute even if there are no nodes in the invoking pipeline, as long as the associated Storm logic executes; and
  - a function within an invoking pipeline will run once each time that pipeline executes; and an invoking pipeline may execute multiple times (for example, if multiple nodes are passing through the invoking pipeline). In this case the nodes themselves don't "cause" the function to execute; the pipeline runs once per node, and the function invoked by the pipeline runs once each time the pipeline runs.
- Nodes do not "pass into" functions by default, as the function and the invoking Storm logic are two separate pipelines. It is possible to **invoke** a function so that it operates on a node or nodes; but the function will not "automatically" do so.

The sections below on *Operating on Nodes* and *Runtsafe vs. Non-Runtsafe Functions* discuss these behaviors in more detail.

Function Basics

Storm supports three types of functions. Each is explained in more detail below.

- **callable** functions, which are "regular" functions (similar to functions in other programming languages). Callable functions return a value.
- **data emitter** functions, which emit data.
- **node yielder** functions, which yield nodes.

Declaring Functions

All functions are **declared** in the same way, using the `function` keyword.

- `function myFunction() { <do stuff> }`
- `function myFunction(foo) { <do stuff> }`
- `function myFunction(bar, baz=$lib.null) { <do stuff> }`

Invoking Functions

All functions are **invoked** using the function name preceded by the dollar sign (`$`), and by passing any required parameters to the function.

- `$myFunction()`
- `$myFunction(foo)`
- `$myFunction($foo)`
- `$myFunction(bar, baz=wheee)`

Parameters can be passed as literals, variables, or keyword=$valu arguments. For example, given a function that takes an organization name as input:

```
function $myFunction(orgname) { <do stuff> }
```

The name can be passed directly:

```
$myFunction("The Vertex Project")
```

. . . as a variable:

```
$name="The Vertex Project"
$myFunction($name)
```

. . . or as a keyword/value pair:

```
$myFunction(orgname="The Vertex Project")
```

```
$name="The Vertex Project"
$myFunction(orgname=$name)
```

Operating on Nodes

Functions do not inherit or operate on the invoking Storm pipeline by default. If you want a function to operate on nodes in a pipeline, you must invoke the function in such a way as to pass the node (or a property or properties of the node) as input to the function.

For example, if your invoking pipeline consists of a set of `inet:ipv4` nodes, a function can take the `:asn` property as input:

```
$myFunction(:asn)
```

Or:

```
$asn=:asn
$myFunction($asn)
```

Alternatively, you can pass the entire `$node` object to the function and use the `yield` keyword within the function to yield the node into the function's pipeline:

```
//Declare function
function $myFunction(inboundNode) {

    yield $inboundNode
    <do stuff>
    return()
}

//Invoke function
$myFunction($node)
```

If another function yields the node(s) you want to operate on, that function can be used as input to a second function. A simple example:

Function 1 (node yielder):

```
function getIPs() {
    //Lift 10 IPv4 addresses
    inet:ipv4 | limit 10
}
```

Function 2 (callable function):

```
//Takes a generator object as input
function counter(genr) {

    //Yield the generator content into the function pipeline
    yield $genr

    //Print the human-readable representation of each node
    $lib.print($node.repr())

    //Return the output of the function
    fini { return() }
}
```

Function 2 invoked with Function 1 as input:

```
$counter($getIPs())
```

When executed, the function produces the following output. Note that the `$counter()` function simply prints the nodes' human-readable representation (`$node.repr()`) as an example; it does not return or yield the `inet:ipv4` nodes:

```
storm>
function getIPs() {
    inet:ipv4 | limit 10
}

function counter(genr) {
    yield $genr
    $lib.print($node.repr())
    fini { return() }
}

$counter($getIPs())
1.1.1.1
2.2.2.2
3.3.3.3
4.4.4.4
5.5.5.5
6.6.6.6
7.7.7.7
8.8.8.8
9.9.9.9
10.10.10.10
```

Runtsafe vs. Non-Runtsafe Functions

Just as variables may be runtime-safe (runtsafe) or non-runtime-safe (non-runtsafe), functions can be invoked in a runtsafe manner (or not) based on the parameters passed to the function.

If a function is invoked with a runtsafe (typically static) value, the function is considered runtsafe. A function that takes an Autonomous System (AS) number as input and is passed a static AS number as a parameter is invoked in a **runtsafe** manner:

```
$myFunction(9009)
```

Or:

```
$asn=9009
myFunction($asn)
```

If the same function is invoked with a per-node, non-runtsafe value or values, the function is considered **non-runtsafe,** such as the example above where the invoking pipeline contains `inet:ipv4` nodes and the function is invoked with the value of each node's `:asn` property:

```
$myFunction(:asn)
```

Or:

```
$asn=:asn
$myFunction($asn)
```

Tip

Keep in mind that functions execute when they are invoked. This has some implications with respect to runtime safety ("runtsafety"):

- A non-runtsafe function (i.e., that is dependent on a per-node value) will **not** execute when invoked if there are no nodes in the invoking pipeline. Synapse will not generate an error but the function will not "do anything".
- A runtsafe function (i.e., one whose parameters are **not** node-dependent) will still execute once each time it is invoked. If the invoking Storm executes multiple times, this can result in the runtsafe function running repeatedly while simply "doing the same thing" each time (based on its runtsafe input parameters). If the function should only execute once, it can be placed in a fini block (or an init block as appropriate).

Function Output

Functions do not modify the invoking Storm pipeline by default. To access the output of a function (whether nodes, data, or a value), you can:

- Assign the output of the function to a variable:

```
$x = $myFunction()
```

- Iterate over the function's output (used with data emitters and node yielders):

```
for $x in $myFunction() { <do stuff> }
```

- Add the node or nodes generated by the function directly to the invoking Storm pipeline with the `yield` keyword (used with node yielders and callable functions that return a node):

```
yield $myFunction()
```

Types of Functions

Note

Because all functions in Storm are declared and invoked the same way, the Storm syntax parser relies on the presence (or absence) of specific **keywords** within a function to identify the type of function and how to execute it.

- Callable functions **must** include a `return()` statement (and must not use `emit`).
- Data emitter functions **must** use the `emit` keyword (and must not use `return()`).
- Node yielder functions **must not** include the keywords `emit` or `return()`.

Both data emitters and node yielders may optionally include the keyword `stop` to cleanly halt execution and exit the function. (Using `stop` in a callable function will generate a `StormStop` error.)

Functions can be declared and invoked on their own, but are most often used when authoring more extensive Storm code to implement a set of related functionality, such as a Rapid Power-Up. A set of functions, each encapsulating Storm logic to perform a specific task, can work together to implement more complex capabilities. Given this architecture, it

is common for functions to invoke other functions as part of their code, or to take the output of another function as an input parameter to perform another operation, as seen in some of the examples below.

See the *Rapid Power-Up Development* section of the *Synapse Developer Guide* for a more in-depth discussion of how to integrate multiple Storm components into a larger package.

Callable Functions

Callable functions are "regular" functions, similar to those in other programming languages. A callable function is invoked (called) and returns a value using a `return()` statement. A `return()` statement **must** be present for a callable function to execute properly even if the function does not return a specific value.

Callable functions are **executed in their entirety** before returning. They return **exactly** one value.

> **Tip**
>
> Callable functions may contain multiple `return()` statements, based on the function's logic. The **first** `return()` encountered during the function's execution will cause the function to stop execution and return. If you are performing multiple actions within the function and want to ensure they all complete before the function returns, place the `return()` in a fini block so it executes once at the end of the function's pipeline.

Use Cases

Callable functions can be used to:

- Check a condition and return a status (e.g., `return((0))` vs. `return((1))`).
- Return a value (such as a count).
- Return a single node.
- Perform isolated operations on a node in the pipeline.
- Retrieve data from an external API.

Pseudocode

```
function callable() {

    <do stuff>
    return()
}
```

Examples

Return a node

A callable function can take input and attempt to create (or lift) a node.

```
//Takes a value expected to be an IPv4 or IPv6 as input
function makeIP(ip) {

    //Attempt to create (or lift) an IPv4 from the input
    //Return the IPv4 and exit if successful
    [ inet:ipv4 ?= $ip ]
```

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```
    return($node)

    //Otherwise, atempt to create (or lift) an IPv6 from the input
    //Return the IPv6 and exit if successful
    [ inet:ipv6 ?= $ip ]
    return($node)

    //If the input is not a valid IPv4 or IPv6, the function
    // will execute but will not return a node.
}

//Invoke the function with the specified input and
// yield the result (if any) into the pipeline
yield $makeIP(8.8.8.8)
```

Return a node using secondary property deconfliction

When ingesting or creating guid-based nodes, a common deconfliction strategy is to check for existing nodes using one or more secondary properties (known as secondary property deconfliction). A callable function that takes a secondary property value (or values) as input and returns (or creates) the node simplifies this process.

```
//Create an ou:org node based on an org name (ou:name)

//Declare function - takes 'name' as input
function genOrgByName(name) {

    //Check whether input is valid for an ou:name value
    //If not, return / exit
    ($ok, $name) = $lib.trycast(ou:name, $name)
    if (not $ok) { return() }

    //If name is valid, attempt to identify an existing ou:org
    //Lift the ou:name node for 'name' (if it exists)
    // and pivot to an org with that name (if it exists)
    //Return the existing node if found
    ou:name=$name -> ou:org
    return($node)

    //If an org is not found, create a new ou:org using 'gen' and the name
    // as input for the org's guid; set the :name prop
    //Return the new node
    [ ou:org=(gen, $name) :name=$name ]
    return($node)
}

//Invoke the function with input name "The Vertex Project" and yield
// the result into the pipeline
yield $genOrgByName("The Vertex Project")
```

Tip

Synapse includes gen.* (generator) Storm commands and $lib.gen APIs that can generate many common guid-based

forms using secondary property deconfliction.

Return a value

Some data sources provide feed-like APIs that allow you to retrieve either the entire feed or just retrieve any new items added since your last update. The "last update" time can be stored as *Node Data* on the `meta:source` node for the data source. A callable function can retrieve the "last updated" date (e.g., to pass the value to another function used to retrieve only the latest feed data).

```
function getLastReportDate() {

    //Invoke an existing function to create (initialize) or retrieve the meta:source node
    // and yield the node into the function's pipeline
    yield $initMetaSource()

    //Set the $date variable to the value of the node data key mysource:report:date from
    // the meta:source node.
    $date = $node.data.get(mysource:report:date)

    //If there is no value for this key return the integer 0
    if ($date = $lib.null) { return((0)) }

    //Otherwise return the date
    return($date)
}

//Assign the value returned by this function to the variable $date for use by the
// invoking Storm pipeline. This value can be passed to another function that retrieves
// the latest feed data.
$date = $getLastReportDate()
```

Data Emitter Functions

Data emitter functions emit data using the `emit` keyword. The `stop` keyword can optionally be used to halt processing and exit the function. The `emit` keyword **must** be present for a data emitter function to execute properly.

Data emitter functions **stream** data (technically, they return a **generator object** that is iterated over). They are designed to emit data to the invoking pipeline as it is available; they may be invoked with **for** or **while** loops for this purpose. When data is emitted, execution of the function is paused until the invoking pipeline requests the next value, at which point the function's execution resumes.

Use Cases

Data emitter functions can be used to:

- Consume data from sources that paginate results, where you want to mask the pagination (i.e., a data emitter can consume and emit the first page of results; then consume and emit the next page; and so on).
- Consume data from sources that stream results, where the data emitter is used to continue the streaming behavior.

Tip

Data emitters can be used to emit nodes (e.g., `emit $node`), though this is an uncommon use case. The ability of data emitters to emit data incrementally is useful when consuming large result sets from an API. "Subsets" of

results (such as individual JSON objects from a JSON blob) can be made available more quickly (e.g., to another function responsible for creating nodes from the JSON) while the emitter continues to process data.

In contrast, if the same set of API results was consumed by a callable function, the function would need to consume the entire result set before returning.

Pseudocode

```
function data_emitter() {

    for $thing in $things {
        <do stuff>
        emit $thing
    }
}
```

Or:

```
function data_emitter() {

    for $thing in $things {
        <do stuff>
        emit $thing

        if ($thing = "badthing") {
            stop
        }
    }
}
```

Or:

```
function data_emitter() {

    while (1) {
        <do stuff>
        emit $thing

        if (<end condition>) { stop }

        <update something to continue while loop>
    }
}
```

Example

Some data sources may paginate results, returning X number of objects (e.g., in a JSON blob) at a time until all results are returned. A data emitter function can emit individual JSON objects from the blob (e.g., for consumption by another function that processes the object and creates nodes) until all of the results have been received.

```
function emitReportFeed() {
```

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```
    //Set variables for the current time and the # of objects to retrieve per page
    $now = $lib.time.now()
    $pagelim = 100

    //Set a variable for API query parameters
    $params = ({
        "limit": $pagelim,
    })

    //Set a variable for the initial offset
    $offset = (0)

    //While loop to retrieve records
    while (1) {

        //Set the value of the 'offset' parameter
        $params.offset = $offset

        //Invoke an existing function to retrieve the JSON using $params as parameters
        // to the API request.
        //Assign the returned JSON to the variable $data
        $data = $getJson("/reports", params=$params)

        //If no data is returned, stop and exit this function
        if ($data = $lib.null) { stop }

        //If data is returned, loop over the JSON and emit each item / ojbect
        for $item in $data.data { emit $item }

        //Set $datasize to the size (number of items) in the returned JSON
        $datasize = $data.data.size()

        //Check whether the # of records returned is less than our page limit
        //If so we have retrieved all available records
        if ($datasize < $pagelim) {

            //Print status to CLI if debug is in use
            if $lib.debug { $lib.print(`Reports ingested up to {$now}`) }

            //Invoke an existing function to update the 'last retrieved' date to the␣
↪current time
            //E.g., this value may be stored as node data on the feed's meta:source node
            $setReportFeedLast($now)

            //Stop and exit the function
            stop
        }

        //If $datasize is NOT < $pagelim there is more data
        //Update the $offset value and execute the while loop again
        $offset = ($offset + $pagelim)
    }
```

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```
}
```

Node Yielder Functions

Node yielder functions yield nodes. If a function **does not** include either of the keywords `return` or `emit`, it is presumed to be a node yielder.

Node yielder functions **stream** nodes; (technically, they return a **generator object** that is iterated over). They are designed to yield nodes as they are available while continuing to execute. They may be invoked with the `yield` keyword or with a **for** loop for this purpose.

Use Cases

Node yielder functions can be used to:

- Isolate different node construction pipelines during complex data ingest logic.

Pseudocode

```
function node_yielder() {
    <do stuff>
}
```

Examples

Some data sources allow you to retrieve specific records or reports (e.g., based on a record or report number). A node yielder function can request the record(s) and yield the node(s) created from those records (e.g., a report retrieved from a data source may be used to create a `media:news` node).

```
//Function takes one or more IDs as input
function reportByID(reportids) {

    //Loop over report IDs
    for $reportid in $reportids {

        //Invoke an existing privileged function to retrieve the report object (i.e., a␣
↪JSON response)
        //A privileged module may be invoked to mask sensitive data such as an API key␣
↪from a normal user
        $report = $privsep.getReportById($reportid)

        //Print the JSON to CLI if debug is in use
        if $lib.debug { $lib.pprint($report) }

        //Yield the node (e.g., media:news node) created by invoking an existing␣
↪function that
        // creates the media:news node from the $report
        yield $ingest.addReport($report)
    }
}
```

Functions and Privilege Separation

Functions can be used to support **privilege separation** ("privsep") for things like custom Power-Up development. Storm logic that requires access to sensitive information (such as API keys or other credentials) can be encapsulated in a function that is not accessible to unprivileged users. The function can return non-sensitive data that is "safe" for viewing or consumption.

See the *Rapid Power-Up Development* Guide and in particular the section on privileged modules for more information.

Function Debugging Tips

Functions execute Storm, so standard Storm debugging tips still apply to all code **within** the function itself (and to the Storm code that invokes the function, of course). The following additional tips apply to functions in particular.

Use the right type of function for your use case. Each Storm function serves a different purpose; be clear on what type of function you need for a given situation.

For example, a node yielder can yield multiple nodes. A callable function can also yield multiple nodes (e.g., by returning a set or list object). But there can be significant (even damaging) performance differences between the two, depending on the nature of the function.

A node yielder yields a generator object that can incrementally provide results (i.e., for a streaming effect). When written as a node yielder, a function to lift every node in a Cortex is workable, even for large result sets:

```
function allnodes() { .created }
```

You could write the same function as a callable function, but it would likely blow up your system by consuming all available memory. A callable function can only return exactly one object; it can't stream results. You could write a callable function to lift each node, add it to a set object, and have the function return the set. But the callable function will need to construct and store the **entire set** in memory until the object can be returned:

```
// NEVER DO THIS
function allnodes() {

    $set = ([])
    .created
    $set.add($node)
    fini { return($set) }
}
```

While this is an extreme example, it serves to illustrate some of the differences between function types.

Ensure necessary keywords are present for your function type. Synapse determines "what kind" of function is present and how to execute it based on keywords (e.g., `return()` for callable functions, `emit` for data emitters). If you write a node yielder function with a `return()` statement, Synapse will attempt to execute it as a callable function. Similarly, a callable function that is missing a `return()` will not execute properly.

> **Note**
>
> Data emitters and node yielders may **fail** to emit data or yield nodes, based on the input to the function and the function's code. In these situations it can be challenging to determine whether a function that is "not doing anything" is a yielder / emitter that is failing to produce output, or a callable function that is missing a `return()` statement.

Understand pipeline interactions between functions and Storm logic that invokes them. By default, functions do not interact with the Storm pipeline that invokes them.

If you want a function to operate on nodes in the invoking Storm pipeline, you must invoke the function in such a way as to do this.

> **Note**
>
> If a function is written to operate on or iterate over nodes, and there are no nodes in the pipeline (based on previously executing Storm logic), the function will not execute.

If you want the invoking Storm pipeline to operate on the function's output, you must ensure that the output is returned to the pipeline (e.g., assign the function's output to a variable; use the `yield` keyword to yield any nodes into the pipeline; use a for loop to iterate over function results; etc.).

3.8 Model Updates

The following are model updates which have been made with different Synapse releases.

3.8.1 v2.215.0 Model Updates

The following model updates were made during the `v2.215.0` Synapse release.

New Forms

`it:os:windows:service`
: A Microsoft Windows service configuration on a host.

New Properties

`it:exec:proc`
: The form had the following property added to it:

  `windows:service`
  : The Microsoft Windows service responsible for starting the process.

3.8.2 v2.214.0 Model Updates

The following model updates were made during the `v2.214.0` Synapse release.

New Properties

`inet:service:account`
: The form had the following property added to it:

  `app`
  : The app which contains the account.

`inet:service:app`
: The form had the following property added to it:

  `app`
  : The app which contains the application.

`inet:service:bucket`
: The form had the following property added to it:

  `app`
  : The app which contains the bucket.

inet:service:bucket:item
The form had the following property added to it:

app
The app which contains the bucket item.

inet:service:channel
The form had the following property added to it:

app
The app which contains the channel.

inet:service:channel:member
The form had the following property added to it:

app
The app which contains the channel membership.

inet:service:emote
The form had the following property added to it:

app
The app which contains the emote.

inet:service:group
The form had the following property added to it:

app
The app which contains the group.

inet:service:group:member
The form had the following property added to it:

app
The app which contains the group membership.

inet:service:instance
The form had the following property added to it:

app
The app which contains the instance.

inet:service:permission
The form had the following property added to it:

app
The app which contains the permission.

inet:service:relationship
The form had the following property added to it:

app
The app which contains the relationship.

inet:service:resource
The form had the following property added to it:

app
The app which contains the resource.

inet:service:rule
The form had the following property added to it:

app
: The app which contains the rule.

inet:service:session
: The form had the following property added to it:

  app
  : The app which contains the session.

inet:service:subscription
: The form had the following property added to it:

  app
  : The app which contains the subscription.

inet:service:tenant
: The form had the following property added to it:

  app
  : The app which contains the tenant.

inet:service:thread
: The form had the following property added to it:

  app
  : The app which contains the thread.

it:dev:repo
: The form had the following property added to it:

  app
  : The app which contains the repository.

it:dev:repo:branch
: The form had the following property added to it:

  app
  : The app which contains the repository branch.

it:dev:repo:commit
: The form had the following property added to it:

  app
  : The app which contains the repository commit.

it:dev:repo:diff:comment
: The form had the following property added to it:

  app
  : The app which contains the repository diff comment.

it:dev:repo:issue
: The form had the following property added to it:

  app
  : The app which contains the repository issue.

it:dev:repo:issue:comment
: The form had the following property added to it:

  app
  : The app which contains the repository issue comment.

it:dev:repo:issue:label
The form had the following property added to it:

app
The app which contains the repository issue label.

it:host
The form had the following property added to it:

app
The app which contains the host.

it:host:tenancy
The form had the following property added to it:

app
The app which contains the host tenancy.

it:software:image
The form had the following property added to it:

app
The app which contains the software image.

Updated Interfaces

inet:service:object
The property app has been added to the interface.

3.8.3 v2.212.0 Model Updates

The following model updates were made during the v2.212.0 Synapse release.

New Forms

inet:tls:ja4:sample
A JA4 TLS client fingerprint used by a client.

inet:tls:ja4s:sample
A JA4S TLS server fingerprint used by a server.

inet:tls:ja4
A JA4 TLS client fingerprint.

inet:tls:ja4s
A JA4S TLS server fingerprint.

New Properties

inet:tls:handshake
The form had the following properties added to it:

client:ja3
The JA3 fingerprint of the client request.

client:ja4
The JA4 fingerprint of the client request.

server:ja3s
The JA3S fingerprint of the server response.

server:ja4s
The JA4S fingerprint of the server response.

Deprecated Properties

inet:tls:handshake
The form had the following properties deprecated:

client:fingerprint:ja3
Deprecated. Please use :client:ja3.

server:fingerprint:ja3
Deprecated. Please use :server:ja3s.

3.8.4 v2.211.0 Model Updates

The following model updates were made during the v2.211.0 Synapse release.

New Types

inet:service:access:action:taxonomy
A hierarchical taxonomy of service actions.

New Forms

inet:service:app
A platform specific application.

New Properties

inet:search:query
The form had the following properties added to it:

app
The app which handled the action.

client:app
The client service app which initiated the action.

inet:service:access
The form had the following properties added to it:

action
The platform specific action which this access records.

app
The app which handled the action.

client:app
The client service app which initiated the action.

inet:service:login
The form had the following properties added to it:

app
The app which handled the action.

client:app
The client service app which initiated the action.

inet:service:message
The form had the following properties added to it:

app
The app which handled the action.

client:app
The client service app which initiated the action.

inet:service:platform
The form had the following properties added to it:

names
An array of alternate names for the platform.

urls
An array of alternate URLs for the platform.

Updated Interfaces

inet:service:action
The property app has been added to the interface.

The property client:app has been added to the interface.

Updated Properties

inet:service:platform
The form had the following properties updated:

The property name had the names property declared as an alternative value for guid based deconfliction.

The property url had the urls property declared as an alternative value for guid based deconfliction.

ou:conference:event
The form had the following property updated:

The property conference had the readonly flag removed from its definition.

3.8.5 v2.210.0 Model Updates

The following model updates were made during the v2.210.0 Synapse release.

New Types

entity:actor
An entity which has initiative to act.

New Forms

entity:relationship
A directional relationship between two actor entities.

entity:relationship:type:taxonomy
A hierarchical taxonomy of entity relationship types.

New Properties

inet:service:channel
The form had the following property added to it:

topic
The visible topic of the channel.

inet:service:message
The form had the following properties added to it:

hashtags
An array of hashtags mentioned within the message.

mentions
Contactable entities mentioned within the message.

ps:contact
The form had the following properties added to it:

banner
The file representing the banner for the contact.

passwd
The current password for the contact.

website
A related URL specified by the contact (e.g., a personal or company web page, blog, etc.).

websites
Alternative related URLs specified by the contact.

3.8.6 v2.206.0 Model Updates

The following model updates were made during the `v2.206.0` Synapse release.

New Forms

tel:mob:tadig
A Transferred Account Data Interchange Group number issued to a GSM carrier.

New Properties

it:network
The form had the following property added to it:

dns:resolvers
An array of DNS servers configured to resolve requests for hosts on the network.

tel:mob:carrier
The form had the following property added to it:

tadig
The TADIG code issued to the carrier.

Light Edges

has
When used with a `meta:ruleset` and an `it:app:yara:rule` node, the edge indicates the meta:ruleset includes the it:app:yara:rule.

has
: When used with a `meta:ruleset` and an `it:app:snort:rule` node, the edge indicates the meta:ruleset includes the it:app:snort:rule.

has
: When used with a `meta:ruleset` and an `inet:service:rule` node, the edge indicates the meta:ruleset includes the inet:service:rule.

3.8.7 v2.205.0 Model Updates

The following model updates were made during the `v2.205.0` Synapse release.

New Forms

tel:phone:type:taxonomy
: A taxonomy of phone number types.

New Properties

econ:acct:balance
: The form had the following property added to it:

  instrument
  : The financial instrument holding the balance.

tel:phone
: The form had the following property added to it:

  type
  : The type of phone number.

Light Edges

targets
: When used with a `risk:compromise` and an `ou:industry` node, the edge indicates the compromise was assessed to be based on the victim's role in the industry.

uses
: When used with an `it:prod:soft` and a `risk:vuln` node, the edge indicates the software uses the vulnerability.

Deprecated Properties

econ:acct:balance
: The form had the following properties deprecated:

  crypto:address
  : Deprecated. Please use `:instrument`.

  pay:card
  : Deprecated. Please use `:instrument`.

3.8.8 v2.204.0 Model Updates

The following model updates were made during the `v2.204.0` Synapse release.

New Properties

ps:contact
The form had the following property added to it:

id
A type or source specific unique ID for the contact.

3.8.9 v2.203.0 Model Updates

The following model updates were made during the v2.203.0 Synapse release.

New Forms

meta:feed:type:taxonomy
A data feed type taxonomy.

meta:feed
A data feed provided by a specific source.

Light Edges

found
When used with a meta:feed node, the edge indicates the meta:feed produced the target node.

Deprecated Types

The following forms have been marked as deprecated:

- meta:seen

3.8.10 v2.201.0 Model Updates

The following model updates were made during the v2.201.0 Synapse release.

New Properties

risk:mitigation:type:taxonomy
The form had the following properties added to it:

base
The base taxon.

depth
The depth indexed from 0.

desc
A definition of the taxonomy entry.

parent
The taxonomy parent.

sort
A display sort order for siblings.

summary
Deprecated. Please use title/desc.

title
A brief title of the definition.

Updated Types

risk:mitigation:type:taxonomy
The type interface has been modified to inherit from the `meta:taxonomy` interface.

Updated Properties

proj:ticket
The form had the following property updated:

The property `type` had an example added to its definition.

3.8.11 v2.198.0 Model Updates

The following model updates were made during the `v2.198.0` Synapse release.

New Properties

it:exec:query
The form had the following properties added to it:

service:account
The service account which ran the query.

service:instance
The service instance which was queried.

service:platform
The service platform which was queried.

it:log:event
The form had the following properties added to it:

service:account
The service account which generated the log event.

service:instance
The service instance which generated the log event.

service:platform
The service platform which generated the log event.

risk:alert
The form had the following properties added to it:

service:account
The service account which generated the alert.

service:instance
The service instance which generated the alert.

service:platform
The service platform which generated the alert.

3.8.12 v2.197.0 Model Updates

The following model updates were made during the `v2.197.0` Synapse release.

New Forms

doc:requirement
A single requirement, often defined by a standard.

doc:resume
A CV/resume document.

doc:resume:type:taxonomy
A taxonomy of resume types.

doc:requirement:type:taxonomy
A taxonomy of requirement types.

Updated Properties

ou:enacted
The form had the following property updated:

The property doc has been modified to allow the doc:requirement form.

Deprecated Types

The following types have been marked as deprecated:

- ou:alias

Deprecated Properties

ou:org
The form had the following property deprecated:

alias
Deprecated. Please use ou:org:names.

3.8.13 v2.196.0 Model Updates

The following model updates were made during the v2.196.0 Synapse release.

New Properties

it:av:scan:result
The form had the following property added to it:

categories
A list of categories for the result returned by the scanner.

it:sec:cve
The form had the following properties added to it:

cisa:kev:action
The action to mitigate the vulnerability according to the CISA KEV database.

cisa:kev:added
The date the vulnerability was added to the CISA KEV database.

cisa:kev:desc
The description of the vulnerability according to the CISA KEV database.

cisa:kev:duedate
The date the action is due according to the CISA KEV database.

cisa:kev:name
The name of the vulnerability according to the CISA KEV database.

cisa:kev:product
The product name listed in the CISA KEV database.

cisa:kev:vendor
The vendor name listed in the CISA KEV database.

nist:nvd:modified
The date the vulnerability was last modified in the NVD.

nist:nvd:published
The date the vulnerability was first published in the NVD.

nist:nvd:source
The name of the organization which reported the vulnerability to NIST.

meta:source
The form had the following property added to it:

ingest:cursor
Used by ingest logic to capture the current ingest cursor within a feed.

ou:contest:result
The form had the following property added to it:

period
The period of time when the participant competed in the contest.

risk:vuln
The form had the following property added to it:

tag
A tag used to annotate the presence or use of the vulnerability.

Updated Properties

transport:sea:vessel
The form had the following property updated:

The property `name` has been modified from `str` to `entity:name`.

Deprecated Properties

it:prod:softver
The form had the following properties deprecated:

semver:build
Deprecated.

semver:major
Deprecated. Please use semver range queries.

semver:minor
Deprecated. Please use semver range queries.

semver:patch
Deprecated. Please use semver range queries.

semver:pre
Deprecated.

risk:vuln
The form had the following properties deprecated:

cisa:kev:action
Deprecated. Please use `it:sec:cve:cisa:kev:action`.

cisa:kev:added
Deprecated. Please use `it:sec:cve:cisa:kev:added`.

cisa:kev:desc
Deprecated. Please use `it:sec:cve:cisa:kev:desc`.

cisa:kev:duedate
Deprecated. Please use `it:sec:cve:cisa:kev:duedate`.

cisa:kev:name
Deprecated. Please use `it:sec:cve:cisa:kev:name`.

cisa:kev:product
Deprecated. Please use `it:sec:cve:cisa:kev:product`.

cisa:kev:vendor
Deprecated. Please use `it:sec:cve:cisa:kev:vendor`.

nist:nvd:modified
Deprecated. Please use `it:sec:cve:nist:nvd:modified`.

nist:nvd:published
Deprecated. Please use `it:sec:cve:nist:nvd:published`.

nist:nvd:source
Deprecated. Please use `it:sec:cve:nist:nvd:source`.

3.8.14 v2.195.0 Model Updates

The following model updates were made during the `v2.195.0` Synapse release.

New Interfaces

transport:vehicle
Properties common to a vehicle.

transport:container
Properties common to a container used to transport cargo or people.

phys:object
Properties common to all physical objects.

transport:schedule
Properties common to travel schedules.

transport:trip
Properties common to a specific trip taken by a vehicle.

geo:locatable
Properties common to items and events which may be geolocated.

New Types

transport:vehicle
A vehicle such as an aircraft or sea vessel.

transport:container
A container capable of transporting cargo or personnel.

phys:object
A node which represents a physical object.

transport:point
A departure/arrival point such as an airport gate or train platform.

transport:trip
A trip such as a flight or train ride.

New Forms

transport:rail:car:type:taxonomy
A hierarchical taxonomy of rail car types.

phys:contained:type:taxonomy
A taxonomy for types of contained relationships.

transport:rail:consist
A group of rail cars and locomotives connected together.

transport:occupant:role:taxonomy
A taxonomy of transportation occupant roles.

transport:sea:vessel:type:taxonomy
A hierarchical taxonomy of sea vessel types.

transport:land:vehicle:type:taxonomy
A type taxonomy for land vehicles.

transport:occupant
An occupant of a vehicle on a trip.

transport:shipping:container
An individual shipping container.

transport:rail:car
An individual train car.

transport:rail:train
An individual instance of a consist of train cars running a route.

phys:contained
A node which represents a physical object containing another physical object.

transport:land:drive
A drive taken by a land vehicle.

transport:stop
A stop made by a vehicle on a trip.

transport:cargo
Cargo being carried by a vehicle on a trip.

New Properties

geo:place
The form had the following property added to it:

id
A type specific identifier such as an airport ID.

geo:telem
The form had the following properties added to it:

phys:height
The height of the object.

phys:length
The length of the object.

phys:mass
The mass of the object.

phys:volume
The cubed volume of the object.

phys:width
The width of the object.

place:address
The postal address of the place where the object was located.

place:country
The country where the object was located.

place:country:code
The country code where the object was located.

place:latlong
The latlong where the object was located.

place:latlong:accuracy
The accuracy of the latlong where the object was located.

place:loc
The geopolitical location of the object.

it:host
The form had the following properties added to it:

phys:height
The height of the physical host.

phys:length
The length of the physical host.

phys:mass
The mass of the physical host.

phys:volume
The cubed volume of the physical host.

phys:width
The width of the physical host.

mat:item
The form had the following properties added to it:

phys:height
The height of the item.

phys:length
The length of the item.

phys:mass
The mass of the item.

phys:volume
The cubed volume of the item.

phys:width
The width of the item.

place:address
The postal address of the place where the item was located.

place:country
The country where the item was located.

place:country:code
The country code where the item was located.

place:latlong
The latlong where the item was located.

place:latlong:accuracy
The accuracy of the latlong where the item was located.

place:loc
The geopolitical location of the item.

place:name
The name of the place where the item was located.

ou:id:type
The form had the following property added to it:

names
An array of alternate names for the ID number type.

ps:vitals
The form had the following properties added to it:

phys:height
The height of the person.

phys:length
The length of the person.

phys:mass
The mass of the person.

phys:volume
The cubed volume of the person.

phys:width
The width of the person.

transport:air:craft
The form had the following properties added to it:

manufacturer
: The organization which manufactured the aircraft.

manufacturer:name
: The name of the organization which manufactured the aircraft.

max:cargo:mass
: The maximum mass the aircraft can carry as cargo.

max:cargo:volume
: The maximum volume the aircraft can carry as cargo.

max:occupants
: The maximum number of occupants the aircraft can hold.

owner
: The contact information of the owner of the aircraft.

phys:height
: The height of the aircraft.

phys:length
: The length of the aircraft.

phys:mass
: The mass of the aircraft.

phys:volume
: The cubed volume of the aircraft.

phys:width
: The width of the aircraft.

transport:air:flight
: The form had the following properties added to it:

arrived:place
: The actual arrival airport.

arrived:point
: The actual arrival gate.

cargo:mass
: The cargo mass carried by the aircraft on this flight.

cargo:volume
: The cargo volume carried by the aircraft on this flight.

departed:place
: The actual departure airport.

departed:point
: The actual departure gate.

duration
: The actual duration.

occupants
: The number of occupants of the aircraft on this flight.

operator
: The contact information of the operator of the flight.

scheduled:arrival:place
The scheduled arrival airport.

scheduled:arrival:point
The scheduled arrival gate.

scheduled:departure:place
The scheduled departure airport.

scheduled:departure:point
The scheduled departure gate.

scheduled:duration
The scheduled duration.

status
The status of the flight.

vehicle
The aircraft which traveled the flight.

transport:land:vehicle
The form had the following properties added to it:

desc
A description of the vehicle.

manufacturer
The organization which manufactured the vehicle.

manufacturer:name
The name of the organization which manufactured the vehicle.

max:cargo:mass
The maximum mass the vehicle can carry as cargo.

max:cargo:volume
The maximum volume the vehicle can carry as cargo.

max:occupants
The maximum number of occupants the vehicle can hold.

operator
The contact information of the operator of the vehicle.

phys:height
The height of the vehicle.

phys:length
The length of the vehicle.

phys:mass
The mass of the vehicle.

phys:volume
The cubed volume of the vehicle.

phys:width
The width of the vehicle.

type
The type of land vehicle.

transport:sea:vessel
The form had the following properties added to it:

manufacturer
The organization which manufactured the vessel.

manufacturer:name
The name of the organization which manufactured the vessel.

max:cargo:mass
The maximum mass the vessel can carry as cargo.

max:cargo:volume
The maximum volume the vessel can carry as cargo.

max:occupants
The maximum number of occupants the vessel can hold.

owner
The contact information of the owner of the vessel.

phys:height
The height of the vessel.

phys:length
The length of the vessel.

phys:mass
The mass of the vessel.

phys:volume
The cubed volume of the vessel.

phys:width
The width of the vessel.

serial
The manufacturer assigned serial number of the vessel.

type
The type of vessel.

Updated Types

geo:telem
The type interface has been modified to inherit from the `phys:object` and `geo:locatable` interfaces.

it:host
The type interface has been modified from `inet:service:object` to inherit from the `inet:service:object` and `phys:object` interfaces.

mat:item
The type interface has been modified to inherit from the `phys:object` and `geo:locatable` interfaces.

ps:vitals
The type interface has been modified to inherit from the `phys:object` interface.

transport:air:craft
The type interface has been modified to inherit from the `transport:vehicle` interface.

transport:air:flight
The type interface has been modified to inherit from the `transport:trip` interface.

transport:land:vehicle
The type interface has been modified to inherit from the `transport:vehicle` interface.

transport:sea:vessel
The type interface has been modified to inherit from the `transport:vehicle` interface.

Updated Properties

ou:id:type
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

transport:air:craft
The form had the following property updated:

The property `model` has been modified to `onespace` the strings.

transport:sea:vessel
The form had the following property updated:

The property `model` has been modified to `onespace` the strings.

Deprecated Types

The following types have been marked as deprecated:

- `edge`
- `timeedge`

Deprecated Types

The following forms have been marked as deprecated:

- `transport:air:occupant`

Deprecated Properties

geo:telem
The form had the following properties deprecated:

accuracy
Deprecated. Please use `:place:latlong:accuracy`.

latlong
Deprecated. Please use `:place:latlong`.

mat:item
The form had the following properties deprecated:

latlong
Deprecated. Please use `:place:latlong`.

loc
Deprecated. Please use `:place:loc`.

syn:cmd
The form had the following properties deprecated:

input
The list of forms accepted by the command as input.

nodedata
The list of nodedata that may be added by the command.

output
The list of forms produced by the command as output.

transport:air:craft
The form had the following property deprecated:

make
Deprecated. Please use :manufacturer:name.

transport:air:flight
The form had the following properties deprecated:

cancelled
Deprecated. Please use :status.

carrier
Deprecated. Please use :operator.

craft
Deprecated. Please use :vehicle.

from:port
Deprecated. Please use :departure:place.

stops
Deprecated. Please use transport:stop.

to:port
Deprecated. Please use :arrival:place.

transport:air:occupant
The form had the following properties deprecated:

contact
Deprecated. Please use transport:occupant.

flight
Deprecated. Please use transport:occupant.

seat
Deprecated. Please use transport:occupant.

type
Deprecated. Please use transport:occupant.

transport:land:vehicle
The form had the following property deprecated:

make
Deprecated. Please use :manufacturer:name.

transport:sea:vessel
The form had the following properties deprecated:

length
Deprecated. Please use :phys:length.

make
Deprecated. Please use :manufacturer:name.

3.8.15 v2.194.0 Model Updates

The following model updates were made during the `v2.194.0` Synapse release.

New Properties

inet:service:message
The form had the following property added to it:

repost
The original message reposted by this message.

it:prod:soft
The form had the following property added to it:

id
An ID for the software.

ps:contact
The form had the following property added to it:

bio
A brief bio provided for the contact.

Updated Properties

geo:place
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

it:prod:soft
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

it:prod:softver
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

ou:campaign
The form had the following properties updated:

The property `goal` had the alternative property names added to its definition.

The property `name` had the alternative property names added to its definition.

ou:conference
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

ou:goal
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

ou:industry
The form had the following property updated:

The property `name` had the alternative property names added to its definition.

pol:country
The form had the following property updated:

The property name had the alternative property names added to its definition.

ps:contact
The form had the following properties updated:

The property email had the alternative property names added to its definition.

The property id:number had the alternative property names added to its definition.

The property lang had the alternative property names added to its definition.

The property name had the alternative property names added to its definition.

The property orgname had the alternative property names added to its definition.

The property title had the alternative property names added to its definition.

The property user had the alternative property names added to its definition.

ps:person
The form had the following property updated:

The property name had the alternative property names added to its definition.

risk:threat
The form had the following property updated:

The property org:name had the alternative property names added to its definition.

risk:tool:software
The form had the following property updated:

The property soft:name had the alternative property names added to its definition.

risk:vuln
The form had the following property updated:

The property name had the alternative property names added to its definition.

tel:mob:telem
The form had the following property updated:

The property adid had the following docstring added:

The advertising ID of the mobile telemetry sample.

Deprecated Types

The following forms have been marked as deprecated:

- it:os:android:aaid
- it:os:ios:idfa

Deprecated Properties

tel:mob:telem
The form had the following properties deprecated:

aaid
Deprecated. Please use :adid.

idfa
Deprecated. Please use :adid.

3.8.16 v2.193.0 Model Updates

The following model updates were made during the `v2.193.0` Synapse release.

New Properties

inet:egress
The form had the following property added to it:

host:iface
The interface which the host used to connect out via the egress.

inet:email:message
The form had the following property added to it:

id
The ID parsed from the "message-id" header.

inet:flow
The form had the following property added to it:

capture:host
The host which captured the flow.

inet:service:account
The form had the following property added to it:

url
The primary URL associated with the account.

inet:service:bucket
The form had the following property added to it:

url
The primary URL associated with the bucket.

inet:service:bucket:item
The form had the following property added to it:

url
The primary URL associated with the bucket item.

inet:service:channel
The form had the following property added to it:

url
The primary URL associated with the channel.

inet:service:channel:member
The form had the following property added to it:

url
The primary URL associated with the channel membership.

inet:service:emote
The form had the following property added to it:

url
The primary URL associated with the emote.

inet:service:group
The form had the following property added to it:

url
The primary URL associated with the group.

inet:service:group:member
The form had the following property added to it:

url
The primary URL associated with the group membership.

inet:service:permission
The form had the following property added to it:

url
The primary URL associated with the permission.

inet:service:relationship
The form had the following property added to it:

url
The primary URL associated with the relationship.

inet:service:rule
The form had the following property added to it:

url
The primary URL associated with the rule.

inet:service:session
The form had the following property added to it:

url
The primary URL associated with the session.

inet:service:subscription
The form had the following property added to it:

url
The primary URL associated with the subscription.

inet:service:tenant
The form had the following property added to it:

url
The primary URL associated with the tenant.

inet:service:thread
The form had the following property added to it:

url
The primary URL associated with the thread.

it:dev:repo:issue:label
The form had the following property added to it:

url
The primary URL associated with the repository issue label.

it:host
The form had the following property added to it:

url
The primary URL associated with the host.

it:host:tenancy
The form had the following property added to it:

url
The primary URL associated with the host tenancy.

it:software:image
The form had the following property added to it:

url
The primary URL associated with the software image.

risk:leak
The form had the following property added to it:

recipient
The identity which received the leaked information.

Updated Interfaces

inet:service:object
The property `url` has been added to the interface.

Updated Types

inet:web:hashtag
The regular expression used to validate hashtags has been relaxed.

Light Edges

enabled
When used with a `risk:leak` and a `risk:leak` node, the edge indicates the source leak enabled the target leak to occur.

uses
When used with a `risk:mitigation` and an `it:prod:softver` node, the edge indicates the mitigation uses the software version.

When used with a `risk:mitigation` and an `it:prod:hardware` node, the edge indicates the mitigation uses the hardware.

Deprecated Properties

risk:mitigation
The form had the following properties deprecated:

hardware
Deprecated. Please use risk:mitigation -(uses)> it:prod:hardware.

software
Deprecated. Please use risk:mitigation -(uses)> it:prod:softver.

3.8.17 v2.191.0 Model Updates

The following model updates were made during the `v2.191.0` Synapse release.

New Interfaces

inet:service:subscriber
Properties common to the nodes which subscribe to services.

econ:pay:instrument
An interface for forms which may act as a payment instrument.

New Types

meta:ruleset:type:taxonomy
A taxonomy for meta:ruleset types.

markdown
A markdown string.

econ:pay:instrument
A node which may act as a payment instrument.

inet:service:subscriber
A node which may subscribe to a service subscription.

meta:activity
A generic activity level enumeration.

New Forms

inet:service:subscription:level:taxonomy
A taxonomy of platform specific subscription levels.

inet:service:subscription
A subscription to a service platform or instance.

inet:service:tenant
A tenant which groups accounts and instances.

New Properties

econ:acct:payment
The form had the following properties added to it:

from:instrument
The payment instrument used to make the payment.

to:instrument
The payment instrument which received funds from the payment.

inet:service:account
The form had the following property added to it:

tenant
The tenant which contains the account.

inet:service:instance
The form had the following property added to it:

tenant
The tenant which contains the instance.

inet:service:session
The form had the following property added to it:

http:session
The HTTP session associated with the service session.

meta:ruleset
The form had the following property added to it:

type
The ruleset type.

meta:source
The form had the following properties added to it:

ingest:latest
Used by ingest logic to capture the last time a feed ingest ran.

ingest:offset
Used by ingest logic to capture the current ingest offset within a feed.

ps:contactlist
The form had the following property added to it:

source:account
The service account from which the contact list was extracted.

risk:outage
The form had the following property added to it:

attack
An attack which caused the outage.

risk:threat
The form had the following property added to it:

activity
The most recently assessed activity level of the threat cluster.

Updated Types

crypto:currency:address
The type interface has been modified to inherit from `econ:pay:instrument`.

econ:bank:account
The type interface has been modified to inherit from `econ:pay:instrument`.

econ:pay:card
The type interface has been modified to inherit from `econ:pay:instrument`.

inet:service:account
The type interface has been modified to inherit from `inet:service:object` instead of `inet:service:subscriber`.

Deprecated Properties

auth:creds
The form had the following property deprecated:

web:acct
Deprecated. Use :service:account.

econ:acct:payment
The form had the following properties deprecated:

from:account
Deprecated. Please use :from:instrument.

from:coinaddr
Deprecated. Please use :from:instrument.

from:pay:card
Deprecated. Please use :from:instrument.

to:account
Deprecated. Please use :to:instrument.

to:coinaddr
Deprecated. Please use :to:instrument.

inet:service:message
The form had the following property deprecated:

client:address
Deprecated. Please use :client

ps:contact
The form had the following properties deprecated:

web:acct
Deprecated. Use :service:accounts.

web:accts
Deprecated. Use :service:accounts.

web:group
Deprecated. Use inet:service:group:profile to link to a group.

ps:contactlist
The form had the following property deprecated:

source:acct
Deprecated. Use :source:account.

tel:mob:telem
The form had the following property deprecated:

acct
Deprecated, use :account.

3.8.18 v2.189.0 Model Updates

The following model updates were made during the `v2.189.0` Synapse release.

New Properties

risk:vulnerable
The form had the following property added to it:

technique
The technique that the node is susceptible to.

3.8.19 v2.188.0 Model Updates

The following model updates were made during the `v2.188.0` Synapse release.

New Types

inet:service:object
An ndef type including all forms which implement the `inet:service:object` interface.

New Forms

risk:outage
An outage event which affected resource availability.

meta:aggregate:type:taxonomy
A type of item being counted in aggregate.

ou:candidate:method:taxonomy
A taxonomy of methods by which a candidate came under consideration.

risk:outage:type:taxonomy
An outage type taxonomy.

file:attachment
A file attachment.

risk:outage:cause:taxonomy
An outage cause taxonomy.

inet:service:relationship
A relationship between two service objects.

meta:aggregate
A node which represents an aggregate count of a specific type.

inet:service:relationship:type:taxonomy
A service object relationship type taxonomy.

inet:service:emote
An emote or reaction by an account.

ou:candidate
A candidate being considered for a role within an organization.

New Properties

inet:flow
The form had the following properties added to it:

dst:txfiles
An array of files sent by the destination host.

src:txfiles
An array of files sent by the source host.

ou:industry
The form had the following properties added to it:

reporter
The organization reporting on the industry.

reporter:name
The name of the organization reporting on the industry.

Light Edges

caused
When used with a `risk:attack` and an `risk:outage` node, the edge indicates the attack caused the outage.

When used with a `meta:event` and an `risk:outage` node, the edge indicates the event caused the outage.

impacted
When used with a `risk:outage` node, the edge indicates the outage event impacted the availability of the target node.

When used with a `risk:vuln` and an `ou:technique` node, the edge indicates the vulnerability uses the technique.

uses
When used with a `ou:technique` and an `risk:vuln` node, the edge indicates the technique uses the vulnerability.

3.8.20 v2.187.0 Model Updates

The following model updates were made during the `v2.187.0` Synapse release.

Updated Types

it:sec:cpe
Update the parsing of CPE 2.2 and CPE 2.3 strings to be strict according to the CPE specification (NISTIR 7695).

3.8.21 v2.186.0 Model Updates

The following model updates were made during the `v2.186.0` Synapse release.

New Properties

risk:tool:software
The form had the following property added to it:

id
An ID for the tool.

3.8.22 v2.185.0 Model Updates

The following model updates were made during the `v2.185.0` Synapse release.

New Interfaces

doc:document
A common interface for documents.

proj:task
A common interface for tasks.

New Forms

ou:enacted:status:taxonomy
A taxonomy of enacted statuses.

doc:policy
Guiding principles used to reach a set of goals.

doc:policy:type:taxonomy
A taxonomy of policy types.

ou:enacted
An organization enacting a document.

doc:standard
A group of requirements which define how to implement a policy or goal.

doc:standard:type:taxonomy
A taxonomy of standard types.

New Properties

proj:ticket
The form had the following properties added to it:

completed
The time the ticket was completed.

due
The time the ticket must be complete.

id
The ID of the ticket.

Updated Types

proj:ticket
The type interface now inherits from the `proj:task` interface.

syn:role
The type has been modified to allow norming role names into their guid values, and repring guid values into their role names.

syn:user
The type has been modified to allow norming usernames into their guid values, and repring guid values into their usernames.

Updated Properties

proj:ticket
The form had the following properties updated:

The property `updated` has been modified to remove the `ismax` option.

Deprecated Properties

proj:ticket
The form had the following property deprecated:

ext:id
Deprecated. Please use `:id`.

3.8.23 v2.184.0 Model Updates

The following model updates were made during the `v2.184.0` Synapse release.

New Forms

ou:asset
A node for tracking assets which belong to an organization.

ou:asset:status:taxonomy
An asset status taxonomy.

ou:asset:type:taxonomy
An asset type taxonomy.

ou:requirement:type:taxonomy
A taxonomy of requirement types.

risk:mitigation:type:taxonomy
A taxonomy of mitigation types.

New Properties

it:app:snort:hit
The form had the following property added to it:

dropped
Set to true if the network traffic was dropped due to the match.

ou:requirement
The form had the following property added to it:

type
The type of requirement.

ou:vitals
The form had the following property added to it:

budget
The budget allocated for the period.

risk:mitigation
The form had the following property added to it:

type
A taxonomy type entry for the mitigation.

Light Edges

uses
When used with a `risk:mitigation` and an `inet:service:rule` node, the edge indicates the mitigation uses the service rule.

When used with a `risk:mitigation` and a `meta:rule` node, the edge indicates the mitigation uses the rule.

When used with a `risk:mitigation` and an `it:app:yara:rule` node, the edge indicates the mitigation uses the YARA rule.

When used with a `risk:mitigation` and an `it:app:snort:rule` node, the edge indicates the mitigation uses the Snort rule.

3.8.24 v2.183.0 Model Updates

The following model updates were made during the `v2.183.0` Synapse release.

Updated Properties

it:exec:file:add
The form had the following properties updated:

The property `path:base` is no longer marked as read only.

The property `path:dir` is no longer marked as read only.

The property `path:ext` is no longer marked as read only.

it:exec:file:del
The form had the following properties updated:

The property `path:base` is no longer marked as read only.

The property `path:dir` is no longer marked as read only.

The property `path:ext` is no longer marked as read only.

it:exec:file:read
The form had the following properties updated:

The property `path:base` is no longer marked as read only.

The property `path:dir` is no longer marked as read only.

The property `path:ext` is no longer marked as read only.

it:exec:file:write
The form had the following properties updated:

The property `path:base` is no longer marked as read only.

The property `path:dir` is no longer marked as read only.

The property `path:ext` is no longer marked as read only.

it:fs:file
The form had the following properties updated:

The property `path:base` is no longer marked as read only.

The property `path:dir` is no longer marked as read only.

The property `path:ext` is no longer marked as read only.

3.8.25 v2.181.0 Model Updates

The following model updates were made during the `v2.181.0` Synapse release.

New Forms

lang:phrase
A small group of words which stand together as a concept.

math:algorithm:type:taxonomy
A hierarchical taxonomy of algorithm types.

ou:industry:type:taxonomy
An industry type taxonomy.

math:algorithm
A mathematical algorithm.

New Properties

ou:campaign
The form had the following property added to it:

slogan
The slogan used by the campaign.

ou:org
The form had the following property added to it:

motto
The motto used by the organization.

risk:vulnerable
The form had the following properties added to it:

mitigated
Set to true if the vulnerable node has been mitigated.

mitigations
The mitigations which were used to address the vulnerable node.

Light Edges

generates
When used with a `math:algorithm` node, the edge indicates the target node was generated by the algorithm.

has
When used with an `it:dev:repo` and an `inet:url` node, the edge indicates the repo has content hosted at the URL.

uses
When used with a `risk:tool:software` and a `math:algorithm` node, the edge indicates the tool uses the algorithm.

When used with a `file:bytes` and a `math:algorithm` node, the edge indicates the file uses the algorithm.

When used with an `it:prod:softver` and a `math:algorithm` node, the edge indicates the software uses the algorithm.

3.8.26 v2.180.0 Model Updates

The following model updates were made during the `v2.180.0` Synapse release.

New Properties

auth:creds
The form had the following property added to it:

service:account
The service account that the credentials allow access to.

inet:search:query
The form had the following properties added to it:

account
The account which initiated the action.

client
: The network address of the client which initiated the action.

client:host
: The client host which initiated the action.

error:code
: The platform specific error code if the action was unsuccessful.

error:reason
: The platform specific friendly error reason if the action was unsuccessful.

id
: A platform specific ID.

instance
: The platform instance which defines the node.

platform
: The platform which defines the node.

rule
: The rule which allowed or denied the action.

server
: The network address of the server which handled the action.

server:host
: The server host which handled the action.

session
: The session which initiated the action.

success
: Set to true if the action was successful.

it:dev:repo
: The form had the following properties added to it:

creator
: The service account which created the object.

id
: A platform specific ID.

instance
: The platform instance which defines the node.

period
: The period when the object existed.

platform
: The platform which defines the node.

remover
: The service account which removed or decommissioned the object.

status
: The status of this object.

it:dev:repo:branch
: The form had the following properties added to it:

creator
: The service account which created the object.

id
: A platform specific ID.

instance
: The platform instance which defines the node.

period
: The period when the object existed.

platform
: The platform which defines the node.

remover
: The service account which removed or decommissioned the object.

status
: The status of this object.

it:dev:repo:commit
: The form had the following properties added to it:

creator
: The service account which created the object.

instance
: The platform instance which defines the node.

period
: The period when the object existed.

platform
: The platform which defines the node.

remover
: The service account which removed or decommissioned the object.

status
: The status of this object.

it:dev:repo:diff:comment
: The form had the following properties added to it:

creator
: The service account which created the object.

id
: A platform specific ID.

instance
: The platform instance which defines the node.

period
: The period when the object existed.

platform
: The platform which defines the node.

remover
: The service account which removed or decommissioned the object.

status
The status of this object.

it:dev:repo:issue
The form had the following properties added to it:

creator
The service account which created the object.

instance
The platform instance which defines the node.

period
The period when the object existed.

platform
The platform which defines the node.

remover
The service account which removed or decommissioned the object.

status
The status of this object.

it:dev:repo:issue:comment
The form had the following properties added to it:

creator
The service account which created the object.

id
A platform specific ID.

instance
The platform instance which defines the node.

period
The period when the object existed.

platform
The platform which defines the node.

remover
The service account which removed or decommissioned the object.

status
The status of this object.

it:dev:repo:issue:label
The form had the following properties added to it:

creator
The service account which created the object.

id
A platform specific ID.

instance
The platform instance which defines the node.

period
The period when the object existed.

platform
The platform which defines the node.

remover
The service account which removed or decommissioned the object.

status
The status of this object.

pol:candidate
The form had the following property added to it:

id
A unique ID for the candidate issued by an election authority.

ps:contact
The form had the following property added to it:

service:accounts
The service accounts associated with this contact.

tel:mob:telem
The form had the following property added to it:

account
The service account which is associated with the tracked device.

Updated Types

inet:search:query
The type now inherits from the `inet:service:action` interface.

it:dev:repo
The type now inherits from the `inet:service:object` interface.

it:dev:repo:branch
The type now inherits from the `inet:service:object` interface.

it:dev:repo:commit
The type now inherits from the `inet:service:object` interface.

it:dev:repo:diff:comment
The type now inherits from the `inet:service:object` interface.

it:dev:repo:issue
The type now inherits from the `inet:service:object` interface.

it:dev:repo:issue:comment
The type now inherits from the `inet:service:object` interface.

it:dev:repo:issue:label
The type now inherits from the `inet:service:object` interface.

Updated Properties

it:dev:repo:commit
The form had the following property updated:

The property `id` has been modified to strip trailing and leading whitespace.

Deprecated Properties

it:dev:repo
The form had the following property deprecated:

created
Deprecated. Please use :period.

it:dev:repo:branch
The form had the following properties deprecated:

created
Deprecated. Please use :period.

deleted
Deprecated. Please use :period.

it:dev:repo:commit
The form had the following property deprecated:

created
Deprecated. Please use :period.

it:dev:repo:diff:comment
The form had the following property deprecated:

created
Deprecated. Please use :period.

it:dev:repo:issue
The form had the following property deprecated:

created
Deprecated. Please use :period.

it:dev:repo:issue:comment
The form had the following property deprecated:

created
Deprecated. Please use :period.

it:dev:repo:issue:label
The form had the following properties deprecated:

applied
Deprecated. Please use :period.

removed
Deprecated. Please use :period.

3.8.27 v2.179.0 Model Updates

The following model updates were made during the v2.179.0 Synapse release.

New Forms

it:app:yara:netmatch
An instance of a YARA rule network hunting match.

New Properties

geo:telem
The form had the following property added to it:

node
The node that was observed at the associated time and place.

it:sec:stix:indicator
The form had the following properties added to it:

confidence
The confidence field from the STIX indicator.

description
The description field from the STIX indicator.

pattern_type
The STIX indicator pattern type.

revoked
The revoked field from the STIX indicator.

valid_from
The valid_from field from the STIX indicator.

valid_until
The valid_until field from the STIX indicator.

Updated Types

pe:langid
The type has been modified to add additional known language codes to its enums list.

Updated Properties

inet:dns:request
The form had the following property updated:

The property `reply:code` has been modified to add enums for known DNS reply code values.

Deprecated Edges

seenat
The edge has been deprecated when used with a `geo:telem` target node. Please use `geo:telem:node`.

3.8.28 v2.177.0 Model Updates

The following model updates were made during the `v2.177.0` Synapse release.

New Forms

inet:service:message:type:taxonomy
A message type taxonomy.

meta:rule:type:taxonomy
A taxonomy for meta:rule types.

New Properties

biz:deal
The form had the following property added to it:

id
An identifier for the deal.

file:mime:lnk
The form had the following properties added to it:

driveserial
The drive serial number of the volume the link target is stored on.

iconindex
A resource index for an icon within an icon location.

machineid
The NetBIOS name of the machine where the link target was last located.

inet:service:message
The form had the following property added to it:

type
The type of message.

meta:rule
The form had the following property added to it:

type
The rule type.

3.8.29 v2.176.0 Model Updates

The following model updates were made during the `v2.176.0` Synapse release.

New Forms

inet:service:thread
A message thread.

New Properties

`inet:service:message` The form had the following properties added to it:

thread
The thread which contains the message.

title
The message title.

Updated Forms

inet:service:account
The form now inherits from the `inet:service:object` interface.

3.8.30 v2.174.0 Model Updates

The following model updates were made during the `v2.174.0` Synapse release.

New Forms

econ:currency
: The name of a system of money in general use.

entity:name
: A name used to refer to an entity.

New Properties

crypto:key
: The form had the following properties added to it:

  private:text
  : Set only if the `:private` property decodes to ASCII.

  public:text
  : Set only if the `:public` property decodes to ASCII.

econ:acct:payment
: The form had the following properties added to it:

  from:cash
  : Set to true if the payment input was in cash.

  to:cash
  : Set to true if the payment output was in cash.

  place
  : The place where the payment occurred.

  place:address
  : The address of the place where the payment occurred.

  place:latlong
  : The latlong where the payment occurred.

  place:loc
  : The loc of the place where the payment occurred.

  place:name
  : The name of the place where the payment occurred.

pol:country
: The form had the following property added to it:

  currencies
  : The official currencies used in the country.

Updated Properties

ou:position
: The form had the following property updated on it:

  title
  : This property is now an `entity:name` type.

ou:conference
: The form had the following properties updated on it:

name
: This property is now an `entity:name` type.

names
: This property is now an array of `entity:name` type.

Light Edges

refs
: When used with a `files:bytes` and an `it:dev:str` node, the edge indicates the source file contains the target string.

3.8.31 v2.173.1 Model Updates

The following model updates were made during the `v2.173.1` Synapse release.

New Properties

ou:conference
: The form had the following property added to it:

  names
  : An array of alternate names for the conference.

ps:contact
: The form had the following property added to it:

  titles
  : An array of alternate titles for the contact.

Light Edges

uses
: When used with a `plan:procedure:step` node, the edge indicates the step in the procedure makes use of the target node.

3.8.32 v2.173.0 Model Updates

The following model updates were made during the `v2.173.0` Synapse release.

New Interfaces

inet:service:base
: Properties common to most forms within a service platform.

inet:service:object
: Properties common to objects within a service platform. This inherits from the `inet:service:base` interface.

New Forms

inet:service:access
: Represents a user access request to a service resource.

inet:service:account
: An account within a service platform. Accounts may be instance specific.

inet:service:bucket
: A file/blob storage object within a service architecture.

inet:service:bucket:item
An individual file stored within a bucket.

inet:service:channel
A channel used to distribute messages.

inet:service:channel:member
Represents a service account being a member of a channel.

inet:service:group
A group or role which contains member accounts.

inet:service:group:member
Represents a service account being a member of a group.

inet:service:instance
An instance of the platform such as Slack or Discord instances.

inet:service:login
A login event for a service account.

inet:service:message
A message or post created by an account.

inet:service:message:link
A URL link included within a message.

inet:service:message:attachment
A file attachment included within a message.

inet:service:login:method:taxonomy
A taxonomy of inet service login methods.

inet:service:object:status
An object status enumeration.

inet:service:permission
A permission which may be granted to a service account or role.

inet:service:permission:type:taxonomy
A permission type taxonomy.

inet:service:platform
A network platform which provides services.

inet:service:resource
A generic resource provided by the service architecture.

inet:service:resource:type:taxonomy
A taxonomy of inet service resource types.

inet:service:rule
A rule which grants or denies a permission to a service account or role.

inet:service:session
An authenticated session.

it:cmd:history
A single command executed within a session.

it:cmd:session
A command line session with multiple commands run over time.

it:host:tenancy
A time window where a host was a tenant run by another host.

it:network:type:taxonomy
A taxonomy of network types.

it:software:image:type:taxonomy
A taxonomy of software image types.

it:software:image
The base image used to create a container or OS.

it:storage:mount
A storage volume that has been attached to an image.

it:storage:volume
A physical or logical storage volume that can be attached to a physical/virtual machine or container.

it:storage:volume:type:taxonomy
A taxonomy of storage volume types.

New Properties

biz:listing
The form had the following properties added to it:

count:remaining
The current remaining number of instances for sale.

count:total
The number of instances for sale.

econ:purchase
The form had the following property added to it:

listing
The purchase was made based on the given listing.

it:exec:proc
The form had the following property added to it:

cmd:history
The command history entry which caused this process to be run.

it:exec:query
The form had the following property added to it:

synuser
The synapse user who executed the query.

it:host
The form had the following property added to it:

image
The container image or OS image running on the host.

it:network
The form had the following property added to it:

type
The type of network.

meta:note
The form had the following property added to it:

replyto
The note is a reply to the specified note.

ou:campaign
The form had the following property added to it:

ext:id
An external identifier for the campaign.

ou:org
The form had the following property added to it:

ext:id
An external identifier for the organization.

ou:technique
The form had the following property added to it:

ext:id
An external identifier for the technique.

risk:extortion
The form had the following properties added to it:

paid:price
The total price paid by the target of the extortion.

payments
Payments made from the target to the attacker.

risk:leak
The form had the following properties added to it:

size:count
The number of files included in the leaked data.

size:percent
The total percent of the data leaked.

risk:threat
The form had the following property added to it:

ext:id
An external identifier for the threat.

Updated Types

inet:web:hashtag
Update the regex to allow the middle dot (U+00B7) character to be part of the hashtag after the first unicode word character.

transport:air:flightnum
Loosen the regex for flight number validation.

Updated Forms

it:host
The form now inherits from the `inet:service:object` interface.

3.8.33 v2.172.0 Model Updates

The following model updates were made during the `v2.172.0` Synapse release.

New Interfaces

inet:service:base
Properties common to most forms within a service platform.

inet:service:object
Properties common to objects within a service platform. This inherits from the `inet:service:base` interface.

New Forms

inet:service:access
Represents a user access request to a service resource.

inet:service:account
An account within a service platform. Accounts may be instance specific.

inet:service:bucket
A file/blob storage object within a service architecture.

inet:service:bucket:item
An individual file stored within a bucket.

inet:service:channel
A channel used to distribute messages.

inet:service:channel:member
Represents a service account being a member of a channel.

inet:service:group
A group or role which contains member accounts.

inet:service:group:member
Represents a service account being a member of a group.

inet:service:instance
An instance of the platform such as Slack or Discord instances.

inet:service:login
A login event for a service account.

inet:service:message
A message or post created by an account.

inet:service:message:link
A URL link included within a message.

inet:service:message:attachment
A file attachment included within a message.

inet:service:login:method:taxonomy
A taxonomy of inet service login methods.

inet:service:object:status
An object status enumeration.

inet:service:permission
A permission which may be granted to a service account or role.

inet:service:permission:type:taxonomy
A permission type taxonomy.

inet:service:platform
A network platform which provides services.

inet:service:resource
A generic resource provided by the service architecture.

inet:service:resource:type:taxonomy
A taxonomy of inet service resource types.

inet:service:rule
A rule which grants or denies a permission to a service account or role.

inet:service:session
An authenticated session.

it:cmd:history
A single command executed within a session.

it:cmd:session
A command line session with multiple commands run over time.

it:host:tenancy
A time window where a host was a tenant run by another host.

it:network:type:taxonomy
A taxonomy of network types.

it:software:image:type:taxonomy
A taxonomy of software image types.

it:software:image
The base image used to create a container or OS.

it:storage:mount
A storage volume that has been attached to an image.

it:storage:volume
A physical or logical storage volume that can be attached to a physical/virtual machine or container.

it:storage:volume:type:taxonomy
A taxonomy of storage volume types.

New Properties

`biz:listing` The form had the following properties added to it:

count:remaining
The current remaining number of instances for sale.

count:total
The number of instances for sale.

econ:purchase
The form had the following property added to it:

listing
The purchase was made based on the given listing.

it:exec:proc
The form had the following property added to it:

cmd:history
The command history entry which caused this process to be run.

it:exec:query
The form had the following property added to it:

synuser
The synapse user who executed the query.

it:host
The form had the following property added to it:

image
The container image or OS image running on the host.

it:network
The form had the following property added to it:

type
The type of network.

meta:note
The form had the following property added to it:

replyto
The note is a reply to the specified note.

ou:campaign
The form had the following property added to it:

ext:id
An external identifier for the campaign.

ou:org
The form had the following property added to it:

ext:id
An external identifier for the organization.

ou:technique
The form had the following property added to it:

ext:id
An external identifier for the technique.

risk:extortion
The form had the following properties added to it:

paid:price
The total price paid by the target of the extortion.

payments
Payments made from the target to the attacker.

risk:leak
The form had the following properties added to it:

size:count
The number of files included in the leaked data.

size:percent
The total percent of the data leaked.

risk:threat
The form had the following property added to it:

ext:id
An external identifier for the threat.

Updated Types

inet:web:hashtag
Update the regex to allow the middle dot (U+00B7) character to be part of the hashtag after the first unicode word character.

transport:air:flightnum
Loosen the regex for flight number validation.

Updated Forms

it:host
The form now inherits from the `inet:service:object` interface.

3.8.34 v2.170.0 Model Updates

The following model updates were made during the `v2.170.0` Synapse release.

New Forms

file:mime:lnk
Metadata pulled from a Windows shortcut or LNK file.

it:mitre:attack:datasource
A MITRE ATT&CK Datasource ID.

it:mitre:attack:data:component
A MITRE ATT&CK data component.

New Properties

it:mitre:attack:technique
The form had the following property added to it:

data:components
An array of MITRE ATT&CK data components that detect the ATT&CK technique.

it:prod:hardware
The form had the following properties added to it:

manufacturer
The organization that manufactures this hardware.

manufacturer:name
The name of the organization that manufactures this hardware.

Deprecated Properties

it:prod:hardware
The `it:prod:hardware` form had the following property marked as deprecated:

- `make`

3.8.35 v2.168.0 Model Updates

The following model updates were made during the `v2.168.0` Synapse release.

New Forms

`plan:system`
A planning or behavioral analysis system that defines phases and procedures.

`plan:phase`
A phase within a planning system which may be used to group steps within a procedure.

`plan:procedure`
A procedure consisting of steps.

`plan:procedure:type:taxonomy`
A taxonomy of procedure types.

`plan:procedure:variable`
A variable used by a procedure.

`plan:procedure:step`
A step within a procedure.

`plan:procedure:link`
A link between steps in a procedure.

3.8.36 v2.167.0 Model Updates

The following model updates were made during the `v2.167.0` Synapse release.

Updated Types

`file:path`
Normalizing paths such as `../.././..` previously failed. This now produces an empty path.

Deprecated Types

The following types have been marked as deprecated:

- `edge`
- `timeedge`

Deprecated Forms

The following forms have been marked as deprecated:

- `graph:cluster`
- `graph:node`
- `graph:event`
- `edge:refs`
- `edge:has`
- `edge:wentto`
- `graph:edge`
- `graph:timeedge`

3.8.37 v2.166.0 Model Updates

The following model updates were made during the `v2.166.0` Synapse release.

New Forms

`inet:tls:handshake`
: An instance of a TLS handshake between a server and client.

`inet:tls:ja3:sample`
: A JA3 sample taken from a client.

`inet:tls:ja3s:sample`
: A JA3 sample taken from a server.

`inet:tls:servercert`
: An x509 certificate sent by a server for TLS.

`inet:tls:clientcert`
: An x509 certificate sent by a client for TLS.

New Properties

`risk:extortion`
: The form had the following property added to it:

  `deadline`
  : The time that the demand must be met.

`risk:leak`
: The form had the following properties added on it:

  `extortion`
  : The extortion event which used the threat of the leak as leverage.

  `size:bytes`
  : The approximate uncompressed size of the total data leaked.

`it:mitre:attack:technique`
: The form had the following properties updated on it:

  `name`
  : This property is now lower-cased and single spaced.

Deprecated Forms

The following forms have been marked as deprecated:

`inet:ssl:cert`
: Please use `inet:tls:clientcert` or `inet:tls:servercert`.

Column Display Hints

The following forms had column display hints added to them:

`ou:campaign` `ou:conference` `ou:goal` `ou:org` `ou:team` `ou:technique` `ps:contact` `ps:skill` `ps:proficiency` `risk:threat` `risk:compromise` `risk:mitigation` `risk:tool:software`

Light Edges

uses
When used with a `risk:extortion` and an `ou:technique` node, the edge indicates the attacker used the technique to extort the victim.

3.8.38 v2.165.0 Model Updates

The following model updates were made during the `v2.165.0` Synapse release.

New Forms

econ:acct:receipt
A receipt issued as proof of payment.

econ:acct:invoice
An invoice issued requesting payment.

econ:bank:account:type:taxonomy
A bank account type taxonomy.

econ:bank:account
A bank account.

econ:bank:balance
A balance contained by a bank account at a point in time.

econ:bank:statement
A statement of bank account payment activity over a period of time.

econ:bank:aba:rtn
An American Bank Association (ABA) routing transit number (RTN).

econ:bank:iban
An International Bank Account Number.

econ:bank:swift:bic
A Society for Worldwide Interbank Financial Telecommunication (SWIFT) Business Identifier Code (BIC).

risk:vulnerable
Indicates that a node is susceptible to a vulnerability.

sci:hypothesis:type:taxonomy
A taxonomy of hypothesis types.

sci:hypothesis
A hypothesis or theory.

sci:experiment:type:taxonomy
A taxonomy of experiment types.

sci:experiment
An instance of running an experiment.

sci:observation
An observation which may have resulted from an experiment.

sci:evidence
An assessment of how an observation supports or refutes a hypothesis.

Updated Properties

risk:mitigation
The form had the following properties updated on it:

name
This property is now lower-cased and single spaced.

it:mitre:attack:technique
The form had the following properties updated on it:

name
This property is now lower-cased and single spaced.

it:mitre:attack:mitigation
The form had the following properties updated on it:

name
This property is now lower-cased and single spaced.

New Properties

econ:acct:payment
The form had the following properties added to it:

from:account
The bank account which made the payment.

to:account
The bank account which received the payment.

invoice
The invoice that the payment applies to.

receipt
The receipt that was issued for the payment.

file:mime:image
The interface had the following property added to it:

text
The text contained within the image.

inet:email:message
The form had the following property added to it:

flow
The inet:flow which delivered the message.

ou:id:number
The form had the following property added to it:

issuer
The contact information of the office which issued the ID number.

risk:threat
The form had the following property added to it:

mitre:attack:group
A mapping to a MITRE ATT&CK group if applicable.

risk:tool:software
The form had the following property added to it:

mitre:attack:software
A mapping to a MITRE ATT&CK software if applicable.

risk:mitigation
The form had the following property added to it:

mitre:attack:mitigation
A mapping to a MITRE ATT&CK mitigation if applicable.

Deprecated Forms

The following forms have been marked as deprecated:

risk:hasvuln
Please use `risk:vulnerable`.

Light Edges

has
When used with an `econ:bank:statement` and an `econ:acct:payment`, the edge indicates the bank statement includes the payment.

When used with an `ou:org` node, the edge indicates the organization is or was in possession of the target node.

When used with a `ps:contact` node, the edge indicates the contact is or was in possession of the target node.

When used with a `ps:person` node, the edge indicates the person is or was in possession of the target node.

When used with a `sci:observation` node, the edge indicates the observations are summarized from the target nodes.

When used with an `sci:evidence` node, the edge indicates the evidence includes observations from the target nodes.

owns
When used with an `ou:org` node, the edge indicates the organization owns or owned the target node.

When used with a `ps:contact` node, the edge indicates the contact owns or owned the target node.

When used with a `ps:person` node, the edge indicates the person owns or owned the target node.

uses
When used with a `sci:experiment` node, the edge indicates the experiment used the target nodes when it was run.

3.8.39 v2.162.0 Model Updates

The following model updates were made during the `v2.162.0` Synapse release.

New Properties

inet:email:message
The form had the following properties added to it:

received:from:ipv4
The sending SMTP server IPv4, potentially from the Received: header.

received:from:ipv6
The sending SMTP server IPv6, potentially from the Received: header.

received:from:fqdn
The sending server FQDN, potentially from the Received: header.

ou:oid:type
The form had the following property added to it:

url
The official URL of the issuer.

proj:project
The form had the following property added to it:

type
The project type.

risk:alert
The form had the following properties added to it:

status
The status of the alert.

assignee
The Synapse user who is assigned to investigate the alert.

ext:assignee
The alert assignee contact information from an external system.

risk:mitigation
The form had the following properties added to it:

reporter
The organization reporting on the mitigation.

reporter:name
The name of the organization reporting on the mitigation.

tag
The tag used to annotate nodes which have the mitigation in place.

New Forms

proj:project:type:taxonomy
A type taxonomy for projects.

Deprecated Properties

it:mitre:attack:group
The `it:mitre:attack:group` form had the following property marked as deprecated:

- `tag`

it:mitre:attack:tactic
The `it:mitre:attack:tactic` form had the following property marked as deprecated:

- `tag`

it:mitre:attack:technique
The `it:mitre:attack:technique` form had the following property marked as deprecated:

- `tag`

it:mitre:attack:software
The `it:mitre:attack:software` form had the following property marked as deprecated:

- `tag`

it:mitre:attack:campaign
The `it:mitre:attack:campaign` form had the following property marked as deprecated:

- `tag`

3.8.40 v2.160.0 Model Updates

The following model updates were made during the `v2.160.0` Synapse release.

New Properties

risk:vuln
The form had the following properties added to it:

severity
The severity of the vulnerability.

priority
The priority of the vulnerability.

inet:ipv6
The form had the following properties added to it:

type
The type of IP address (e.g., private, multicast, etc.).

scope
The IPv6 scope of the address (e.g., global, link-local, etc.).

Updated Types

it:exec:proc
This now inherits the `it:host:activity` interface.

it:exec:thread
This now inherits the `it:host:activity` interface.

it:exec:loadlib
This now inherits the `it:host:activity` interface.

it:exec:mmap
This now inherits the `it:host:activity` interface.

it:exec:mutex
This now inherits the `it:host:activity` interface.

it:exec:pipe
This now inherits the `it:host:activity` interface.

it:exec:url
This now inherits the `it:host:activity` interface.

it:exec:bind
This now inherits the `it:host:activity` interface.

it:exec:file:add
This now inherits the `it:host:activity` interface.

it:exec:file:read
This now inherits the `it:host:activity` interface.

it:exec:file:write
This now inherits the `it:host:activity` interface.

it:exec:file:del
This now inherits the `it:host:activity` interface.

it:exec:reg:get
This now inherits the `it:host:activity` interface.

it:exec:reg:set
This now inherits the `it:host:activity` interface.

it:exec:reg:del
This now inherits the `it:host:activity` interface.

3.8.41 v2.156.0 Model Updates

The following model updates were made during the `v2.156.0` Synapse release.

New Properties

it:av:scan:result
The form had the following properties added to it:

target:ipv4
The IPv4 address that was scanned to produce the result.

target:ipv6
The IPv6 address that was scanned to produce the result.

ou:campaign
The form had the following property added to it:

mitre:attack:campaign
A mapping to a Mitre ATT&CK campaign if applicable.

risk:vuln
The form had the following property added to it:

id
An identifier for the vulnerability.

New Forms

it:mitre:attack:campaign
A Mitre ATT&CK Campaign ID.

risk:technique:masquerade
Represents the assessment that a node is designed to resemble another in order to mislead.

Updated Types

it:os:windows:sid
The regular expression used to validate the SID has been updated to allow modeling well-known SID values.

3.8.42 v2.155.0 Model Updates

The following model updates were made during the `v2.155.0` Synapse release.

New Forms

it:av:scan:result
The result of running an antivirus scanner.

New Properties

proj:ticket
The form had the following property added to it:

ext:assignee
Ticket assignee contact information from an external system.

risk:alert
The form had the following property added to it:

severity
A severity rank for the alert.

it:exec:query
The form had the following property added to it:

offset
The offset of the last record consumed from the query.

Updated Properties

risk:alert
The form had the following properties updated on it:

priority
The type of this property has been changed from an `int` to `meta:priority`.

risk:attack
The form had the following properties updated on it:

severity
The type of this property has been changed from an `int` to `meta:severity`.

risk:compromise
The form had the following properties updated on it:

severity
The type of this property has been changed from an `int` to `meta:severity`.

Deprecated Forms

The following forms have been marked as deprecated:

it:av:sig
Please use `it:av:scan:result`.

it:av:filehit
Please use `it:av:scan:result`.

it:av:prochit
Please use `it:av:scan:result`.

3.8.43 v2.154.0 Model Updates

The following model updates were made during the `v2.154.0` Synapse release.

New Forms

ou:requirement
A specific requirement.

risk:leak
An event where information was disclosed without permission.

risk:leak:type:taxonomy
A taxonomy of leak event types

risk:extortion
An event where an attacker attempted to extort a victim.

risk:extortion:type:taxonomy
A taxonomy of extortion event types.

New Properties

ou:org
The form had the following property added to it:

tag
A base tag used to encode assessments made by the organization.

risk:compromise
The form had the following properties added to it:

ext:id
An external unique ID for the compromise.

url
A URL which documents the compromise.

risk:alert
The form had the following property added to it:

host
The host which generated the alert.

Updated Types

inet:ipv4
RFC6598 addresses now have a `:type` property value of `shared`.

inet:url
Accept Microsoft URLPrefix strings with a strong wildcard host value.

Add a check to prevent creating `inet:url` nodes with an empty host and path part, such as `inet:url=file://''`.

Light Edges

leaked
When used with a `risk:leak` node, the edge indicates the leak included the disclosure of the target node.

leveraged
When used with a risk:extortion node, the edge indicates the extortion event was based on attacker access to the target node.

meets
When used with a ou:requirement node, the edge indicates the requirement was met by the source node.

3.8.44 v2.153.0 Model Updates

The following model updates were made during the v2.153.0 Synapse release.

Deprecated Properties

inet:web:acct
The inet:web:acct form had the following properties marked as deprecated:

- name:en
- realname:en

inet:web:group
The inet:web:group form had the following property marked as deprecated:

- name:en

ou:industry
The ou:industry form had the following property marked as deprecated:

- subs

3.8.45 v2.152.0 Model Updates

The following model updates were made during the v2.152.0 Synapse release.

New Forms

it:dev:repo:label
A developer selected label.

it:dev:repo:issue:label
A label applied to a repository issue.

Updated Interfaces

crypto:smart:effect
Add a doc value to the interface.

it:host:activity
Add a doc value to the interface.

taxonomy
Add a doc value to the interface.

Updated Types

time
The time type now recognizes RFC822 formatted time strings.

biz:service:type:taxonomy
The taxonomy interface has been added to the type.

geo:place:taxonomy
The taxonomy interface has been added to the type.

it:log:event:type:taxonomy
The taxonomy interface has been added to the type.

it:prod:soft:taxonomy
The taxonomy interface has been added to the type.

mat:type
The taxonomy interface has been added to the type.

media:news:taxonomy
The taxonomy interface has been added to the type.

risk:alert:taxonomy
The taxonomy interface has been added to the type.

risk:alert:verdict:taxonomy
The taxonomy interface has been added to the type.

risk:threat:type:taxonomy
The taxonomy interface has been added to the type.

3.8.46 v2.151.0 Model Updates

The following model updates were made during the v2.151.0 Synapse release.

New Forms

it:mitre:attack:flow
A MITRE ATT&CK Flow diagram.

3.8.47 v2.150.0 Model Updates

The following model updates were made during the v2.150.0 Synapse release.

Updated Types

inet:url
The inet:url type now recognizes UNC network paths and converts them into smb:// URLs.

3.8.48 v2.149.0 Model Updates

The following model updates were made during the v2.149.0 Synapse release.

New Properties

taxonomy
The interface had the following property added to it:

description
A definition of the taxonomy entry.

inet:email:message
The form had the following property added to it:

cc
Email addresses parsed from the "cc" header.

meta:source
The form had the following property added to it:

url
A URL which documents the meta source.

ou:campaign
The form had the following property added to it:

timeline
A timeline of significant events related to the campaign.

Deprecated Properties

taxonomy
The `taxonomy` interface had the following property marked as deprecated:

`summary`

3.8.49 v2.145.0 Model Updates

The following model updates were made during the `v2.145.0` Synapse release.

New Types

it:sec:tlp
The US CISA Traffic-Light-Protocol used to designate information sharing boundaries.

meta:priority
A generic priority enumeration.

meta:severity
A generic severity enumeration.

New Forms

it:sec:metrics
A node used to track metrics of an organization's infosec program.

it:sec:vuln:scan
An instance of running a vulnerability scan.

it:sec:vuln:scan:result
A vulnerability scan result for an asset.``

New Properties

it:dev:repo:issue
The form had the following properties added to it:

updated
The time the issue was updated.

id
The ID of the issue in the repository system.

it:dev:repo:issue:comment
The form had the following properties added to it:

created
The time the comment was created.

updated
The time the comment was updated.

it:dev:repo:diff:comment
The form had the following properties added to it:

created
The time the comment was created.

updated
The time the comment was updated.

meta:note
The form had the following properties added to it:

updated
The time the note was updated.

Deprecated Properties

it:exec:proc
The `it:exec:proc` form had the following property marked as deprecated:

- `src:exe`

inet:whois:iprec
The `inet:whois:iprec` form had the following property marked as deprecated:

- `registrant`

3.8.50 v2.144.0 Model Updates

The following model updates were made during the `v2.144.0` Synapse release.

New Forms

it:dev:repo:type:taxonomy
A version control system type taxonomy.

it:dev:repo
A version control system instance.

it:dev:repo:remote
A remote repo that is tracked for changes/branches/etc.

it:dev:repo:branch
A branch in a version control system instance.

it:dev:repo:commit
A commit to a repository.

it:dev:repo:diff
A diff of a file being applied in a single commit.

it:dev:repo:issue
An issue raised in a repository.

it:dev:repo:issue:comment
A comment on an issue in a repository.

it:dev:repo:diff:comment
A comment on a diff in a repository.

New Properties

inet:dns:answer
The form had the following properties added to it:

time
The time that the DNS response was transmitted.

3.8.51 v2.143.0 Model Updates

The following model updates were made during the `v2.143.0` Synapse release.

Updated Types

hex
The `zeropad` option has been changed from a `bool` to an `int`. It may now be used to specify the zero extended length of the hex string.

Updated Properties

crypto:x509:cert
The form had the following properties updated on it:

serial
The `size` value has been changed to `zeropad` to zeropad values with less than 40 octets, and to allow storing large serial numbers from malformed certificates.

3.8.52 v2.142.0 Model Updates

The following model updates were made during the `v2.142.0` Synapse release.

New Forms

risk:vulnname
Add a form to capture vulnerability name such as log4j or rowhammer.

New Properties

it:sec:c2:config
The form had the following properties added to it:

decoys
An array of URLs used as decoy connections to obfuscate the C2 servers.

ou:technique
The form had the following properties added to it:

reporter
The organization reporting on the technique.

reporter:name
The name of the organization reporting on the technique.

risk:vuln
The form had the following properties added to it:

names
An array of alternate names for the vulnerability.

Updated Types

hex
: The `hex` base type now accepts a `zeropad` option that can be used to zero-extend a hex string during normalization.

cvss:v2
: The type now accepts and normalizes unordered CVSS vectors.

cvss:v3
: The type now accepts and normalizes unordered CVSS vectors.

3.8.53 v2.141.0 Model Updates

The following model updates were made during the `v2.141.0` Synapse release.

New Properties

it:host
: The form had the following properties added to it:

  keyboard:language
  : The primary keyboard input language configured on the host.

  keyboard:layout
  : The primary keyboard layout configured on the host.

lang:language
: The form had the following property added to it:

  code
  : The language code for this language.

3.8.54 v2.140.0 Model Updates

The following model updates were made during the `v2.140.0` Synapse release.

New Types

file:archive:entry
: Add a type to capture an archive entry representing a file and metadata from within a parent archive file.

Updated Types

time
: Time values with precision beyond milliseconds are now truncated to millsecond values.

hex
: Hex types now have whitespace and colon (`:`) characters stripped from them when lifting and normalizing them.

inet:ipv6
: Add comparators for >=, >, <=, < operations when lifting and filtering IPV6 values.

ou:naics
: Update the type to allow recording NIACS sector and subsector prefixes.

3.8.55 v2.137.0 Model Updates

The following model updates were made during the `v2.137.0` Synapse release.

New Types

it:mitre:attack:matrix
Add a type to capture the enumeration of MITRE ATT&CK matrix values.

New Forms

inet:egress
Add a form to capture a host using a specific network egress client address.

it:prod:softreg
Add a form to capture a registry entry is created by a specific software version.

transport:land:vehicle
Add a form to capture an individual vehicle.

transport:land:registration
Add a form to capture the registration issued to a contact for a land vehicle.

transport:land:license
Add a form to capture the license to operate a land vehicle issued to a contact.

New Properties

inet:http:request
The form had the following property added to it:

referer
The referer URL parsed from the "Referer:" header in the request.

inet:search:query
The form had the following property added to it:

request
The HTTP request used to issue the query.

it:mitre:attack:tactic
The form had the following property added to it:

matrix
The ATT&CK matrix which defines the tactic.

it:mitre:attack:technique
The form had the following property added to it:

matrix
The ATT&CK matrix which defines the technique.

it:mitre:attack:mitigation
The form had the following property added to it:

matrix
The ATT&CK matrix which defines the mitigation.

it:app:snort:rule
The form had the following property added to it:

engine
The snort engine ID which can parse and evaluate the rule text.

it:app:yara:rule
The form had the following properties added to it:

ext:id
The YARA rule ID from an external system.

url
A URL which documents the YARA rule.

ou:campaign
The form had the following property added to it:

tag
The tag used to annotate nodes that are associated with the campaign.

ou:org
The form had the following properties added to it:

country
The organization's country of origin.

country:code
The 2 digit ISO 3166 country code for the organization's country of origin.

risk:threat
The form had the following properties added to it:

country
The reporting organization's assessed country of origin of the threat cluster.

country:code
The 2 digit ISO 3166 country code for the threat cluster's assessed country of origin.

risk:compromise
The form had the following property added to it:

vector
The attack assessed to be the initial compromise vector.

Light Edges

detects
When used with a `meta:rule` node, the edge indicates the rule was designed to detect instances of the target node.

When used with an `it:app:snort:rule` node, the edge indicates the rule was designed to detect instances of the target node.

When used with an `it:app:yara:rule` node, the edge indicates the rule was designed to detect instances of the target node.

contains
When used between two `geo:place` nodes, the edge indicates the source place completely contains the target place.

Deprecated Properties

geo:place
The form had the following property marked as deprecated:

- `parent`

3.8.56 v2.134.0 Model Updates

The following model updates were made during the `v2.134.0` Synapse release.

Light Edges

`addresses`
: When used with a `risk:mitigation` and a `ou:technique` node, the edge indicates the mitigation addresses the technique.

3.8.57 v2.133.0 Model Updates

The following model updates were made during the `v2.133.0` Synapse release.

New Properties

`risk:vuln`
: The `risk:vuln` form had the following properties added to it:

  `cvss:v2`
  : The CVSS v2 vector for the vulnerability.

  `cvss:v2_0:score`
  : The CVSS v2.0 overall score for the vulnerability.

  `cvss:v2_0:score:base`
  : The CVSS v2.0 base score for the vulnerability.

  `cvss:v2_0:score:temporal`
  : The CVSS v2.0 temporal score for the vulnerability.

  `cvss:v2_0:score:environmental`
  : The CVSS v2.0 environmental score for the vulnerability.

  `cvss:v3`
  : The CVSS v3 vector for the vulnerability.

  `cvss:v3_0:score`
  : The CVSS v3.0 overall score for the vulnerability.

  `cvss:v3_0:score:base`
  : The CVSS v3.0 base score for the vulnerability.

  `cvss:v3_0:scare:temporal`
  : The CVSS v3.0 temporal score for the vulnerability.

  `cvss:v3_0:score:environmental`
  : The CVSS v3.0 environmental score for the vulnerability.

  `cvss:v3_1:score`
  : The CVSS v3.1 overall score for the vulnerability.

  `cvss:v3_1:score:base`
  : The CVSS v3.1 base score for the vulnerability.

  `cvss:v3_1:scare:temporal`
  : The CVSS v3.1 temporal score for the vulnerability.

  `cvss:v3_1:score:environmental`
  : The CVSS v3.1 environmental score for the vulnerability.

Deprecated Properties

risk:vuln

The risk:vuln form had the following properties marked as deprecated:

- cvss:av
- cvss:ac
- cvss:pr
- cvss:ui
- cvss:s
- cvss:c
- cvss:i
- cvss:a
- cvss:e
- cvss:rl
- cvss:rc
- cvss:mav
- cvss:mac
- cvss:mpr
- cvss:mui
- cvss:ms
- cvss:mc
- cvss:mi
- cvss:ma
- cvss:cr
- cvss:ir
- cvss:ar
- cvss:score
- cvss:score:temporal
- cvss:score:environmental

Many of the concepts above are closely related and this outline represents a reasonable effort to introduce concepts in a logical order. However, it is difficult to fully understand the potential of Synapse without grasping the power of the Storm query language to understand, manipulate, and annotate data. Similarly, it's hard to understand the effectiveness of Storm without knowledge of the underlying data model. The outline above is our suggested order but readers are encouraged to skip around or revisit earlier sections after digesting later sections to better see how these topics are tied together.

CHAPTER

FOUR

SYNAPSE ADMIN GUIDE

This guide is designed for use by Synapse Administrators ("global admins"). Synapse Admins are typically Synapse power-users with `admin=true` privileges on the *Cortex* who are responsible for configuration and management of a production instance of Synapse.

The Synapse Admin Guide provides important instructions and background information on topics related to day-to-day Synapse administrative tasks, and focuses on using *Storm* to carry out those tasks.

Synapse provides a number of additional methods that can be used to perform some or all of the tasks described in this guide; however, these methods are **not** covered here. Additional methods include:

- *Storm Libraries* that allow you to work with a broad range of objects in Synapse.
- Synapse tools that can be used from the host CLI (as opposed to the Storm CLI). Tools are available in the synapse.tools package of the *Synapse Python API*. The *Synapse User Guide* includes documentation on some of these *Tools*.
- The *Synapse HTTP/REST API*.

Tip

If you are a commercial Synapse user with the Synapse UI (Optic), see the UI documentation for information on performing Synapse Admin tasks using Optic. Optic simplifies many of Synapse's administrative tasks. However, we encourage you to review the information in this guide for important background and an overview of the relevant topics.

4.1 Enable Synapse Power-Ups

The Vertex Project provides a number of Power-Ups that extend the functionality of Synapse. For more information on configuring your Cortex to use **Rapid Power-Ups,** see the blog post on Synapse Power-Ups.

Note

Advanced Power-Ups are deployed via their own Docker containers and are typically configured by a DevOps team.

4.2 Create and Manage Users and Roles

A *User* account is required to authenticate to and access Synapse. Having "a Synapse account" effectively means having an account in the Cortex.

In Synapse, a *Role* can be used to "group" users with similar responsibilities (and related permissions requirements). You can **grant** or **revoke** one or more roles from a user.

You grant (or deny) **permissions** to users or roles by assigning **rules** that specify those permissions (see *Assign and Manage Permissions*).

Synapse includes the following built-in users and roles:

- **Root** user. The **root** account has *Admin* privileges in the Cortex. The **admin** status of the root account cannot be revoked, and the account cannot be locked / disabled.
- **All** role. The **all** role has **read** access to the Cortex (specifically, to any view with `worldreadable=true`, which includes the **default** view). All user accounts are automatically granted the **all** role (are part of the **all** "group"); this role cannot be revoked.

Tip

The set of Storm *auth* commands are collectively used to manage users, roles, and permissions from Storm.

In the commercial Optic UI, users, roles, and permissions can be managed through the **Admin Tool** and through dialogs associated with various objects (such as Views or Stories).

Note

The descriptions and examples below assume that you have deployed Synapse using native Synapse management and authentication of users, roles, and permissions.

The *Synapse Devops Guide* includes information on provisioning **initial** users when Synapse is first deployed (see *Managing Users and Roles*). This guide focuses on ongoing management of users and roles once Synapse admins have access to Storm (i.e., the Storm CLI or Optic UI).

4.2.1 Working with Users

Add a User

The *auth.user.add* command creates a new user. Newly created users do not have any permissions (other than those associated with the built-in **all** role).

Example:

Add the user "Ron" with email address `ronthecat@vertex.link`:

```
storm> auth.user.add ron --email ronthecat@vertex.link
User (ron) added with iden: e33912faf689c663f418017ed08b4e2a
```

Tip

Users are represented by a unique 128-bit identifier (iden). You can modify information about the user account (such as the username or associated email address) without affecting the underlying identifier or any associated roles or permissions.

Display a User

The *auth.user.show* command displays information about a user, including any assigned roles or rules (permissions) and their order.

Example:

Display information for user "Ron":

```
storm> auth.user.show ron
User: ron (e33912faf689c663f418017ed08b4e2a)

  Locked: false
  Admin: false
  Email: ronthecat@vertex.link
  Rules:

  Roles:
    0aaac2016b15e0604d0fc150298c5e06 - all

  Gates:
```

Modify a User

The *auth.user.mod* command modifies a user account. Use the command to:

- Change the username or email address associated with the user.
- Set or reset the user's password.
- Assign (or remove) **admin** status for the user.
- Lock (or unlock) the account.

Examples:

Update the email address for user "Ron":

```
storm> auth.user.mod ron --email ron@vertex.link
User (ron) email address set to ron@vertex.link.
```

Assign **admin** status to the user "ron_admin":

```
storm> auth.user.mod ron_admin --admin $lib.true
User (ron_admin) admin status set to true.
```

Remove **admin** status from user "ron_admin":

```
storm> auth.user.mod ron_admin --admin $lib.false
User (ron_admin) admin status set to false.
```

Lock the user account "ron_admin":

```
storm> auth.user.mod ron_admin --locked $lib.true
User (ron_admin) locked status set to true.
```

Warning

We strongly encourage you to **lock** (disable) accounts when necessary instead of deleting them. Changes to data in the Cortex (such as creating nodes, setting properties, or adding tags) are associated with the user account that made those changes. Deleting an account associated with past changes will prohibit you from identifying the user who made those changes.

If necesssary, user accounts can be deleted using the *$lib.auth.users.del(iden)* library, but there is no equivalent Storm command.

List All Users

The *auth.user.list* command lists all users in the Cortex.

Example:

List all users:

```
storm> auth.user.list
Users:
  ron
  root

Locked Users:
  ron_admin
```

4.2.2 Working with Roles

Add a Role

The *auth.role.add* command creates a new role. Newly created roles do not have any permissions or associated user accounts.

Example:

Add the new role "cattribution analyst":

```
storm> auth.role.add "cattribution analyst"
Role (cattribution analyst) added with iden: db2189860420 5a497fe391b55efe2d55
```

Tip

Roles are represented by a unique 128-bit identifier (iden). You can later change information about the role (such as the role name) without affecting the underlying role or any associated permissions or users.

Display a Role

The *auth.role.show* command displays information about a role, including any assigned rules (permissions) and their associated objects.

Example:

Display information for the "all" role:

```
storm> auth.role.show all
Role: all (0aaac2016b15e0604d0fc150298c5e06)

  Rules:

  Gates:
    f45e8eb20fe73a780e4a0cedef127dda - (layer)
      [0  ] - layer.read
    44f7d75a1f643fa410deb2d406cd4c18 - (view)
      [0  ] - view.read
```

Modify a Role

The *auth.role.mod* command modifies a role. The command can be used to change the name of the role.

Example:

Change the name of the role "cattribution analyst" to "meow-ware analyst":

```
storm> auth.role.mod "cattribution analyst" --name "meow-ware analyst"
Role (cattribution analyst) renamed to meow-ware analyst.
```

List all Roles

The *auth.role.list* command lists all roles in the Cortex.

Example:

List all roles:

```
storm> auth.role.list
Roles:
  a-cat-emic researcher
  all
  cattribution analyst
  meow-ware analyst
```

Delete a Role

The *auth.role.del* command deletes a role.

Example:

Delete the role "meow-ware analyst":

```
storm> auth.role.del "meow-ware analyst"
Role (meow-ware analyst) deleted.
```

Note

Deleting a role has no impact on any users who have been granted the role (other than losing any permissions provided by that role). The user accounts remain intact and the role is simply removed from each user's list of roles.

4.2.3 Grant or Revoke Roles

Granting a role to a user allows the user to inherit the role's permissions. **Revoking** a role removes the associated permissions from the user. It is not possible to grant a role to another role (i.e., roles cannot be nested).

Roles can be granted or revoked using the *auth.user.grant* and *auth.user.revoke* commands.

Examples:

Grant the role "cattribution analyst" to the user "ron":

```
storm> auth.user.grant ron "cattribution analyst"
Granting role cattribution analyst to user ron.
```

Revoke the role "a-cat-emic researcher" from user "ron":

```
storm> auth.user.revoke ron "a-cat-emic researcher"
Revoking role a-cat-emic researcher from user ron.
```

Note

The order in which roles are granted to a user matters; when determining whether a user has permission to perform an action, the permissions for each of the user's roles are checked in sequence.

Each role granted to a user is added to the **end** of the set of roles **unless** a location (index) for the role is specified. To "reorder" roles, you must either:

- revoke the roles and grant them in the desired order;
- use the `--index` option to specify the location to insert the role;
- use *setRoles(idens)* to replace the user's roles with a new list of roles; or
- use the commercial Synapse UI (Optic) to reorder the roles using drag-and drop.

See *Permissions Background* for additional detail on permissions and *Precedence*.

4.3 Assign and Manage Permissions

Synapse provides a highly flexible system of role-based access control (RBAC). **Rules** are used to assign permissions to users and / or roles, with a defined order of precedence for how permissions are evaluated.

Permissions can be assigned very broadly, such as allowing a user (or role) to create / modify / delete any node. Permissions can also be very fine-grained, restricting users so that they can **only** create specific nodes, set specific properties, create specific edges, or apply specific tags.

4.3.1 Permissions Background

Before describing how to assign and manage permissions in Synapse, it is helpful to define some key components of Synapse and the permissions ecosystem.

Services

Synapse is designed as a modular set of **services.** A service can be thought of as a container used to run an application. **Synapse services** make up the core Synapse architecture, and include the *Cortex* (data store), *Axon* (file storage), and the commercial *Optic* UI. Services handle user authentication and authorization.

From a Synapse Admin perspective, you will primarily be concerned with managing user accounts and permissions to (and within) the Synapse **Cortex.**

Tip

When we talk about "Synapse users" or "permissions to Synapse" we are generally referring to user accounts and roles in a Cortex, and permissions to a Cortex and its associated objects.

Depending on your Synapse deployment, you may need to grant or manage permissions to additional Synapse services. See the sections on *Optic Permissions* and *Power-Up Permissions* for details.

Cortex

The **Cortex** is Synapse's primary data store. Users and roles are created and managed in the Cortex, and most things for which users will need permissions apply to the Cortex and to the views, layers, and data (nodes, tags, etc.) that reside there.

Auth Gate

An **Auth Gate** (or "gate", informally) is an object within a service (such as a Cortex) that may have its own set of permissions. A *View* and a *Layer* are both common examples of Auth Gates.

Auth Gates are represented by a 128-bit identifier (iden) that uniquely identifies the Auth Gate object itself. They also have an associated type to specify the kind of Auth Gate object (e.g., "view"). Some Auth Gates also support the use of "user friendly" names, though this is dependent on the type of Auth Gate and has no impact on the underlying iden or associated permissions.

Scope

Scope refers to the object to which a particular permission applies. For example, permissions granted on an Auth Gate (such as a view) are scoped to (or **local** to) that Auth Gate. Permissions granted at the Cortex level are **global** with respect to the Cortex.

Scope affects the order (precedence) in which permissions are evaluated.

Permission

A **permission** is a string that is used to control access. For example:

```
view.add
```

Tip

A list of most permissions available in a Cortex can be found under *Cortex Permissions*. You can also display the list in Synapse using the `auth.list.perms` command.

Most permission strings use a dotted (hierarchical) format; specifying a permission higher up in the hierarchy includes all permissions below it. For example, the permission `view` includes all of the following permissions: `view.add`, `view.del`, `view.read`, and `view.set`.

Permissions related to objects such as nodes or tags can optionally extend the permission string to be highly specific, referencing particular forms, properties, tags/tag trees, or light edges. This allows you to set highly granular permissions.

Granular permissions may be useful for organizations with specialized users or teams, where certain individuals are responsible for specific types of analysis (e.g., strategic analysis vs. tactical threat tracking) and should be the only users authorized to create, modify, and tag certain types of data.

Granular permissions can also be used to differentiate between senior and junior roles; for example, only senior analysts may be allowed to apply tags representing certain assessments (such as attribution).

Examples:

Description	Permission
Perform **any** action on **any** kind of node (including deleting nodes and working with properties, tags, edges, and node data)	`node`
Add any kind of node (but not delete nodes, or work with properties, tags, edges, or node data)	`node.add`
Only add `inet:ipv4` nodes (but not set properties, or work with tags or edges)	`node.add.inet:ipv4`
Only add (set) the `:asn` property of `inet:ipv4` nodes (but not create nodes or work with other properties, tags, edges, etc.)	`node.prop.set.inet:ipv4:asn`
Add or remove **any** tag (Note that adding/removing tags may require the ability to create `syn:tag` nodes, unless those nodes already exist.)	`node.tag`
Only add and remove tags in the "mytag" tag tree	`node.tag.add.mytag` `node.tag.del.mytag`
Add or remove **any** edge (Note that adding or removing edges allows creating edges between **any** nodes; there are no model constraints on the kinds of nodes that can be joined. It also allows the creation of new / arbitrarily named edges.)	`node.edge`
Only add edges	`node.edge.add`
Only add `refs` edges	`node.edge.add.refs`

Note

Permissions strings **do not** support wildcards (*). For example, you cannot specify `node.tag.*.mytag` to allow users to both add and delete tags in the `mytag` tree.

Rule

A **rule** is used to grant (or prohibit) a specific permission. Rules are evaluated in a defined order of precedence.

When you specify a rule, there is an implicit **allow** directive; a permission string by itself indicates the permission is allowed/true:

```
view.add
```

To use a rule to **deny** a permission, use the "not" or "bang" symbol (`!`) to indicate the permission is denied/false:

```
!node.tag.add.mytag
```

Precedence

Rules in Synapse are evaluated in order of **precedence.** A requested action will be allowed (or denied) based on the **first matching rule** found for the action. If no matching rule is found, the action is **denied.**

Generally speaking, rules are evaluated from "most specific" to "least specific". Rules are evaluated in the following order:

- **User** rules at the **local** (i.e., Auth Gate) level.
- **Role** rules at the **local** level.
- **User** rules at the **global** (i.e., Cortex) level.
- **Role** rules at the **global** level.

> **Note**
>
> Because global rules are evaluated after local rules, permissions granted at the global level can "override" permissions that are not explicitly denied at the local level. For example, a user may fork a view (making them admin of that view) and grant "read" access to a coworker (`view.read`).
>
> If the coworker has "write" permissions (such as `node.tag`) at the **global** level, they will be able to add tags within the forked view (or any view where they have `view.read` permissions).
>
> If the user forking the view also specified `!node` for the view's layer, the coworker would be prevented from adding any tags in the forked view (or making any edits whatsoever).

Roles (granted to a user) and **rules** (assigned to a user or role) are **also ordered:**

- When granting roles to a user, each new role is added to the **end** of the list of roles **unless** a location (index) for the role is specified.
- When assigning rules to a role or user, each new rule is added to the **end** of the list of rules **unless** a location (index) for the rule is specified.

Rules and roles are evaluated in the following order:

- **User rules** are evaluated in order from first to last.
- Each **role** granted to a user is evaluated in order from first to last.
- For each role, the **role's rules** are evaluated in order from first to last.

This means that the same rules, applied and evaluated in a different order, will give different results. As a simple example:

These rules will **allow** the creation of `file:bytes` nodes, but no other nodes:

```
node.add.file:bytes
!node.add
```

The same rules in the opposite order will **disallow** the creation of **any** nodes:

```
!node.add
node.add.file:bytes
```

Admin

Admin status allows a user to **bypass all permissions checks** for the **scope** where the user is admin. For example, a Synapse (Cortex) admin user can bypass all Cortex permissions checks (can "do anything" within the Cortex).

Users are generally **admin** of objects that they create. A user who forks a view is **admin** for the view that they fork, and can bypass all permissions checks ("do anything") within the forked view.

> **Note**
>
> It is not possible to assign **admin** privileges to a role.

Easy Permissions

Easy permissions ("easy perms" for short) is a mechanism that simplifies granting common sets of permissions to users or roles for a particular object. Where easy perms are used, you can specify four levels of access: **deny, read, edit,** and **admin.** These access levels have corresponding integer values:

- Deny = 0
- Read = 1
- Edit = 2
- Admin = 3

Easy perms apply to specific objects. Where easy perms are available, the following conventions apply:

- The user who creates the object has **admin** privileges for that object.
- **Admin** privileges include the ability to grant permissions to others (including the ability to explicitly deny access).
- Admin privileges are required to **delete** the object (i.e., **edit** permissions do not include **delete**).

> **Tip**
>
> $lib.macro.grant library is an example of where easy permissions can be used to assign permissions.

Views and Layers

Data in a Cortex is stored in one or more **layers** (see *Layer*). Layers are composed into **views** (see *View*) containing the data that should be visible to users or roles. (A standard installation of Synapse consists of the default view, which contains one layer.)

Views define the data that a user or role can **see** - they act as a **read** boundary. Granting the `view.read` permission on a view allows users to see (read) data in any of the view's layers; you do not need to explicitly grant "read" access to the individual layers themselves.

The ability to read data in a view is "all or nothing" - you cannot allow users to see some nodes in a view but not others. (Sensitive data should be stored in its own layer, and views containing that layer should be limited to users or roles with a need to access that data.)

Layers define the changes (if any) that a user or role can make to data in Synapse - they act as a **write** boundary. In normal circumstances, only the top layer in a view is writable. The ability to write data **to** a layer is controlled by the various `node.*` permissions, which specify the forms / properties / tags / light edges a user or role can work with (create / modify / delete). Permissions to modify data must be assigned at the appropriate **layer** (or globally, if the permissions apply to all writable layers in the Cortex).

4.3.2 Assign Permissions

You assign (allow or deny) permissions in Synapse by adding rules to (or removing rules from) roles or users. Recall that **order matters** when adding rules (see *Precedence*).

From a Synapse Admin perspective, managing permissions within Synapse commonly involves:

- Assigning rules to users and roles within the Cortex.
- Assigning rules to users and roles for various Auth Gates (such as layers or views) if necessary.
- Assigning rules to users and roles to allow or deny access to additional services, such as various Power-Ups.

Permissions in Synapse are managed using the Storm *auth* commands.

In the commercial Optic UI, permissions can also be managed through the **Admin Tool** and through dialogs associated with various objects (such as Views or Stories).

Tip

If a user attempts an action that they do not have permissions to perform, Synapse will return an `AuthDeny` error that lists the specific permission that is required.

Note

The descriptions and examples below assume that you have deployed Synapse using native Synapse management and authentication of users, roles, and permissions.

Default Permissions

Synapse includes the following default permissions:

- The built-in **root** user has **admin** access (`admin=true`) to the Cortex.
- The built-in **all** role has **read** access (`view.read`) to any view created with `worldreadable=True`. This includes the **default** view.

Any additional permissions must be **explicitly granted** to users or roles. In all but a few edge cases, Synapse assumes an implicit default `deny all` as the final rule evaluated when checking permissions.

Note

There are a few edge cases where a specific permission assumes a **default allow** instead of a **default deny,** but these are uncommon. These cases are highly specific, and usually arise in cases where a **new** permission has been implemented. That is, an action that was not originally subject to a permissions check now has one (usually because of a need to explicitly **deny** that action to particular users or roles).

If a previously unchecked action were added with "default deny", it would potentially break existing Synapse deployments by suddenly blocking an action that had been previously allowed (ungated). In these circumstances the new permission is given a "default allow" that can then be specifically denied if necessary.

Available Permissions

The *auth.perms.list* command can be used to display the set of permissions available in your Cortex. This includes native Synapse permissions as well as any permissions associated with other packages and services.

Sample output for this command can be seen under *Cortex Permissions*. The permissions available on your Cortex may vary depending on the services and packages installed (e.g., such as Power-Ups).

Global (Cortex) Permissions

Permissions in Synapse can be assigned at the global (Cortex) level, or to a specific Auth Gate (see *Auth Gate Permissions*). To assign permissions to an Auth Gate, you must specify its identifier (iden) (i.e., using the `--gate` option to the appropriate Storm command) when adding the associated rule to a user or role.

If you do not specify an Auth Gate, the permissions are **global** and apply to any / all instances within the Cortex where a user or role has access. For example, the following Storm command:

```
auth.role.addrule all node
```

. . . grants (allows) the `node` permission to the built-in **all** role. This allows **any** user (because all users are granted the **all** role by default) to perform **any** action on **any** node in **any** layer that is the topmost (writeable) layer in **any** view that the user can see.

Specifying rules at the global (Cortex) level may be sufficient for many basic Synapse deployments.

Note

Recall that **order matters** when adding rules:

- by default, each rule is added to the **end** of the list of rules assigned to a user or role; and
- rules are evaluated in order of precedence.

To reorder rules, you must:

- use the `--index` option with `auth.user.addrule` or `auth.role.addrule` to specify a location to insert a specific rule;
- remove and re-add the rules in the desired order;
- use *setRules(rules, gateiden=(null))* or *setRules(rules, gateiden=(null))* to replace the rules for a user or role with a new set of rules; or
- use the commercial Synapse UI (Optic) to reorder rules using drag-and-drop.

Assign Permissions

Permissions rules (allow or deny) are assigned using the *auth.user.addrule* and *auth.role.addrule* commands.

Examples:

Prevent the user "ron" from setting tag descriptions (setting the `syn:tag:desc` property):

```
storm> auth.user.addrule ron "!node.prop.set.syn:tag:desc"
Added rule !node.prop.set.syn:tag:desc to user ron.
```

Tip

Deny rules specified with Storm must be enclosed in quotes (single or double) because they begin with a symbol (`!`).

Allow the role "senior analysts" to add tags in threat attribution (`cno.threat`) tag tree:

```
storm> auth.role.addrule "senior analysts" node.tag.add.cno.threat
Added rule node.tag.add.cno.threat to role senior analysts.
```

Prevent the "all" role from deleting nodes:

```
storm> auth.role.addrule all "!node.del"
Added rule !node.del to role all.
```

Prevent the "all" role from deleting nodes, and insert this as the first rule for the role:

```
storm> auth.role.addrule --index 0 all "!node.del"
Added rule !node.del to role all.
```

Tip

Recall that you can *Display a User* or *Display a Role* with the *auth.user.show* and *auth.role.show* commands.

Revoke Permissions

Permissions rules are revoked using the `auth.user.delrule` and `auth.role.delrule` commands.

Examples:

Revoke the rule that prevents user "ron" from setting tag descriptions:

```
storm> auth.user.delrule ron "!node.prop.set.syn:tag:desc"
Removed rule !node.prop.set.syn:tag:desc from user ron.
```

Revoke the rule that allows "junior analysts" to apply tags in the `cno.threat` tag tree:

```
storm> auth.role.delrule "junior analysts" node.tag.cno.threat
Removed rule node.tag.cno.threat from role junior analysts.
```

Check Permissions

The *auth.user.allowed* command can be used to check whether a user has a particular permission (i.e., is allowed to perform the associated operation) for a specific **scope** (i.e., globally or for an individual Auth Gate). If an appropriate `allow` rule exists, the command will show the source (i.e., the rule, role, and / or associated Auth Gate) where the permission has been assigned.

Tip

- A user may have permissions locally (e.g., to a specific Auth Gate) that they do not have globally. In other words a **global** check may (correctly) show that a user does **not** have an expected permission globally, but the permission will show as "allowed" when the appropriate Auth Gate is checked.
- When checking whether a user can see (read) data or manipulate (e.g., fork) a view, check the relevant **view.**
- When checking whether a user can modify (write or delete) data, check the relevant **layer.**

Examples:

Check whether user 'ron' is allowed to apply tags in the `cno` tag tree **globally:**

```
storm> auth.user.allowed ron node.tag.add.cno
allowed: true - Matched role rule (node.tag.add.cno) for role cattribution analyst.
```

Check whether user 'ron' is allowed to apply tags in the cno tag tree in the **current layer:**

```
storm> auth.user.allowed --gate $lib.layer.get().iden ron node.tag.add.cno
allowed: true - Matched role rule (node.tag.add.cno) for role cattribution analyst.
```

Note that the response for each of the commands above is identical, even though the first example performed a global check (no `--gate` option) while the second example checked the current layer (retrieved with `$lib.layer.get()`). The response in the second example shows that Ron can apply tags in the current layer because he has **global** permissions for this action - indicated by the **absence** of an iden in the response. If Ron's permissions were restricted to the queried gate (in this case, the layer), the associated iden would have been included in the command output.

Check whether user 'ron' is allowed to fork the **current view:**

```
storm> auth.user.allowed --gate $lib.view.get().iden ron view.add
allowed: false - No matching rule found.
```

Auth Gate Permissions

To assign permissions for an Auth Gate, you use the same Storm commands used to assign global permissions, but you must specify the Auth Gate's full identifier (iden) (using the `--gate` option) when adding or removing the rule.

Obtain a Gate's Iden

The Storm *view* and *layer* commands can be used to manage views and layers, respectively. In particular, the following commands are useful for displaying all views or layers (including their idens), or displaying a specific view or layer:

- *view.list*
- *view.get*
- *layer.list*
- *layer.get*

Examples:

Display all views:

```
storm> view.list

View: 44f7d75a1f643fa410deb2d406cd4c18 (name: default)
  Creator: 47407e9ec98e9391d75f0fa38affd205
  Layers:
    f45e8eb20fe73a780e4a0cedef127dda: default readonly: False
```

Display the current layer:

```
storm> layer.get
Layer: f45e8eb20fe73a780e4a0cedef127dda (name: default) readonly: False creator:␣
↪47407e9ec98e9391d75f0fa38affd205
```

View a Gate's Permissions

The `auth.gate.show` command is used to display permissions information about a particular Auth Gate (e.g., a view or layer). You can provide the specific iden for an Auth Gate, or use the syntax below to retrieve information for the **current** view or layer. (Viewing information for the "current layer" will return information for the top layer of the current view.)

Example:

Display information for the current view:

```
storm> auth.gate.show $lib.view.get().iden
Gate Type: view

Auth Gate Users:
  47407e9ec98e9391d75f0fa38affd205 - root
    Admin: true
    Rules:

Auth Gate Roles:
  0aaac2016b15e0604d0fc150298c5e06 - all
    Rules:
      [0  ] - view.read
```

Display information for the current layer (i.e., the top layer of the current view):

```
storm> auth.gate.show $lib.layer.get().iden
Gate Type: layer

Auth Gate Users:
  47407e9ec98e9391d75f0fa38affd205 - root
    Admin: true
    Rules:

Auth Gate Roles:
  0aaac2016b15e0604d0fc150298c5e06 - all
    Rules:
      [0  ] - layer.read
```

4.3.3 Permissions Best Practices

- Synapse Admins should use a designated admin account for administrative tasks and a separate account for their user tasks.
- Where possible, assign permissions to roles and grant roles to users vs. assigning permissions to users directly.
- Create a general purpose role (such as `users`, or use the built-in `all` role) and assign the basic permissions that **all** Synapse users should have to this role. This includes "things all users should be able to do" (allow rules) as well as "things all users should be **explicitly** prohibited from doing" (deny rules). Create additional roles as needed to allow (or further restrict) specific operations.
- Segregate data with different access requirements into different **layers.** Grant access to data sets by composing those layers into **views** and granting roles access to the appropriate view(s).
- The ability to **delete nodes** in Synapse should be granted to a limited number of trusted individuals. We recommend creating a dedicated role for this purpose.
- If a role will have **limited permissions,** it is generally easier to **explicitly allow** only those actions; everything else will be denied by default.
- If a role or user will have **broad permissions** with some restrictions, it is generally easier to **explicitly deny** the restricted actions first, and then **grant** broad permissions (for example `!node.del` followed by `node`). Because permissions rules are checked in order, Synapse will encounter any deny rules first (i.e., user is unable to delete nodes), blocking the prohibited action while then allowing anything not specifically denied (i.e., user can do anything else to nodes).

4.3.4 Example Permissions

The examples below illustrate a few common use cases for roles and permissions within Synapse. These rule sets are meant as simple illustrations and do not necessarily illustrate fully-defined, production-ready permission sets.

Recall that:

- Views control **read** access to the data store. Users with read access to a view (`view.read`) can read all data in all layers of the view (i.e., no additional layer-specific permissions are required for read access).
- Layers control **write** access to the data store. Use permissions to manage the data that can be written to a given layer (including the ability to merge data into that layer from a forked view).
- A user who can fork a view is **admin** within their forked view.

A list of available Cortex permissions is available under the *Cortex Permissions* section, or can be viewed in Synapse with the `auth.perms.list` command.

Case 1 - Grant common permissions - basic

These basic permissions can be assigned to a role to allow users to perform common operations in Synapse.

Permission	Description
`view.read`	See / read any view
`view.add`	Fork any view they can see
`node`	Create, modify, or delete any type of data (nodes, properties, light edges, tags, and node data) in the top layer of any view they can see

Tips:

- The `all` role has implicit (and non-revocable) "read" access to Synapse's **default** view. This is not the same as global `view.read` access. To allow the `all` role (or any role) to see other views, you must explicitly assign the `view.read` permission (either globally or to individual views).
- Users can only fork (`view.add`) views they can see (`view.read`). If users should be allowed to fork any view where they have read access, the `view.add` permission can be assigned **globally** even if read access is managed on a **per-view** basis.

Case 2 - Grant common permissions - intermediate

These permissions expand on Case 1, but only allow the role to see **specific** views (by granting `view.read` locally to individual views).

Any **global** permissions (e.g., `node.add`) will apply to the top (writeable) layer of **any** view the role can see, unless the permissions are overridden locally.

These permissions also prevent the role from **deleting nodes** globally, while allowing them to delete properties or edges and to remove tags.

Permission	Scope	Description
`view.add`	global	Fork any view they can see (based on `view.read`)
`!node.del`	global	Prevent deletion of any nodes
`node.add`	global	Create nodes in the top layer of any view they can see
`node.prop`	global	Set, modify, or delete node properties in the top layer of any view they can see
`node.edge`	global	Add or remove light edges in the top layer of any view they can see
`node.tag`	global	Add or remove tags from nodes in the top layer of any view they can see
`view.read`	local	See all the data in all the layers of the specific view(s) where the rule is assigned

Case 3 - Create a dedicated role that can delete nodes

Deleting nodes indiscriminately or incorrectly can negatively impact your data store (i.e., leaving "holes" in the graph or destroying data). Synapse requires that users run an explicit command (*delnode*) to delete nodes, so the action is a deliberate choice (vs. an "accidental click").

We strongly recommend that you create a role whose sole permission is the ability to delete nodes, and grant that role to a limited number of users. To do this:

- **Explicitly deny** permission to delete nodes (`!node.del`) at the **global** level to the general purpose role you use to manage permissions for all users (as shown in Case 2 above).
- Create a dedicated role whose only permission will be the ability to delete nodes.
  - We encourage a name that inspires caution, such as `fire ze missiles` or `agents of destruction`, but you can just use `deleters`.
- Assign the `node.del` rule to the role (globally, or for specific layers).

Tips:

- All delete operations (whether deleting nodes, properties, edges, or removing tags) must be performed directly in the layer where the data resides. As admin of any view that they fork, "normal" users can delete data created or modified **within** their forked view.

Case 4 - Place guardrails around writing (creating or merging) data

Permissions can be used to prevent roles from:

- creating various types of data directly in a layer/view; or
- merging various types of data into an underlying view (technically, to the view's top layer).

These types of permissions can help ensure that data in a "production" layer remains as pristine and error-free as possible. For example:

- Help to limit typos that result in "bad" tags or edges.
- Prevent data from a sensitive or restricted layer from being written to a non-restricted layer.

Example use cases:

- Use permissions around light edges to only allow the creation of specific named edges. This can limit typos in edge names and/or prevent users from creating arbitrarily named edges.

- Use permissions around tags or tag trees to only allow applying certain tags (e.g., to enforce your organization's tag conventions). For example, permissions can ensure that users' "scratch" tags (`#thesilence.mywork`) or tags indicating sensitive data (`#tlp.red`) are not added to "production" data.
- Use permissions around individual properties to prohibit setting specific properties in particular layers. For example, taxonomy properties (such as `risk:threat:type`) may be "under development" in an internal analysis view while users test and agree on appropriate categories. You may want to prevent this property from being set (merged) into production data until the taxonomy is finalized.

Tip

The degree to which you enforce data and tag conventions through permissions vs. by consensus (i.e., users agree on "best efforts" to keep the data tidy) will depend on your organization and your use case. Managing permissions adds overhead, but may be worth the effort for data sets that require high fidelity or quality. The overhead may have less benefit for internal data or test data where occasional errors have minimal impact and can be "cleaned up" as needed.

The sample rules below can be applied **globally** (a user with this role can write "approved" data to any writeable layer of any view they can see) or **locally** to specific layers.

The examples below **only** illustrate how certain write actions can be restricted and do not address other permissions that a user/role might need. These permissions could be added to an existing role (such as your general `users` role), or granted via their own role.

Example 1:

If a limited set of actions are allowed, simply specify the changes that the role can make. Anything else is implicitly denied by default.

In this example, a role with the following permissions can:

- **only** add and remove tags in the listed tag trees; and
- **only** create and delete the listed edges.

Permission	Description
`node.tag.add.cno`	Add / apply tags in the `cno` tree (e.g., `cno`, `cno.mal`, `cno.mal.plugx` etc.)
`node.tag.del.cno`	Remove any tags in the `cno` tree
`node.tag.add.rep`	Add / apply any tags in the `rep` tree
`node.tag.del.rep`	Remove any tags in the `rep` tree
`node.edge.add.refs`	Add `refs` light edges
`node.edge.del.refs`	Delete `refs` light edges
`node.edge.add.uses`	Add `uses` light edges
`node.edge.del.uses`	Delete `uses` light edges
`node.edge.add.targets`	Add `targets` light edges
`node.edge.del.targets`	Delete `targets` light edges

Example 2:

If specific actions are prohibited, **deny** those changes and then **allow** "everything else".

A role with the following permissions is **prohibited** from:

- Creating `risk:threat:type:taxonomy` nodes (representing "categories" of threats).

- Setting the `:type` property for `risk:threat` nodes (e.g., specifying the taxonomy category for a particular threat).
- Creating tags in the `tlp` tree.

Note that the permissions as listed only prohibit actions. For a role with these permissions to be able to make other changes (e.g., add other nodes or edges), those permissions need to be granted after these "deny" rules, or as part of another role.

Permission	Description
`!node.add.risk:threat:type:taxonomy`	Prevent creating these nodes
`!node.prop.set.risk:threat:type`	Prevent setting this property (i.e., on existing `risk:threat` nodes)
`!node.tag.add.tlp`	Prevent applying tags in the `tlp` tree

Tip

To prevent users or roles from making **any** changes to a particular view (i.e., users cannot merge any data into the view / write any data directly to the view's topmost layer):

- Do not add `node` permissions to the view's topmost layer (write permissions that are not granted are implicitly denied).
- If a role has been granted `node` (or similar) permissions **globally,** override this by explicitly denying (`!node`) the permission on the layer you want to protect.

Case 5 - Senior vs. junior roles

Senior roles (with more permissions) and junior roles (with limited permissions) are used in a variety of situations, such as new trainees vs. experienced users or junior vs. senior analysts.

When using a "fork and merge" workflow, a junior user can "do anything" (as **admin**) in a view that they fork. This allows them to enrich data and annotate their assessments using tags. But permissions can prevent them from merging some (or all) data and tags until a senior user has reviewed the changes. The senior role (with appropriate permissions) can then merge the data on the junior user's behalf.

For example, tags representing key analytical assessments - such as determining if a file or indicator is associated with a malware family, or tags representing threat clustering and attribution - may require careful consideration. The ability to merge these tags may be limited to senior analysts who can verify that the junior analyst has applied them correctly.

These types of permissions are typically **cumulative;** generic users may be prohibited (or simply not allowed) to perform a certain action, with additional permissions granted to increasingly senior or experienced roles. In the example below, all users would have the general `users` role and analysts would be granted **each** additional role as they gained experience.

Example:

Role	Permission(s)	Description

users	`!node.tag.cno`
	`!node.tag.rep`
	`node.tag`
		Prevent applying tags in the `cno` and `rep` trees (representing specific analytical assessements) but apply other tags

novice analyst	`node.tag.add.rep`	Novices can apply tags in the `rep` tree (representing third-party reporting)
junior analyst	`node.tag.add.cno.infra`	Junior analysts can apply tags in the `cno.infra` tree (related to network infrastructure)
senior analyst	`node.tag.add.cno.threat` `node.tag.add.cno.mal`	Senior analysts can apply tags in the `cno.threat` and `cno.mal` trees (assessments related to threat clusters and malware families)

Note

Because of *Precedence*, as additional roles are granted, they would need to be added (indexed) **before** the `users` role to prevent that role's explicit deny permissions from overriding the newly allowed tag privileges.

Case 6 - Specialized roles

For organizations with diverse analysis teams (e.g., where analysts specialize in particular areas) or organizations where multiple teams or departments use Synapse for different purposes, it may be helpful to create highly specialized roles.

Examples:

- An organization with a dedicated malware analysis team may **only** allow those specialists to apply tags related to malware/code families and malware ecosystems.
- An organization's strategic analysts may be solely responsible for certain objects and related data. For example, a strategic team may be in charge of researching and creating organizations (`ou:org`) and associated industries (`ou:industry`) in order to track victimology. Strategic analysts can ensure that these objects are created according to the team's standards and that organizations are assigned to the appropriate industries.

Malware analyst example:

- We assume the ability to apply the specialized tags listed below is either **not granted** or **explicitly denied** elsewhere/to other roles.
- Malware analysts can also be granted the ability to **remove** the tags listed below with the corresponding `node.tag.del` permissions.

Permission	Description
`node.tag.add.cno.code`	Apply `cno.code` tags (designating specific samples of code families - e.g., `cno.code.plugx`)
`node.tag.add.cno.mal`	Apply `cno.mal` tags (designating components of malware / code family ecosystems, such as related droppers or C2 - e.g., `cno.mal.plugx`)
`node.tag.add.cno.rel`	Apply `cno.rel` tags (designating components that may be observed as part of a malware ecosystem but are not inherently malicious - e.g., `cno.rel.plugx`)

Strategic analyst example:

- We assume the ability to create these nodes / set these properties is either **not granted** or **explicitly denied** elsewhere/to other roles.
- Strategic analysts can optionally be granted the ability to delete relevant nodes/properties with the corresponding `node.del` or `node.prop.del` permissions.
- Depending on how you assign permissions, keep in mind that roles that cannot **create** nodes may still be able to **set or modify properties** on the node as long as the node already exists. This ability can be restricted via additional `node.prop.set` rules if necessary.

Permission	Description
`node.add.ou:org`	Create organization nodes
`node.prop.set.ou:org:industries`	Assign organizations to one or more industries
`node.add.ou:industry`	Create industry nodes

4.3.5 Cortex Permissions

The following is a list of the Cortex permissions that may be granted to a user or role. If a gate other than `cortex` is specified, the permission will be checked against the specific gate instance and if no match is found, it will be checked against the global rules.

```
storm> auth.perms.list
auth.role.set.name
    Permits a user to change the name of a role.
    gate: cortex
    default: false

auth.role.set.rules
    Permits a user to modify rules of a role.
    gate: cortex
    default: false

auth.self.set.apikey
    Permits a user to manage their API keys.
    gate: cortex
    default: true

auth.self.set.email
    Permits a user to change their own email address.
    gate: cortex
    default: true

auth.self.set.name
    Permits a user to change their own username.
    gate: cortex
    default: true

auth.self.set.passwd
    Permits a user to change their own password.
    gate: cortex
    default: true

auth.user.get.profile.<name>
```

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```
    Permits a user to retrieve their profile information.
    gate: cortex
    default: false
    example: auth.user.get.profile.fullname

auth.user.grant
    Controls granting roles to a user.
    gate: cortex
    default: false

auth.user.pop.profile.<name>
    Permits a user to remove profile information.
    gate: cortex
    default: false
    example: auth.user.pop.profile.fullname

auth.user.revoke
    Controls revoking roles from a user.
    gate: cortex
    default: false

auth.user.set.admin
    Controls setting/removing a user's admin status.
    gate: cortex
    default: false

auth.user.set.apikey
    Permits a user to manage API keys for other users. USE WITH CAUTUON!
    gate: cortex
    default: false

auth.user.set.archived
    Controls archiving/unarchiving a user account.
    gate: cortex
    default: false

auth.user.set.email
    Controls changing a user's email address.
    gate: cortex
    default: false

auth.user.set.locked
    Controls locking/unlocking a user account.
    gate: cortex
    default: false

auth.user.set.passwd
    Controls changing a user password.
    gate: cortex
    default: false

auth.user.set.profile.<name>
```

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```
    Permits a user to set profile information.
    gate: cortex
    default: false
    example: auth.user.set.profile.fullname

auth.user.set.rules
    Controls adding rules to a user.
    gate: cortex
    default: false

axon.del
    Controls the ability to remove a file from the Axon.
    gate: cortex
    default: false

axon.get
    Controls the ability to retrieve a file from the Axon.
    gate: cortex
    default: false

axon.has
    Controls the ability to check if the Axon contains a file.
    gate: cortex
    default: false

axon.upload
    Controls the ability to upload a file to the Axon.
    gate: cortex
    default: false

backup.del
    Permits a user to delete an existing backup.
    gate: cortex
    default: false

backup.list
    Permits a user to list existing backups.
    gate: cortex
    default: false

backup.run
    Permits a user to create a backup.
    gate: cortex
    default: false

cron.add
    Permits a user to create a cron job.
    gate: view
    default: false

cron.del
    Permits a user to remove a cron job.
```

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```
    gate: cronjob
    default: false

cron.get
    Permits a user to list cron jobs.
    gate: cronjob
    default: false

cron.kill
    Controls the ability to terminate a running cron job.
    gate: cronjob
    default: false

cron.set
    Permits a user to modify/move a cron job.
    gate: cronjob
    default: false

cron.set.creator
    Permits a user to modify the creator property of a cron job.
    gate: cortex
    default: false

globals
    Used to control all operations for global variables.
    gate: cortex
    default: false

globals.get
    Used to control read access to all global variables.
    gate: cortex
    default: false

globals.get.<name>
    Used to control read access to a specific global variable.
    gate: cortex
    default: false

globals.pop
    Used to control delete access to all global variables.
    gate: cortex
    default: false

globals.pop.<name>
    Used to control delete access to a specific global variable.
    gate: cortex
    default: false

globals.set
    Used to control edit access to all global variables.
    gate: cortex
    default: false
```

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```
globals.set.<name>
    Used to control edit access to a specific global variable.
    gate: cortex
    default: false

model.form.add
    Controls access to adding extended model forms.
    gate: cortex
    default: false

model.form.add.<form>
    Controls access to adding specific extended model forms.
    gate: cortex
    default: false
    example: model.form.add._foo:bar

model.form.del
    Controls access to deleting extended model forms.
    gate: cortex
    default: false

model.form.del.<form>
    Controls access to deleting specific extended model forms.
    gate: cortex
    default: false
    example: model.form.del._foo:bar

model.prop.add
    Controls access to adding extended model properties.
    gate: cortex
    default: false

model.prop.add.<form>
    Controls access to adding specific extended model properties.
    gate: cortex
    default: false
    example: model.prop.add._foo:bar

model.prop.del
    Controls access to deleting extended model properties and values.
    gate: cortex
    default: false

model.prop.del.<form>
    Controls access to deleting specific extended model properties and values.
    gate: cortex
    default: false
    example: model.prop.del._foo:bar

model.tagprop.add
    Controls access to adding extended model tag properties and values.
```

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```
    gate: cortex
    default: false

model.tagprop.del
    Controls access to deleting extended model tag properties and values.
    gate: cortex
    default: false

model.type.add
    Controls access to adding extended model types.
    gate: cortex
    default: false

model.type.add.<type>
    Controls access to adding specific extended model types.
    gate: cortex
    default: false
    example: model.type.add._foo:bar

model.type.del
    Controls access to deleting extended model types.
    gate: cortex
    default: false

model.type.del.<type>
    Controls access to deleting specific extended model types.
    gate: cortex
    default: false
    example: model.type.del._foo:bar

model.univ.add
    Controls access to adding extended model universal properties.
    gate: cortex
    default: false

model.univ.del
    Controls access to deleting extended model universal properties and values.
    gate: cortex
    default: false

node
    Controls all node edits in a layer.
    gate: layer
    default: false

node.add
    Controls adding any form of node in a layer.
    gate: layer
    default: false

node.add.<form>
    Controls adding a specific form of node in a layer.
```

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```
    gate: layer
    default: false
    example: node.add.inet:ipv4

node.data.pop
    Permits a user to remove node data in a given layer.
    gate: layer
    default: false

node.data.pop.<key>
    Permits a user to remove node data in a given layer for a specific key.
    gate: layer
    default: false
    example: node.data.pop.hehe

node.data.set
    Permits a user to set node data in a given layer.
    gate: layer
    default: false

node.data.set.<key>
    Permits a user to set node data in a given layer for a specific key.
    gate: layer
    default: false
    example: node.data.set.hehe

node.del
    Controls removing any form of node in a layer.
    gate: layer
    default: false

node.del.<form>
    Controls removing a specific form of node in a layer.
    gate: layer
    default: false

node.edge.add
    Controls adding light edges to a node.
    gate: layer
    default: false

node.edge.add.<verb>
    Controls adding a specific light edge to a node.
    gate: layer
    default: false

node.edge.del
    Controls adding light edges to a node.
    gate: layer
    default: false

node.edge.del.<verb>
```

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```
    Controls adding a specific light edge to a node.
    gate: layer
    default: false

node.prop
    Controls editing any prop on any node in the layer.
    gate: layer
    default: false

node.prop.del
    Controls removing any prop on any node in a layer.
    gate: layer
    default: false

node.prop.del.<form>
    Controls removing any property from a form of node in a layer.
    gate: layer
    default: false
    example: node.prop.del.inet:ipv4

node.prop.del.<form>.<prop>
    Controls removing a specific property from a form of node in a layer.
    gate: layer
    default: false
    example: node.prop.del.inet:ipv4.asn

node.prop.set
    Controls setting any prop on any node in a layer.
    gate: layer
    default: false

node.prop.set.<form>
    Controls setting any property on a form of node in a layer.
    gate: layer
    default: false
    example: node.prop.set.inet:ipv4

node.prop.set.<form>.<prop>
    Controls setting a specific property on a form of node in a layer.
    gate: layer
    default: false
    example: node.prop.set.inet:ipv4.asn

node.tag
    Controls editing any tag on any node in a layer.
    gate: layer
    default: false

node.tag.add
    Controls adding any tag on any node in a layer.
    gate: layer
    default: false
```

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```
node.tag.add.<tag...>
    Controls adding a specific tag on any node in a layer.
    gate: layer
    default: false
    example: node.tag.add.cno.mal.redtree

node.tag.del
    Controls removing any tag on any node in a layer.
    gate: layer
    default: false

node.tag.del.<tag...>
    Controls removing a specific tag on any node in a layer.
    gate: layer
    default: false
    example: node.tag.del.cno.mal.redtree

pkg.add
    Controls access to adding storm packages.
    gate: cortex
    default: false

pkg.del
    Controls access to deleting storm packages.
    gate: cortex
    default: false

queue.add
    Permits a user to create a named queue.
    gate: cortex
    default: false

queue.del
    Permits a user to delete a queue.
    gate: queue
    default: false

queue.get
    Permits a user to access a queue. This allows the user to read from the queue and␣
↪remove items from it.
    gate: queue
    default: false

queue.put
    Permits a user to put items into a queue.
    gate: queue
    default: false

service.add
    Controls the ability to add a Storm Service to the Cortex.
    gate: cortex
```

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```
    default: false

service.del
    Controls the ability to delete a Storm Service from the Cortex
    gate: cortex
    default: false

service.get
    Controls the ability to get the Service object for any Storm Service.
    gate: cortex
    default: false

service.get.<iden>
    Controls the ability to get the Service object for a Storm Service by iden.
    gate: cortex
    default: false

service.list
    Controls the ability to list all available Storm Services and their service␣
↪definitions.
    gate: cortex
    default: false

storm.asroot.cmd.<cmdname>
    Controls running storm commands requiring root privileges.
    gate: cortex
    default: false
    example: storm.asroot.cmd.movetag

storm.asroot.mod.<modname>
    Controls importing modules requiring root privileges.
    gate: cortex
    default: false
    example: storm.asroot.cmd.synapse-misp.privsep

storm.graph.add
    Controls access to add a storm graph.
    gate: cortex
    default: true

storm.inet.imap.connect
    Controls connecting to external servers via imap.
    gate: cortex
    default: false

storm.inet.smtp.send
    Controls sending SMTP messages to external servers.
    gate: cortex
    default: false

storm.lib.auth.roles.add
    Controls the ability to add a role to the system. USE WITH CAUTION!
```

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```
    gate: cortex
    default: false

storm.lib.auth.roles.del
    Controls the ability to remove a role from the system. USE WITH CAUTION!
    gate: cortex
    default: false

storm.lib.auth.users.add
    Controls the ability to add a user to the system. USE WITH CAUTION!
    gate: cortex
    default: false

storm.lib.auth.users.del
    Controls the ability to remove a user from the system. USE WITH CAUTION!
    gate: cortex
    default: false

storm.lib.axon.del
    Controls the ability to remove a file from the Axon.
    gate: cortex
    default: false

storm.lib.axon.get
    Controls the ability to retrieve a file from the Axon.
    gate: cortex
    default: false

storm.lib.axon.has
    Controls the ability to check if the Axon contains a file.
    gate: cortex
    default: false

storm.lib.axon.wget
    Controls the ability to retrieve a file from URL and store it in the Axon.
    gate: cortex
    default: false

storm.lib.axon.wput
    Controls the ability to push a file from the Axon to a URL.
    gate: cortex
    default: false

storm.lib.cortex.httpapi.add
    Controls the ability to add a new Extended HTTP API on the Cortex.
    gate: cortex
    default: false

storm.lib.cortex.httpapi.del
    Controls the ability to delete an Extended HTTP API on the Cortex.
    gate: cortex
    default: false
```

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```
storm.lib.cortex.httpapi.get
    Controls the ability to get or list Extended HTTP APIs on the Cortex.
    gate: cortex
    default: false

storm.lib.cortex.httpapi.set
    Controls the ability to modify an Extended HTTP API on the Cortex.
    gate: cortex
    default: false

storm.lib.inet.http.proxy
    Permits a user to specify the proxy used with `$lib.inet.http` APIs.
    gate: cortex
    default: false

storm.lib.log.debug
    Controls the ability to log a debug level message.
    gate: cortex
    default: false

storm.lib.log.error
    Controls the ability to log a error level message.
    gate: cortex
    default: false

storm.lib.log.info
    Controls the ability to log a info level message.
    gate: cortex
    default: false

storm.lib.log.warning
    Controls the ability to log a warning level message.
    gate: cortex
    default: false

storm.lib.stix.export.maxsize
    Controls the ability to specify a STIX export bundle maxsize of greater than 10,000.
    gate: cortex
    default: false

storm.lib.telepath.open
    Controls the ability to open an arbitrary telepath URL. USE WITH CAUTION.
    gate: cortex
    default: false

storm.lib.telepath.open.<scheme>
    Controls the ability to open a telepath URL with a specific URI scheme. USE WITH␣
↪CAUTION.
    gate: cortex
    default: false
```

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```
storm.macro.add
    Controls access to add a storm macro.
    gate: cortex
    default: true

storm.macro.admin
    Controls access to edit/set/delete a storm macro.
    gate: cortex
    default: false

storm.macro.edit
    Controls access to edit a storm macro.
    gate: cortex
    default: false

task.del
    Controls access to terminate other users tasks.
    gate: cortex
    default: false

task.get
    Controls access to view other users tasks.
    gate: cortex
    default: false

trigger.add
    Controls adding triggers.
    gate: cortex
    default: false

trigger.del
    Controls deleting triggers.
    gate: view
    default: false

trigger.get
    Controls listing/retrieving triggers.
    gate: trigger
    default: false

trigger.set
    Controls enabling, disabling, and modifying the query of a trigger.
    gate: view
    default: false

trigger.set.<property>
    Controls modifying specific trigger properties.
    gate: view
    default: false

trigger.set.doc
    Controls modifying the doc property of triggers.
```

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```
    gate: trigger
    default: false

trigger.set.name
    Controls modifying the name property of triggers.
    gate: trigger
    default: false

trigger.set.user
    Controls modifying the user property of triggers.
    gate: cortex
    default: false

view
    Controls all view permissions.
    gate: cortex
    default: false

view.add
    Controls access to add a new view including forks.
    gate: cortex
    default: false

view.del
    Controls access to delete a view.
    gate: view
    default: false

view.fork
    Controls access to fork a view.
    gate: view
    default: true

view.read
    Controls read access to view.
    gate: view
    default: false

view.set.<setting>
    Controls access to change view settings.
    gate: view
    default: false
    example: view.set.name
```

4.3.6 Optic Permissions

Commercial Synapse customers with the Optic UI may need to explicitly grant users or roles permission to some UI tools (such as Spotlight).

- See the Optic Deployment Guide for information on Optic deployment.
- See the Optic DevOps Guide for information on Optic permissions and other features.

Tip

You do not need to explicitly grant permissions to Optic itself. If you are creating and managing Synapse ("Cortex") users and roles via Optic, they have permission to access Optic by default.

4.3.7 Power-Up Permissions

Synapse **Power-Ups** have their own sets of permissions that must be granted to users or roles to allow them to use the Power-Up and any associated Storm commands. Specific permissions are documented in the **Admin Guide** section of the Power-Up documentation for the individual Power-Up.

Tip

While most Vertex-provided Power-Ups are part of the commercial Synapse offering, the following Rapid Power-Ups are also available for use with the community (open source) version of Synapse:

- Synapse-MISP
- Synapse-MITRE-ATT&CK
- Synapse-PSL (FQDN public suffix list)
- Synapse-TOR

4.3.8 Storm Runtime Permissions

When a user runs a Storm query **interactively** (e.g., in the Storm CLI or via the Optic Query Bar), or performs an action in the Optic UI (such as accessing a menu option), the query or action executes **with the permissions of the user,** based on the applicable user and role permissions and the current scope for the query or action.

There are a few cases of Storm runtime execution where different permissions are used that may require additional considerations.

Automation

Synapse includes the ability to automate Storm-based tasks using triggers, cron jobs, and / or macros. These elements are all impacted by permissions in various ways, including:

- who can create or manage automation (e.g., by default any user can create a macro, but explicit permissions are required to create triggers or cron jobs);
- who a given piece of automation runs as (e.g., macros run as the user who executes them, but triggers and cron jobs run as the user who created them).

Refer to the *Storm Reference - Automation* section of the *Synapse User Guide* for a detailed discussion of automation in Synapse (including permissions considerations).

Power-Ups

Power-Ups implement Storm packages and Storm services to provide additional functionality to Synapse. Power-Ups may be provided by The Vertex Project (as free or commercial offerings). Organizations may also develop their own custom Power-Ups.

Power-Ups commonly install Storm commands to allow users to make use of the additional capabilities of the Power-Up. In some cases, Power-Ups may need to access sensitive data (such as API keys or similar credentials) or perform actions (e.g., in adding nodes or applying tags) that some users would not be allowed to perform on their own.

Power-Ups can use privilege separation ("privsep") so that a limited subset of Power-Up capabilities can run with elevated privileges if necessary, with the remainder of the code running as the user who calls the Power-Up.

See the *Rapid Power-Up Development* section of the *Synapse Developer Guide* for additional details.

Note

Synapse Admins are typically only responsible for ensuring that the appropriate users and roles can use or run individual Power-Ups (see *Power-Up Permissions*). While Synapse Admins should be aware of privilege separation within a Power-Up as a best practice, implementation of privilege separation is left to Power-Up developers.

4.4 Add Extended Model Elements

The Synapse data model in a Cortex can be extended with custom forms or properties by using the model extension Storm Library (*$lib.model.ext*). Extended model forms and properties must have names beginning with an underscore (_) to avoid potential naming conflicts with built-in model elements.

Note

Extended model elements that are in-use (have nodes using the extended forms or properties) cannot be removed until all instances of that extended model element are removed. In other words, before removing extended forms any nodes created with that extended form must be delete first, and before removing extended properties any nodes with that extended property must have the property value removed.

4.4.1 Extended Forms

When adding a form, `$lib.model.ext.addForm` takes the following arguments:

formname
: Name of the form, must begin with an underscore (_) and contain at least one colon (:).

basetype
: The Synapse data model type for the form.

typeopts
: A dictionary of type specific options.

typeinfo
: A dictionary of info values for the form.

To add a new form named `_foocorp:name`, which contains string values which will be normalized to lowercase, with whitespace stripped from the beginning/end:

```
$typeopts = ({'lower': $lib.true, 'strip': $lib.true})
$typeinfo = ({'doc': 'Foocorp name.'})

$lib.model.ext.addForm(_foocorp:name, str, $typeopts, $typeinfo)
```

If the form is no longer in use and there are no nodes of this form in the Cortex, it can be removed with:

```
$lib.model.ext.delForm(_foocorp:name)
```

4.4.2 Extended Properties

When adding properties, `$lib.model.ext.addFormProp` takes the following arguments:

formname
Name of the form to add the property to, may be a built-in or extended model form.

propname
Relative name of the property, must begin with an underscore (_).

typedef
A tuple of (`type`, `typeopts`) which defines the type for the property

propinfo
A dictionary of info values for the property.

To add a property named `_score` to the `_foocorp:name` form which contains int values between 0 and 100:

```
$typeopts = ({'min': 0, 'max': 100})
$propinfo = ({'doc': 'Score for this name.'})

$lib.model.ext.addFormProp(_foocorp:name, _score, (int, $typeopts), $propinfo)
```

To add a property named `_aliases` to the `_foocorp:name` form which contains a unique array of `ou:name` values:

```
$typeopts = ({'type': 'ou:name', 'uniq': $lib.true})
$propinfo = ({'doc': 'Aliases for this name.'})

$lib.model.ext.addFormProp(_foocorp:name, _aliases, (array, $typeopts), $propinfo)
```

Properties may also be added to existing forms, for example, to add a property named `_classification` to `inet:fqdn` which must contain a string from a predefined set of values:

```
$typeopts = ({'enums': 'unknown,benign,malicious'})
$propinfo = ({'doc': 'Classification for this FQDN.'})

$lib.model.ext.addFormProp(inet:fqdn, _classification, (str, $typeopts), $propinfo)
```

4.4.3 Extended Universal Properties

Similar to `$lib.model.ext.addFormProp`, `$lib.model.ext.addUnivProp` takes the same `propname`, `typedef`, and `propinfo` arguments, but applies to all forms.

4.5 Manage Model Deprecations

As the Synapse Data Model grows and evolves, model elements (types, forms, and properties) may be deprecated and should no longer be used for new data modeling. The Storm `model.deprecated` commands can be used to prepare for the eventual removal of deprecated model elements.

4.5.1 Lock Deprecated Model Elements

The *model.deprecated.lock* command edits the lock status of deprecated model elements. Locked model elements can still be viewed or deleted, but can no longer be added. Attempting to add a locked model element will cause an `IsDeprLocked` error. The *model.deprecated.locks* command can be used to show the current lock status of all deprecated model elements.

Examples:

Lock the `ps:person:img` property:

```
storm> model.deprecated.lock ps:person:img
Locking: ps:person:img
```

Unlock the `ps:person:img` property:

```
storm> model.deprecated.lock --unlock ps:person:img
Unlocking: ps:person:img
```

Lock all deprecated model elements:

```
storm> model.deprecated.lock *
Locking all deprecated model elements.
```

4.5.2 Check for Deprecated Model Elements

The *model.deprecated.check* command checks for lock status and the existence of deprecated model elements in the Cortex. Warnings will be produced for any deprecated model elements which are unlocked or still in use in the Cortex. Once all warnings have been resolved, your Cortex will be ready for future model updates.

4.6 Configure a Mirrored Layer

> **Note**
>
> Mirrored layers are deprecated in 2.x and will be removed in 3.0.0. The layer.pull.add and layer.push.add commands can be used to configure streaming edits to/from layers in a separate Cortex.

Once a mirrored layer is configured, it will need to stream down the entire history of events from the upstream layer. During this process, the layer will be readable but writes will hang due to needing to await the write-back A Cortex may be configured to mirror a layer from a remote Cortex which will synchronize all edits from the remote layer and use write-back support to facilitate edits originating from the downstream layer. The mirrored layer will be an exact copy of the layer on the remote system including all edit history and will only allow changes which are first sent to the upstream layer.

When configuring a mirrored layer, you may choose to mirror from a remote layer *or* from the top layer of a remote view. If you choose to mirror from the top layer of a remote view, that view will have the opportunity to fire triggers and enforce model constraints on the changes being provided by the mirrored layer.

To specify a remote layer as the upstream, use a Telepath URL which includes the shared object `*/layer/<layeriden>` such as:

```
aha://cortex.loop.vertex.link/*/layer/8ea600d1732f2c4ef593120b3226dea3
```

To specify a remote view, use the shared object `*/view/<viewiden>` such as:

```
aha://cortex.loop.vertex.link/*/view/8ea600d1732f2c4ef593120b3226dea3
```

When you specify a `--mirror` option to the `layer.add` command or within a layer definition provided to the `$lib.layer.add()` Storm API the telepath URL will not be checked. This allows configuration of a remote layer or view which is not yet provisioned or is currently offline.

Note

To allow write access, the telepath URL must allow admin access to the remote Cortex due to being able to fabricate edit origins. The telepath URL may use aliased names or TLS client side certs to prevent credential disclosure.

Once a mirrored layer is configured, it will need to stream down the entire history of events from the upstream layer. During this process, the layer will be readable but writes will hang due to needing to await the write-back to be fully caught up to guarantee that edits are immediately observable like a normal layer. During that process, you may track progress by calling the `getMirrorStatus()` API on the `layer` object within the Storm runtime.

CHAPTER

FIVE

SYNAPSE DEPLOYMENT GUIDE

5.1 Introduction

This step-by-step guide will walk you through a production-ready Synapse deployment. Services will be configured to register with `AHA` for service discovery and to prepare for future devops tasks such as promoting a mirror to leader and provisioning future Synapse Advanced Power-Ups.

This guide will also walk you through deploying all Synapse services using TLS to authenticate both servers and clients using client-certificates to minimize the need for secrets management by eliminating passwords from all telepath URLs.

For the purposes of this guide, we will use `docker compose` as a light-weight orchestration mechanism. The steps, configurations, and volume mapping guidance given in this guide apply equally to other container orchestration mechanisms such as Kubernetes but for simplicity's sake, this guide will only cover `docker compose` based deployments.

Note

Due to known networking limitations of docker on Mac we do **not** support or recommend the use of Docker for Mac for testing or deploying production Synapse instances. Containers run within separate `docker compose` commands will not be able to reliably communicate with each other.

Synapse services **require persistent storage**. Each `docker` container expects persistent storage to be available within the directory `/vertex/storage` which should be a persistent mapped volume. Only one container may run from a given volume at a time.

Note

To allow hosts to be provisioned on one system, this guide instructs you to disable HTTP API listening ports on all services other than the main Cortex. You may remove those configuration options if you are running on separate hosts or select alternate ports which do not conflict.

5.2 Prepare your Hosts

Ensure that you have an updated install of docker and docker-compose.

In order to help you run the Synapse service containers as a non-root user, Synapse service docker containers have been preconfigured with a user named `synuser` with UID `999`. You may replace `999` in the configs below, but keep in mind that doing so will result in the container not having a name for the user. We recommend that you do **not** use the Linux user `nobody` for this purpose.

Default kernel parameters on most Linux distributions are not optimized for database performance. We recommend adding the following lines to `/etc/sysctl.conf` on all systems being used to host Synapse services:

```
vm.swappiness=10
vm.dirty_expire_centisecs=20
vm.dirty_writeback_centisecs=20
```

See *Performance Tuning* for a list of additional tuning options.

We will use the directory `/srv/syn/` on the host systems as the base directory used to deploy the Synapse services. Each service will be deployed in separate `/srv/syn/<svcname>` directories. This directory can be changed to whatever you would like, and the services may be deployed to any host provided that the hosts can directly connect to each other. It is critical to performance that these storage volumes be low-latency. More latent storage mechanisms such as spinning disks, NFS, or EFS should be avoided!

We highly recommend that hosts used to run Synapse services deploy a log aggregation agent to make it easier to view the logs from the various containers in a single place.

When using AHA, you may run any of the **other** services on additional hosts as long as they can connect directly to the AHA service. You may also shutdown a service, move it's volume to a different host, and start it backup without changing anything.

5.3 Deploy AHA Service

The AHA service is used for service discovery and acts as a CA to issue host/user certificates used to link Synapse services. Other Synapse services will need to be able to resolve the IP address of the AHA service by name, so it is likely that you need to create a DNS A/AAAA record in your existing resolver. When you are using AHA, the only host that needs DNS or other external name resolution is the AHA service.

Note

The AHA service resolver requires that registered services connect directly using IP addresses which must also be reachable to AHA clients. Using an `aha://` telepath URL requires direct routes to the service via its AHA facing network address. If you need to provide telepath access from outside the Synapse service network via any network address translation (NAT) method such as an inbound TCP proxy or docker/kubernetes port mapping, you will need to use `ssl://` based URIs and specify `hostname`, `certname`, and `ca` parameters which match the service's AHA registration info. You will also need to specify a specific `--dmon-port` option when using the `synapse.tools.aha.provision.service` command to provision the services with static ports that you can provide mappings to.

5.3.1 Choose an AHA Network Name

Your AHA network name is separate from DNS and is used by services within the AHA service deployment. It is generally a good idea to chose a name that aligns with the use case for the Synapse deployment. For example, if you plan to have a test/dev/prod deployment, choosing a name like `prod.synapse` will make it clear which deployment is which. Changing this name later is difficult, so choose carefully! Throughout the examples, we will be using `prod.synapse` as the AHA network name which is also used as the common-name (CN) for the CA certificate.

5.3.2 Configure an AHA DNS Name

When choosing the DNS name for your AHA server, it is important to keep in mind that you may eventually want to deploy AHA mirrors for a high-availability deployment. Choosing a name like `00.aha.<dns-network>`, where `<dns-network>` is a DNS zone you control, will allow you to deploy mirrors with a consistent naming convention in the future. Once you have selected the DNS name for your AHA server, you will need to ensure that all deployed Synapse services will be able to resolve that name.

> **Note**
>
> It is important to ensure that `00.aha.<dns-network>` is resolvable via DNS or docker container service name resolution from within the container environment!

5.3.3 Deploy the AHA Container

Create the container directory:

```
mkdir -p /srv/syn/00.aha/storage
```

Create the `/srv/syn/00.aha/docker-compose.yaml` file with contents:

```
services:
  00.aha:
    user: "999"
    image: vertexproject/synapse-aha:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        # disable HTTPS API for now to prevent port collisions
        - SYN_AHA_HTTPS_PORT=null
        - SYN_AHA_AHA_NETWORK=prod.synapse
        - SYN_AHA_DNS_NAME=00.aha.<dns-network>
```

> **Note**
>
> Don't forget to replace `<dns-network>` with your configured DNS suffix.

Change ownership of the storage directory to the user you will use to run the container:

```
chown -R 999 /srv/syn/00.aha/storage
```

Start the container using `docker compose`:

```
docker compose --file /srv/syn/00.aha/docker-compose.yaml pull
docker compose --file /srv/syn/00.aha/docker-compose.yaml up -d
```

To view the container logs at any time you may run the following command on the *host* from the `/srv/syn/aha` directory:

```
docker compose logs -f
```

You may also execute a shell inside the container using `docker compose` from the `/srv/syn/aha` directory on the *host*. This will be necessary for some of the additional provisioning steps:

```
docker compose exec 00.aha /bin/bash
```

5.4 Deploy AHA Mirrors (optional)

For high-availability deployments, you will want to deploy an AHA mirror or two. Typical Synapse service mirroring is configured using AHA based provisioning. Bootstrapping AHA mirrors is simple, but requires a slightly different procedure because you cannot bootstrap AHA via AHA :)

> **Note**
>
> You can deploy AHA mirrors at any time in the future. Once the mirrors are deployed, each AHA enabled Synapse service will retrieve the updated list of AHA servers the next time it is restarted.

For this example, we will assume you chose a DNS name for your primary AHA server similar to the steps listed above. If so, you can simply replace `00` with sequential numbers and repeat this step to deploy however many AHA mirrors you deem appropriate.

By default, AHA uses port `27492` to listen for RPC connections from other Synapse services and port `27272` for the provisioning listener. The following example steps assume you will be running each AHA server on separate hosts or in a containerized deployment to avoid port collisions.

Inside the AHA container

Generate a one-time use provisioning URL:

```
python -m synapse.tools.aha.clone 01.aha.<dns-network>
```

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/01.aha/storage
chown -R 999 /srv/syn/01.aha/storage
```

Create the `/srv/syn/01.aha/docker-compose.yaml` file with contents:

```
services:
  01.aha:
    user: "999"
    image: vertexproject/synapse-aha:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        # disable HTTPS API for now to prevent port collisions
        - SYN_AHA_HTTPS_PORT=null
        - SYN_AHA_CLONE=ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

Start the container:

```
docker compose --file /srv/syn/01.aha/docker-compose.yaml pull
docker compose --file /srv/syn/01.aha/docker-compose.yaml up -d
```

5.5 Deploy Axon Service

In the Synapse service architecture, an Axon provides a place to store arbitrary bytes/files as binary blobs and exposes APIs for streaming files in and out regardless of their size. Given sufficient file system size, an Axon can be used to efficiently store and retrieve very large files as well as a high number (easily billions) of files.

Inside the AHA container

Generate a one-time use provisioning URL:

```
python -m synapse.tools.aha.provision.service 00.axon
```

These one-time use URLs are used to connect to the Aha service, retrieve configuration data, and provision SSL certificates for the service. When this is done, the service records that the URL has been used in its persistent storage, and will not attempt to perform the provisioning process again unless the URL changes. If the provisioning URL is reused, services will encounter **NoSuchName** errors and fail to start up - this indicates a service has attempted to re-use the one-time use URL!

Note

We strongly encourage you to use a numbered hierarchical naming convention for services where the first part of the name is a 0 padded number and the second part is the service type. The above example `00.axon` will allow you to deploy mirror instances in the future, such as `01.axon`, where the AHA name `axon.prod.synapse` will automatically resolve to which ever one is the current leader.

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/00.axon/storage
chown -R 999 /srv/syn/00.axon/storage
```

Create the `/srv/syn/00.axon/docker-compose.yaml` file with contents:

```
services:
  00.axon:
    user: "999"
    image: vertexproject/synapse-axon:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        # disable HTTPS API for now to prevent port collisions
        - SYN_AXON_HTTPS_PORT=null
        - SYN_AXON_AHA_PROVISION=ssl://00.aha.<dns-network>:27272/<guid>?certhash=
↪<sha256>
```

Note

Don't forget to replace your one-time use provisioning URL!

Start the container:

```
docker compose --file /srv/syn/00.axon/docker-compose.yaml pull
docker compose --file /srv/syn/00.axon/docker-compose.yaml up -d
```

5.6 Deploy JSONStor Service

Inside the AHA container

Generate a one-time use provisioning URL:

```
python -m synapse.tools.aha.provision.service 00.jsonstor
```

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/00.jsonstor/storage
chown -R 999 /srv/syn/00.jsonstor/storage
```

Create the `/srv/syn/00.jsonstor/docker-compose.yaml` file with contents:

```
services:
  00.jsonstor:
    user: "999"
    image: vertexproject/synapse-jsonstor:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        # disable HTTPS API for now to prevent port collisions
        - SYN_JSONSTOR_HTTPS_PORT=null
        - SYN_JSONSTOR_AHA_PROVISION=ssl://00.aha.<dns-network>:27272/<guid>?certhash=
↪<sha256>
```

Note

Don't forget to replace your one-time use provisioning URL!

Start the container:

```
docker compose --file /srv/syn/00.jsonstor/docker-compose.yaml pull
docker compose --file /srv/syn/00.jsonstor/docker-compose.yaml up -d
```

5.7 Deploy Cortex Service

Inside the AHA container

Generate a one-time use provisioning URL:

```
python -m synapse.tools.aha.provision.service 00.cortex
```

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/00.cortex/storage
chown -R 999 /srv/syn/00.cortex/storage
```

Create the `/srv/syn/00.cortex/docker-compose.yaml` file with contents:

```
services:
  00.cortex:
    user: "999"
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        - SYN_CORTEX_AXON=aha://axon...
        - SYN_CORTEX_JSONSTOR=aha://jsonstor...
        - SYN_CORTEX_AHA_PROVISION=ssl://00.aha.<dns-network>:27272/<guid>?certhash=
↪<sha256>
```

Note

Don't forget to replace your one-time use provisioning URL!

Note

The values `aha://axon...` and `aha://jsonstor...` can be used as-is without changing them because the AHA network (provided by the provisioning server) is automatically subtituted in any `aha://` scheme URL ending with `...`

Start the container:

```
docker compose --file /srv/syn/00.cortex/docker-compose.yaml pull
docker compose --file /srv/syn/00.cortex/docker-compose.yaml up -d
```

Remember, you can view the container logs in real-time using:

```
docker compose --file /srv/syn/00.cortex/docker-compose.yaml logs -f
```

5.8 Deploy Cortex Mirror (optional)

Inside the AHA container

Generate a one-time use URL for provisioning from *inside the AHA container*:

```
python -m synapse.tools.aha.provision.service 01.cortex --mirror cortex
```

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container storage directory:

```
mkdir -p /srv/syn/01.cortex/storage
chown -R 999 /srv/syn/01.cortex/storage
```

Create the `/srv/syn/01.cortex/docker-compose.yaml` file with contents:

```
services:
  01.cortex:
    user: "999"
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        - SYN_CORTEX_AXON=aha://axon...
        - SYN_CORTEX_JSONSTOR=aha://jsonstor...
        # disable HTTPS API for now to prevent port collisions
        - SYN_CORTEX_HTTPS_PORT=null
        - SYN_CORTEX_AHA_PROVISION=ssl://00.aha.<dns-network>:27272/<guid>?certhash=
↪<sha256>
```

Note

Don't forget to replace your one-time use provisioning URL!

Start the container:

```
docker compose --file /srv/syn/01.cortex/docker-compose.yaml pull
docker compose --file /srv/syn/01.cortex/docker-compose.yaml up -d
```

Note

If you are deploying a mirror from an existing large Cortex, this startup may take a while to complete initialization.

5.9 Enroll CLI Users

A Synapse user is generally synonymous with a user account on the Cortex. To bootstrap CLI users who will have Cortex access using the Telepath API, we will need to add them to the Cortex and generate user certificates for them. To add a new admin user to the Cortex, run the following command from **inside the Cortex container**:

```
python -m synapse.tools.moduser --add --admin true visi
```

> **Note**
>
> If you are a Synapse Enterprise customer, using the Synapse UI with SSO, the admin may now login to the Synapse UI. You may skip the following steps if the admin will not be using CLI tools to access the Cortex.

Then we will need to generate a one-time use URL they may use to generate a user certificate. Run the following command from **inside the AHA container** to generate a one-time use URL for the user:

```
python -m synapse.tools.aha.provision.user visi
```

You should see output that looks similar to this:

```
one-time use URL: ssl://00.aha.<dns-network>:27272/<guid>?certhash=<sha256>
```

Then the **user** may run:

```
python -m synapse.tools.aha.enroll ssl://00.aha.<dns-network>:27272/<guid>?certhash=
↪<sha256>
```

Once they are enrolled, they will have a user certificate located in `~/.syn/certs/users` and their telepath configuration located in `~/.syn/telepath.yaml` will be updated to reflect the use of the AHA server. From there the user should be able to use standard Synapse CLI tools using the `aha://` URL such as:

```
python -m synapse.tools.storm aha://visi@cortex...
```

5.10 Configure a Storm Query Pool (optional)

A Cortex may be configured to use a pool of mirrors in order to offload Storm query execution and distribute query load among a configurable group of mirrors. We will assume you have configured two additional mirrors named `01.cortex...` and `02.cortex...` using the process described in the previous *Deploy Cortex Mirror (optional)* step. In our example, we will also assume that the mirrors will be used for both query parallelism and for graceful promotions to minimize downtime during upgrades and optimization.

The following commands are run using the Storm CLI tool discussed in the *Enroll CLI Users* section. First, use the Storm CLI to run the `aha.pool.add` command to create a new AHA pool:

```
aha.pool.add pool00.cortex...
```

Then add the Cortex leader as well as the two mirrors to the pool:

```
aha.pool.svc.add pool00.cortex... 00.cortex...
aha.pool.svc.add pool00.cortex... 01.cortex...
aha.pool.svc.add pool00.cortex... 02.cortex...
```

Then configure the Cortex to use the newly created AHA service pool:

```
cortex.storm.pool.set aha://pool00.cortex...
```

Now your Cortex will distribute Storm queries across the available mirrors. You may add or remove mirrors from the pool at any time using the `aha.pool.svc.add` and `aha.pool.svc.del` commands and the pool topology updates will be automatically sent. You may want to review some of the command options to adjust timeouts for your environment.

If you wish to remove the pool configuration from the Cortex you may use the `cortex.storm.pool.del` command.

5.11 What's next?

See the *Synapse Admin Guide* for instructions on performing application administrator tasks. See the *Synapse Devops Guide* for instructions on performing various maintenance tasks on your deployment!

CHAPTER

SIX

SYNAPSE DEVOPS GUIDE

6.1 Overview

6.1.1 Docker Images

Each Synapse service is distributed as a `docker` image which contains all the dependencies required to run the service. For the open-source Synapse images, the tag `:v2.x.x` will always be present on the most recent supported release. Image names are specified in each service specific section below.

Synapse services **require persistent storage**. Each `docker` container expects persistent storage to be available within the directory `/vertex/storage` which should be a persistent mapped volume. Only one container may run from a given volume at a time.

6.1.2 cell.yaml

Each Synapse service has one configuration file, `cell.yaml`, which is located in the service storage directory, typically `/vertex/storage/cell.yaml` in the `docker` images. Configuration options are specified in YAML format using the same syntax as their documentation, for example:

```
aha:name: cortex
aha:network: loop.vertex.local
```

6.1.3 Environment Variables

Synapse services may also be configured using environment variables specified in their documentation. The value will be parsed as a YAML value to allow structured data to be specified via environment variables and then subject to normal configuration schema validation.

6.1.4 HTTPS Certificates

Synapse services that expose HTTPS APIs will automatically generate a self-signed certificate and key if they are not found at `sslcert.pem` and `sslkey.pem` in the service storage directory. At any time, you can replace these self-signed files with a certificate and key generated using *easycert* or generated and signed by an external CA.

6.2 Common Devops Tasks

6.2.1 Generating a Backup

> **Note**
>
> If you are a Synapse Enterprise customer you should deploy the Synapse-Backup Advanced Power-Up.

It is strongly recommended that users schedule regular backups of all services deployed within their Synapse ecosystem. Each service must be backed up using either the **live** backup tool `synapse.tools.livebackup` or the offline backup tool `synapse.tools.backup`.

For a production deployment similar to the one described in the *Synapse Deployment Guide* you can easily run the backup tool by executing a shell **inside** the docker container. For example, if we were generating a backup of the Cortex we would:

```
cd /srv/syn/00.cortex
docker compose exec 00.cortex /bin/bash
```

And from the shell executed within the container:

```
python -m synapse.tools.livebackup
```

This will generate a backup in a time stamp directory similar to:

```
/vertex/storage/backups/20220422094622
```

Once the backup directory is generated you may exit the docker shell and the backup will be accessible from the **host** file system as:

```
/srv/syn/00.cortex/storage/backups/20220422094622
```

At this point it is safe to use standard tools like `mv`, `tar`, and `scp` on the backup folder:

```
mv /srv/syn/00.cortex/storage/backups/20220422094622 /nfs/backups/00.cortex/
```

Note

It is important that you use `synapse.tools.livebackup` to ensure a transactionally consistant backup.

Note

When taking a backup of a service, the backup is written by the service locally to disk. This may take up storage space equal to the current size of the service. If the service does not have the `backup:dir` option configured for a dedicated backup directory (or volume), this backup is made to `/vertex/storage/backups` by default. If the volume backing `/vertex/storage` reaches a maximum capacity, the backup process will fail.

To avoid this from being an issue, when using the default configuration, make sure services do not exceed 50% of their storage utilization. For example, a Cortex that has a size of 32GB of utilized space may take up 32GB during a backup. The volume backing `/vertex/storage` should be at least 64GB in size to avoid issues taking backups.

It is also worth noting that the newly created backup is a defragmented / optimized copy of the databases. We recommend occasionally scheduling a maintenance window to create a "cold backup" using the offline `synapse.tools.backup` command with the service offline and deploy the backup copy when bringing the service back online. Regularly performing this "restore from cold backup" procedure can dramatically improve performance and resource utilization.

6.2.2 Restoring a Backup

In the hopefully unlikely event that you need to restore a **Synapse** service from a backup the process is fairly simple. For a production deployment similar to the one described in *Synapse Deployment Guide* and assuming we moved the backup file as described in *Generating a Backup*:

```
cd /srv/syn/00.cortex
docker compose down
mv storage storage.broken
cp -R /nfs/backups/00.cortex/20220422094622 storage
docker compose up -d
```

Then you can tail the logs to ensure the service is fully restored:

```
cd /srv/syn/00.cortex
docker compose logs -f
```

6.2.3 Promoting a Mirror

> **Note**
>
> To gracefully promote a mirror to being the leader, your deployment must include AHA based service discovery as well as use TLS client-certificates for service authentication.

To gracefully promote a mirror which was deployed in a similar fashion to the one described in *Synapse Deployment Guide* you can use the built-in promote tool `synapse.tools.promote`. Begin by executing a shell within the mirror container:

```
cd /srv/syn/01.cortex
docker compose exec 01.cortex /bin/bash
```

And from the shell executed within the container:

```
python -m synapse.tools.promote
```

Once completed, the previous leader will now be configured as a follower of the newly promoted leader.

> **Note**
>
> If you are promoting the follower due to a catastrophic failure of the previous leader, you may use the command `synapse.tools.promote --failure` to force promotion despite not being able to carry out a graceful handoff. It is **critical that you not bring the previous leader back online** once this has been done. To regain redundancy, deploy a new mirror using the AHA provisioning process described in the *Synapse Deployment Guide*.

6.2.4 Updating Services

Updating a Synapse service requires pulling the newest docker image and restarting the container. For Synapse services which have mirrors deployed, you must ensure that the mirrors are updated first so that any newly introduced change messages can be consumed. If you are using a mirrors-of-mirrors tree topology, the update should be deployed in a "leafs first" order.

> **Note**
>
> A service mirror will enter into read-only mode if they detect that their leader is a higher version than they are.

Continuing with our previous example from the *Synapse Deployment Guide* we would update the mirror `01.cortex` first:

```
cd /srv/syn/01.cortex
docker compose pull
docker compose down
docker compose up -d
```

After ensuring that the mirror has come back online and is fully operational, we will update the leader which may include a *Data Migration* while it comes back online:

```
cd /srv/syn/00.cortex
docker compose pull
docker compose down
docker compose up -d
```

> **Note**
>
> Once a Synapse service update has been deployed, you may **NOT** revert to a previous version! Reverting services to prior versions is not supported.

Data Migration

When a Synapse release contains a data migration for a part of the Synapse data model, the Changelog will indicate what component is being migrated and why. This will be made under the `Automated Migrations` header, at the top of the changelog.

Automatic data migrations may cause additional startup times on the first boot of the version. When beginning a data migration, a WARNING level log message will be printed for each stage of the migration:

```
beginning model migration -> (0, 2, 8)
```

Once complete, a WARNING level log message will be issued:

```
...model migrations complete!
```

> **Note**
>
> Please ensure you have a tested backup available before applying these updates.

Synapse Services may have additional data migrations applied during updates as well. These will always be noted in the Changelog for an individual service.

Model Flag Day

Periodically, a Synapse release will include small, but technically backward incompatible, changes to the data model. All such migrations will include a `Model Flag Day` heading in the Changelog with a detailed description of each change to the data model. Additionally, the release will execute an in-place migration to modify data to confirm with model updates. If necessary, any data that can not be migrated automatically will be saved to a location documented within the detailed description.

When we release a Synapse version containing a `Model Flag Day` update, we will simultaneously release updates to any effected Power-Ups.

Examples of potential `Model Flag Day` changes:

- Removing a previously deprecated property
- Specifying a more specific type for a property to allow pivoting
- Tightening type normalization constraints of a property

It is **highly** recommended that production deployments have a process for testing custom storm code in a staging environment to help identify any tweaks that may be necessary due to the updated data model.

> **Note**
>
> Please ensure you have a tested backup available before applying these updates.

Low Downtime Updates

For services that are deployed in a mirror configuration, service upgrades can be performed with minimal downtime.

1. Update the service mirrors.
2. Use the Synapse `synapse.tools.promote` tool to promote a service as a mirror. This will start any data migrations which need to happen. Cortex data model migrations will be checked and executed as well.
3. Update the old service leader.

Continuing with our previous example from the *Synapse Deployment Guide* we would update the mirror `01.cortex` first:

```
cd /srv/syn/01.cortex
docker compose pull
docker compose down
docker compose up -d
```

Then we would promote the mirror to being a leader. This promotion will also start any data migrations that need to be performed:

```
cd /srv/syn/01.cortex
docker compose exec 01.cortex python -m synapse.tools.promote
```

After the promotion is completed, the previous leader can be updated. Since it is now mirroring `01.cortex`, it will start to replicate any changes from the leader once it comes online, including any data migrations that are being performed:

```
cd /srv/syn/00.cortex
docker compose pull
docker compose down
docker compose up -d
```

Restarting the old leader ensures that any services previously talking to `aha://cortex...` will automatically reconnect to the new leader.

Update Sequencing

> **Note**
>
> Some of the services mentioned here are part of our commercial offering.

When deploying updates, we suggest deploying updates to the entire ecosystem in the following order:

1. AHA, Axon, and the JSONStor services:

   This order ensures that the AHA service, Axon, and JSONStor services are all updated first.

2. Cortex:

   Next, the Cortex should be updated. It may use new or updated APIs from the previous services.

3. Search and Metrics services:

   The Search and Metrics updates, in turn, may use new or updated APIs from the Cortex.

4. Optic:

   The Optic service may use new or updated APIs from the previous services. Optic has its own version requirements for communicating with the Cortex and will not work if that version requirement is unmet.

5. Any remaining Advanced Power-Ups:

   Remaining Advanced Power-Ups would provide new or updated functionality to other services.

6. Any Rapid Power-Ups:

   Some Rapid Power-Ups may integrate with Advanced Power-Ups to provide additional functionality. Having the Advanced Power-Ups updated ensures that any optional dependencies that the Rapid Power-Ups may have would be met.

Updating Rapid Power-Ups

When updating Rapid Power-Ups, the `vertex.pkg.upgrade` command can be used to upgrade all installed packages, or to upgrade individual packages.

If you are using the Optic UI for managing Rapid Power-Ups, you can use it to review available upgrades and review their changelogs prior to upgrading. It can also be used to update all available Rapid Power-Ups for you at once.

Release Cadence

Vertex does not follow a strict release cadence for Synapse, Advanced Power-Ups, or Rapid Power-Ups. As we develop new functionality and address issues, we will release new versions of Synapse and Power-Ups on an as-needed basis. We recommend that users and organizations adopt an upgrade cycle that works for their operational needs.

6.2.5 Configure Logging

Synapse services support controlling log verbosity via the `SYN_LOG_LEVEL` environment variable. The following values may be used: `CRITCAL`, `ERROR`, `WARNING`, `INFO`, and `DEBUG`. For example:

```
SYN_LOG_LEVEL=INFO
```

To enable JSON structured logging output suitable for ingest and indexing, specify the following environment variable to the `docker` container:

```
SYN_LOG_STRUCT=true
```

These structured logs are designed to be easy to ingest into third party log collection platforms. They contain the log message, level, time, and metadata about where the log message came from:

```
{
  "message": "log level set to INFO",
  "logger": {
    "name": "synapse.lib.cell",
    "process": "MainProcess",
    "filename": "common.py",
    "func": "setlogging"
  },
  "level": "INFO",
  "time": "2021-06-28 15:47:54,825"
}
```

When exceptions are logged with structured logging, we capture additional information about the exception, including the entire traceback. In the event that the error is a Synapse Err class, we also capture additional metadata which was attached to the error. In the following example, we also have the query text, username and user iden available in the log message pretty-printed log message:

```
{
  "message": "Error during storm execution for { || }",
  "logger": {
    "name": "synapse.lib.view",
    "process": "MainProcess",
    "filename": "view.py",
    "func": "runStorm"
  },
  "level": "ERROR",
  "time": "2021-06-28 15:49:34,401",
  "err": {
    "efile": "coro.py",
    "eline": 233,
    "esrc": "return await asyncio.get_running_loop().run_in_executor(forkpool, _runtodo,␣
↪todo)",
    "ename": "forked",
    "at": 1,
    "text": "||",
    "mesg": "No terminal defined for '|' at line 1 col 2.  Expecting one of: #, $, (, *,␣
↪+ or -, -(, -+>, -->, ->, :, <(, <+-, <-, <--, [, break, command name, continue, fini,␣
↪for, function, if, init, property name, return, switch, while, whitespace or comment,␣
↪yield, {",
    "etb": ".... long traceback ...",
    "errname": "BadSyntax"
  },
  "text": "||",
  "username": "root",
  "user": "3189065f95d3ab0a6904e604260c0be2"
}
```

Custom date formatting strings can also be provided by setting the `SYN_LOG_DATEFORMAT` string. This is expected to be a strftime format string. The following shows an example of setting this value:

```
SYN_LOG_DATEFORMAT="%d%m%Y %H:%M:%S"
```

produces the following output:

```
28062021 15:48:01 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
```

This will also be used to format the `time` key used for structured logging.

> **Warning**
>
> Milliseconds are not available when using the date formatting option. This will result in a loss of precision for the timestamps that appear in log output.

6.2.6 Configure Free Space Requirement

To avoid the risk of data corruption due to lack of disk space, Synapse services periodically check the amount of free space available and will switch to read-only mode if they are below a minimum threshold. This threshold can be controlled via the `limit:disk:free` configuration option, and is set to 5% free space by default.

If the available free space goes below the minimum threshold, the service will continue the free space checks and re-enable writes if the available space returns above the threshold.

6.2.7 Performance Tuning

Performance tuning Synapse services is very similar to performance tuning other database systems like PostgreSQL or MySQL. Recommendations for good performance for other database systems may also apply to Synapse services. Database systems run best when given as much RAM as possible. Under **ideal** circumstances, the amount of RAM exceeds the total database storage size.

Minimizing storage latency is important for a high performance Synapse service. Locating the storage volume backed by a mechanical hard drive is **strongly** discouraged. For the same reason, running Synapse services from an NFS file system (including NFS-based systems like AWS EFS) is **strongly** discouraged.

The default settings of most Linux-based operating systems are not set for ideal performance.

Consider setting the following Linux system variables. These can be set via /etc/sysctl.conf, the sysctl utility, or writing to the /proc/sys file system.

`vm.swappiness=10`
: Reduce preference for kernel to swap out memory-mapped files.

`vm.dirty_expire_centisecs=20`
: Define "old" data to be anything changed more than 200 ms ago.

`vm.dirty_writeback_centisecs=20`
: Accelerate writing "old" data back to disk.

`vm.dirty_background_ratio=2`
: This is expressed as a percentage of total RAM in the system. After the total amount of dirty memory exceeds this threshold, the kernel will begin writing it to disk in the background. We want this low to maximize storage I/O throughput utilization.

  This value is appropriate for systems with 128 GiB RAM. For systems with less RAM, this number should be larger, for systems with more, this number may be smaller.

`vm.dirty_ratio=4`
: This is expressed as a percentage of total RAM in the system. After the total amount of dirty memory exceeds this threshold, all writes will become synchronous, which means the Cortex will "pause" waiting for the write to complete. To avoid large sawtooth-like behavior, this value should be low.

  This value is appropriate for systems with 128 GiB RAM. For systems with less RAM, this number should be larger, for systems with more, this number may be smaller.

  This setting is particularly important for systems with lots of writing (e.g. making new nodes), lots of RAM, and relatively slow storage.

6.2.8 Optimize Databases

As noted in *Generating a Backup*, restoring a service from a backup will result in the service having a defragmented / optimized copy of its databases. An alternative method for optimizing the databases in place is by using the `onboot:optimize` configuration option. Setting `onboot:optimize` to `true` will delay startup to optimize LMDB databases during boot to recover free space and increase performance. Depending on the amount of activity since the last time the databases were optimized, this process may take a significant amount of time. To reduce downtime during this process, deployments with mirrors are encouraged to use a strategy like that described in *Low Downtime Updates* to first optimize a mirror, then promote that mirror to being the leader and optimizing the old service leader.

After the optimization process is completed, the `onboot:optimize` option can be set back to `false`. It is not necessary to optimize the databases on every boot of a service, but regularly scheduling an optimization pass based on the write activity of the service will help ensure optimal performance.

Note

During the optimization process, the service will make an optimized copy of each LMDB database used by the service which will then be atomically swapped into place of the existing database. As a result, an amount of free space equal to the size of the largest database will be required during the optimization.

Note

Though not encouraged, it is safe to shutdown a service during the optimization process. Progress on the LMDB database being optimized at the time of shutdown will be lost.

6.2.9 Managing Users and Roles

Adding Users

Managing users and service accounts in the Synapse ecosystem is most easily accomplished using the `moduser` tool executed from **within** the service `docker` container. In this example we add the user `visi` as an admin user to the Cortex by running the following command from **within the Cortex container**:

```
python -m synapse.tools.moduser --add --admin visi
```

If the deployment is using AHA and TLS client certificates and the user will be connecting via the Telepath API using the *storm* CLI tool, will also need to provision a user TLS certificate for them. This can be done using the `synapse.tools.aha.provision.user` command from **within the AHA container**:

```
python -m synapse.tools.aha.provision.user visi
```

Which will produce output similar to:

```
one-time use URL: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

Note

The enrollment URL may only be used once. It should be given to the user using a secure messaging system to prevent an attacker from using it before the user.

Once the one-time enrollment URL has been passed along to the user, the **user must run an enrollment command** to configure their environment to use the AHA server and generate a user certificate from the host they will be using to run the Storm CLI:

```
python -m synapse.tools.aha.enroll ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

Once they are enrolled, the user can connect using the Telepath URL `aha://cortex.<yournetwork>`:

```
python -m synapse.tools.storm aha://cortex.<yournetwork>
```

Managing Password Policies

Services can be configured with password policies. These can be used to define the complexity of a password, the number of allowed login attempts, and the number of previous passwords to check against. This is configured by setting the `auth:passwd:policy` configuration value for the service, with the desired policy settings. The policy object accepts the following keys:

attempts
: Maximum number of incorrect attempts before locking user account. This is an integer value.

previous
: Number of previous passwords to disallow. This is an integer value.

complexity
: The complexity key must be set to an object. It can have the following keys:

  length
  : Minimum password character length. This is an integer value with a minimum value of 1.

  sequences
  : Maximum sequence length in a password. Sequences can be letters or numbers, forward or reverse. This is an integer value with a minimum value of 2.

  upper:count
  : The minimum number of uppercase characters required in password. This is an integer value.

  upper:valid
  : All valid uppercase characters. This defaults to a string of uppercase ASCII characters. This can be set to a null value to disable any checking of the uppercase characters rules.

  lower:count
  : The minimum number of lowercase characters required in password. This is an integer value.

  lower:valid
  : All valid lowercase characters. This defaults to a string of lowercase ASCII characters. This can be set to a null value to disable any checking of the lowercase character rules.

  special:count
  : The minimum number of special characters required in password. This is an integer value.

special:valid
: All valid special characters. This defaults to a string of ASCII punctuation characters. This can be set to a null value to disable any checking of the special characters rules.

number:count
: The minimum number of digit characters required in password. This is an integer value.

number:valid
: All valid digit characters. This defaults to a string of ASCII number characters. This can be set to a null value to disable any checking of the number character rules.

The following example shows setting a password policy on the Cortex with the following policy:

- Maximum of three failed password login attempts before locking.
- Keep the previous two passwords to prevent password reuse.
- Complexity rules:
  - Require at least 12 total characters.
  - Disallow sequences of more than 3 characters in a row.
  - Require at least two uppercase characters.
  - Require at least two lowercase characters.
  - Specify a custom set of lowercase characters to check against (ASCII & some unicode characters).
  - Require at least two special characters.
  - Require at least two numbers.

The following Compose file shows using the policy:

```
services:
  00.cortex:
    user: "999"
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        SYN_CORTEX_AXON: aha://axon...
        SYN_CORTEX_JSONSTOR: aha://jsonstor...
        SYN_CORTEX_AUTH_PASSWD_POLICY: '{"complexity": {"length": 12, "sequences": 3,
↪"upper:count": 2, "lower:count": 2, "lower:valid": "abcdefghijklmnopqrstuvwxyz",
↪"special:count": 2, "number:count": 2}, "attempts": 3, "previous": 2}'
```

Attempting to set a user password which fails to meet the complexity requirements would produce an error:

```
storm> auth.user.mod lowuser --passwd hehe
ERROR: Cannot change password due to the following policy violations:
  - Password must be at least 12 characters.
  - Password must contain at least 2 uppercase characters, 0 found.
  - Password must contain at least 2 special characters, 0 found.
  - Password must contain at least 2 digit characters, 0 found.
complete. 0 nodes in 146 ms (0/sec).
```

6.2.10 Updating to AHA and Telepath TLS

If you have an existing deployment which didn't initially include AHA and Telepath TLS, it can easily be deployed and configured after the fact. However, as services move to TLS it will **break existing telepath URLs** that may be in use, so you should test the deployment before updating your production instance.

To move to AHA, first deploy an AHA service as discussed in the *Synapse Deployment Guide*. For each service, you may then run the `provision` tool as described and add the `aha:provision` configuration option to the `cell.yaml` or use the service specific environment variable to prompt the service to provision itself.

> **Note**
>
> It is recommended that you name your services with leading numbers to prepare for an eventual mirror deployment.

For example, to add an existing Axon to your new AHA server, you would execute the following from **inside the AHA container**:

```
python -m synapse.tools.aha.provision 00.axon
```

You should see output that looks similar to this:

```
one-time use URL: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

Then add the following entry to the Axon's `cell.conf`:

```
aha:provision: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

Or add the following environment variable to your orchestration:

```
SYN_AXON_AHA_PROVISION=ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

Then restart the Axon container. As it restarts, the service will generate user and host certificates and update it's `cell.yaml` file to include the necessary AHA configuration options. The `dmon:listen` option will be updated to reflect the use of SSL/TLS and the requirement to use client certificates for authentication. As additional services are provisioned, you may update the URLs they use to connect to the Axon to `aha://axon...`.

> **Note**
>
> When specifying a connection string using AHA, you can append a `mirror=true` parameter to the connection string (e.g. `aha://cortex...?mirror=true`) to cause AHA to prefer connecting to a service mirror rather than the leader (if mirrors are available).

6.2.11 Deployment Options

The following are some additional deployment options not covered in the *Synapse Deployment Guide*.

> **Note**
>
> These examples assume the reader has reviewed and understood the Synapse Deployment Guide.

Telepath Listening Port

If you need to deploy a service to have Telepath listen on a specific port, you can use the provision tool to specify the port to bind. This example will show deploying the Axon to a specific Telepath listening port.

Inside the AHA container

Generate a one-time use provisioning URL, with the `--dmon-port` option:

```
python -m synapse.tools.aha.provision.service --dmon-port 30001 01.axon
```

You should see output that looks similar to this:

```
one-time use URL: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/01.axon/storage
chown -R 999 /srv/syn/01.axon/storage
```

Create the `/srv/syn/01.axon/docker-compose.yaml` file with contents:

```
services:
  01.axon:
    user: "999"
    image: vertexproject/synapse-axon:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        # disable HTTPS API for now to prevent port collisions
        - SYN_AXON_HTTPS_PORT=null
        - SYN_AXON_AHA_PROVISION=ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

After starting the service, the Axon will now be configured to bind its Telepath listening port to 30001. This can be seen in the services `cell.yaml` file.

```
---
aha:name: 01.axon
aha:network: <yournetwork>
aha:provision: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
aha:registry:
- ssl://root@aha.<yournetwork>
aha:user: root
dmon:listen: ssl://0.0.0.0:30001?hostname=01.axon.<yournetwork>&ca=
↪<yournetwork>
...
```

HTTPS Listening Port

If you need to deploy a service to have HTTPs listen on a specific port, you can use the provision tool to specify the port to bind. This example will show deploying the Cortex to a specific HTTPS listening port.

Inside the AHA container

Generate a one-time use provisioning URL, with the `--https-port` option:

```
python -m synapse.tools.aha.provision.service --https-port 8443 02.cortex
```

You should see output that looks similar to this:

```
one-time use URL: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

On the Host

Create the container directory:

```
mkdir -p /srv/syn/02.cortex/storage
chown -R 999 /srv/syn/02.cortex/storage
```

Create the `/srv/syn/01.axon/docker-compose.yaml` file with contents:

```
services:
  02.cortex:
    user: "999"
    image: vertexproject/synapse-axon:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        - SYN_CORTEX_AHA_PROVISION=ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

After starting the service, the Cortex will now be configured to bind its HTTPS listening port to 8443. This can be seen in the services `cell.yaml` file.

```
---
aha:name: 02.cortex
aha:network: <yournetwork>
aha:provision: ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
aha:registry:
- ssl://root@aha.<yournetwork>
aha:user: root
dmon:listen: ssl://0.0.0.0:0?hostname=02.cortex.<yournetwork>&ca=<yournetwork>
https:port: 8443
...
```

6.2.12 Trimming the Nexus Log

The Nexus log can be trimmed to reduce the storage size of any Synapse Service that has Nexus logging enabled. This is commonly done before taking backups to reduce to their size.

For a Cortex **without** any mirrors, this is best accomplished in Storm via the following query:

```
$lib.cell.trimNexsLog()
```

The Storm API call will rotate the Nexus log and then delete the older entries.

If the Cortex is mirrored, a list of Telepath URLs of all mirrors must be provided. This ensures that all mirrors have rotated their Nexus logs before the cull operation is executed.

> **Warning**
>
> If this list is omitted, or incorrect, the mirrors may become de-synchronized which will require a re-deployment from a backup of the upstream.

The Telepath URLs can be provided to the Storm API as follows:

```
$mirrors = ("aha://01.cortex...", "aha://02.cortex...")
$lib.cell.trimNexsLog(consumers=$mirrors)
```

6.2.13 Viewing Deprecation Warnings

When functionality in Synapse is deprecated, it is marked with the standard Python warnings mechanism to note that it is deprecated. Deprecated functionality is also noted in service changelogs as well. To view these warnings in your environment, you can set the `PYTHONWARNINGS` environment variable to display them. The following shows this being enabled for a Cortex deployment:

```
services:
  00.cortex:
    user: "999"
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
    environment:
        - SYN_CORTEX_AXON=aha://axon...
        - SYN_CORTEX_JSONSTOR=aha://jsonstor...
        - PYTHONWARNINGS=default::DeprecationWarning:synapse.common
```

With this set, our deprecation warnings are emitted the first time the deprecated functionality is used. For example, if a remote caller uses the `eval()` API on a Cortex, it would log the following message:

```
/usr/local/lib/python3.8/dist-packages/synapse/common.py:913: DeprecationWarning:
↪"CoreApi.eval" is deprecated in 2.x and will be removed in 3.0.0
  warnings.warn(mesg, DeprecationWarning)
```

This would indicate the use of a deprecated API.

6.2.14 Entrypoint Hooking

Synapse service containers provide two ways that users can modify the container startup process, in order to execute their own scripts or commands.

The first way to modify the startup process is using a script that executes before services start. This can be configured by mapping in a file at `/vertex/boothooks/preboot.sh` and making sure it is marked as an executable. If this file is present, the script will be executed prior to booting the service. If this does not return `0`, the container will fail to start up.

One example for using this hook is to use `certbot` to create HTTPS certificates for a Synapse service. This example assumes the Cortex is running as root, so that certbot can bind port 80 to perform the `http-01` challenge. Non-root deployments may require additional port mapping for a given deployment.

Create a boothooks directory:

```
mkdir -p /srv/syn/00.cortex/bookhooks
```

Copy the following script to `/srv/syn/cortex/bookhooks/preboot.sh` and use `chmod` to mark it as an executable file:

```
#!/bin/bash

# Certbot preboot example
# Author: william.gibb@vertex.link

# This script is an example of using Let's Encrypt certbot tool to generate
# an HTTPS certificate for a Synapse service.
#
# This creates and stores a Python venv in the
# /vertex/storage/preboot/letsencrypt/venv directory, so the certbot
# tool is installed once in a separate python environment, and cached in
# a mapped volume.
#
# Once the venv is setup, certbot is used to create and potentially renew
# an HTTPS certificate. This certificate and private key are then copied to
# the locations in /vertex/storage where Synapse services assume they will
# find the HTTPS keys.
#
# certbot does use a random backoff timer when performing a renewal. There may
# be a random delay when starting a service when the certificate needs to be
# renewed.
#
# Required Environment variables:
#
# CERTBOT_HOSTNAME - the hostname that certbot will generate a certificate for.
# CERTBOT_EMAIL - the email address used with certbot.
#
# Optional Environment variables:
#
# CERTBOT_ARGS - additional args passed to the "certbot certonly" and
#   "certbot renew" commands.
#

# set -x # echo commands
set -e # exit on nonzero

BASEDIR=/vertex/preboot
DSTKEY=/vertex/storage/sslkey.pem
DSTCRT=/vertex/storage/sslcert.pem

if [ -z ${CERTBOT_HOSTNAME} ]; then
    echo "CERTBOT_HOSTNAME env var is unset"
    exit 1
fi

if [ -z ${CERTBOT_EMAIL} ]; then
    echo "CERTBOT_EMAIL env var is unset"
    exit 1
```

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```
fi

LEDIR=$BASEDIR/letsencrypt

CONFDIR=$LEDIR/conf
LOGSDIR=$LEDIR/logs
WORKDIR=$LEDIR/work
VENV=$LEDIR/venv

mkdir -p $LOGSDIR
mkdir -p $CONFDIR
mkdir -p $WORKDIR

CERTBOT_DIR_ARGS=" --work-dir ${WORKDIR} --logs-dir=${LOGSDIR} --config-dir=${CONFDIR} "

KEYFILE="${CONFDIR}/live/${CERTBOT_HOSTNAME}/privkey.pem"
CERTFILE="${CONFDIR}/live/${CERTBOT_HOSTNAME}/fullchain.pem"

# Create a python venv, activate it, and install certbot and supporting tools.
if [ ! -d $VENV ]; then
    echo "Creating venv and installing certbot"
    python3 -m venv --without-pip --copies $VENV

    . $VENV/bin/activate

    python3 -c "import urllib.request as ur; ur.urlretrieve('https://bootstrap.pypa.io/
↪get-pip.py', '/tmp/get-pip.py')"
    python3 /tmp/get-pip.py  # installs pip, wheel, setuptools
    python3 -m pip install --no-cache-dir "certbot==2.6.0"

else

    echo "Activating venv"
    . $VENV/bin/activate

fi

if [ ! -f ${KEYFILE} ]; then

    certbot -n ${CERTBOT_DIR_ARGS} certonly --agree-tos --email ${CERTBOT_EMAIL} --
↪standalone -d ${CERTBOT_HOSTNAME} ${CERTBOT_ARGS:-}

    if [ $? -ne 0 ]; then
        echo "Error running certbot"
        exit 1
    fi

fi

certbot -n ${CERTBOT_DIR_ARGS} renew --standalone ${CERTBOT_ARGS:-}

if [ $? -ne 0 ]; then
```

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```
    echo "Error checking certificate renewal"
    exit 1
fi

echo "Copying certificates"

cp ${KEYFILE} ${DSTKEY}
cp ${CERTFILE} ${DSTCRT}

echo "Done setting up HTTPS certificates"
```

That directory will be mounted at `/vertex/boothooks`. The following Compose file shows mounting that directory into the container and setting environment variables for the script to use:

```
services:
  00.cortex:
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
        - ./boothooks:/vertex/boothooks
    environment:
        SYN_LOG_LEVEL: "DEBUG"
        SYN_CORTEX_STORM_LOG: "true"
        SYN_CORTEX_AHA_PROVISION: "ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
↪"
        CERTBOT_HOSTNAME: "cortex.acme.corp"
        CERTBOT_EMAIL: "user@acme.corp"
```

When started, the container will attempt to run the script before starting the Cortex service.

The second way to modify a container startup process is running a script concurrently to the service. This can be set by mapping in a file at `/vertex/boothooks/concurrent.sh`, also as an executable file. If this file is present, the script is executed as a backgrounded task prior to starting up the Synapse service. This script would be stopped when the container is stopped.

Note

If a volume is mapped into `/vertex/boothooks/` it will not be included in any backups made by a Synapse service using the backup APIs. Making backups of any data persisted in these locations is the responsibility of the operator configuring the container.

6.2.15 Containers with Custom Users

By default, Synapse service containers will work running as `root` (uid 0) and `synuser` (uid 999) without any modification. In order to run a Synapse service container as a different user that is not built into the container by default, the user, group and home directory need to be added to the image. This can be done with a custom Dockerfile to modify a container. For example, the following Dockerfile would add the user `altuser` to the Container with a user id value of 8888:

```
FROM vertexproject/synapse-cortex:v2.x.x
RUN set -ex \
&& groupadd -g 8888 altuser \
&& useradd -r --home-dir=/home/altuser -u 8888 -g altuser --shell /bin/bash altuser \
&& mkdir -p /home/altuser \
&& chown 8888:8888 /home/altuser
```

Running this with a `docker build` command can be used to create the image `customcortex:v2.x.x`:

```
$ docker build -f Dockerfile --tag  customcortex:v2.x.x .
Sending build context to Docker daemon  4.608kB
Step 1/2 : FROM vertexproject/synapse-cortex:v2.113.0
---> 8a2dd3465700
Step 2/2 : RUN set -ex && groupadd -g 8888 altuser && useradd -r --home-dir=/home/
↪altuser -u 8888 -g altuser --shell /bin/bash altuser && mkdir -p /home/altuser &&␣
↪chown 8888:8888 /home/altuser
---> Running in 9c7b30365c2d
+ groupadd -g 8888 altuser
+ useradd -r --home-dir=/home/altuser -u 8888 -g altuser --shell /bin/bash altuser
+ mkdir -p /home/altuser
+ chown 8888:8888 /home/altuser
Removing intermediate container 9c7b30365c2d
 ---> fd7173d42923
Successfully built fd7173d42923
Successfully tagged customcortex:v2.x.x
```

That custom user can then be used to run the Cortex:

```
services:
  00.cortex:
    user: "8888"
    image: customcortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
    - ./storage:/vertex/storage
    environment:
    - SYN_CORTEX_AXON=aha://axon...
    - SYN_CORTEX_JSONSTOR=aha://jsonstor...
    - SYN_CORTEX_AHA_PROVISION=ssl://aha.<yournetwork>:27272/<guid>?certhash=<sha256>
```

The following bash script can be used to help automate this process, by adding the user to an image and appending the custom username to the image tag:

```
#!/bin/bash
# Add a user to a debian based container with an arbitrary uid/gid value.
# default username: altuser
# default uid: 8888

set -e

if [ -z $1 ]
then
```

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```
    echo "Usage: srcImage name id suffix"
    echo "srcImage required."
    exit 1
fi

SRC_IMAGE_NAME=$1
NEW_NAME=${2:-altuser}
NEW_ID=${3:-8888}
SUFFIX=-${4:-$NEW_NAME}

echo "Add user/group ${NEW_NAME} with ${NEW_ID} into ${SRC_IMAGE_NAME}, creating: ${SRC_
↪IMAGE_NAME}${SUFFIX}"

printf "FROM $SRC_IMAGE_NAME \
\nRUN set -ex \\
    && groupadd -g $NEW_ID $NEW_NAME \\
    && useradd -r --home-dir=/home/$NEW_NAME -u $NEW_ID -g $NEW_NAME --shell /bin/bash
↪$NEW_NAME \\
    && mkdir -p /home/$NEW_NAME \\
    && chown $NEW_ID:$NEW_ID /home/$NEW_NAME\n" > ./Dockerfile

docker build -t $SRC_IMAGE_NAME$SUFFIX -f ./Dockerfile .

rm ./Dockerfile

exit 0
```

Saving this to `adduserimage.sh`, it can then be used to quickly modify an image. The following example shows running this to add a user named `foouser` with the uid 1234:

```
$ ./adduserimage.sh vertexproject/synapse-aha:v2.113.0 foouser 1234
Add user/group foouser with 1234 into vertexproject/synapse-aha:v2.113.0, creating:␣
↪vertexproject/synapse-aha:v2.113.0-foouser
Sending build context to Docker daemon  4.608kB
Step 1/2 : FROM vertexproject/synapse-aha:v2.113.0
 ---> 53251b832df0
Step 2/2 : RUN set -ex && groupadd -g 1234 foouser && useradd -r --home-dir=/home/
↪foouser -u 1234 -g foouser --shell /bin/bash foouser && mkdir -p /home/foouser &&␣
↪chown 1234:1234 /home/foouser
 ---> Running in 1c9e793d6761
+ groupadd -g 1234 foouser
+ useradd -r --home-dir=/home/foouser -u 1234 -g foouser --shell /bin/bash foouser
+ mkdir -p /home/foouser
+ chown 1234:1234 /home/foouser
Removing intermediate container 1c9e793d6761
 ---> 21a12f395462
Successfully built 21a12f395462
Successfully tagged vertexproject/synapse-aha:v2.113.0-foouser
```

6.2.16 Configure Custom CA Certificates for HTTP Requests

The Cortex and Axon can be configured to use additional CA certificates when making HTTP requests via Storm. To do this, you need to provide the certificates (in PEM format only) to the Cortex in a directory on disk, and then configure the Cortex to look up that directory via the `tls:ca:dir` configuration option.

The following Compose file shows an example using this option with the Cortex.

```
services:
  00.cortex:
    user: "999"
    image: vertexproject/synapse-cortex:v2.x.x
    network_mode: host
    restart: unless-stopped
    volumes:
        - ./storage:/vertex/storage
        - ./tls-ca-certs:/vertex/tls-ca-certs
    environment:
        SYN_CORTEX_TLS_CA_DIR: /vertex/tls-ca-certs
```

Note

CA certificates provided via the `tls:ca:dir` configuration option MUST include the full chain of certificates all the way up to the root. Providing only partial CA chains may result in verification failures.

This chain should start with the specific certificate for the principal who "is" the client or server, and then the certificate for the issuer of that certificate, and then the certificate for the issuer of that certificate, and so on up the chain until you get to a certificate which is self-signed, that is, a certificate which has the same subject and issuer, sometimes called a root certificate.

Configure Custom CA Certificates with Kubernetes

To configure custom CA certificates with kubernetes, do the following:

1. Create a config map from your CA certificate files.

   The example has a pre-created root CA and an intermediate CA certificate in PEM format:

   ```
   $ ls -l ./cas
   total 8
   -rw-rw-r-- 1 user user 1708 Feb 14 19:19 intermediate.crt
   -rw-rw-r-- 1 user user 1696 Feb 14 19:19 root.crt

   $ kubectl create configmap tls-ca-certs --from-file ./cas
   configmap/tls-ca-certs created

   $ kubectl describe configmap tls-ca-certs
   Name:         tls-ca-certs
   Namespace:    default
   Labels:       <none>
   Annotations:  <none>
   ```

   Example Data:

```
intermediate.crt:

-----BEGIN CERTIFICATE-----
MIIEwTCCAqmgAwIBAgIRALMB8pwt2Ivp29Ij5DqnPfYwDQYJKoZIhvcNAQELBQAw
<snip certificate body ...>
5haPeH+7M+DxEhwanIcfBXNY/7Xn
-----END CERTIFICATE-----

root.crt:

-----BEGIN CERTIFICATE-----
MIIEuDCCAqCgAwIBAgIQY7KrFPXtwpWTYfCA2pktSjANBgkqhkiG9w0BAQsFADAP
<snip certificate body ...>
i03ynl21g6erwz0c
-----END CERTIFICATE-----
```

2. Add the `volume`, `volumeMount`, and `environment` variables to the Cortex. You may need to specify permissions on your certificates as needed, as long as they are readable by your Cortex user, that is fine.

   Example volume:

```
- name: tls-ca-certs
  configMap:
    name: tls-ca-certs
```

   Example volumeMount:

```
- mountPath: /vertex/tls-ca-certs
  name: tls-ca-certs
```

   Example environment variable:

```
- name: SYN_CORTEX_TLS_CA_DIR
  value: "/vertex/tls-ca-dir-certs/"
```

3. Verify the TLS certificates were loaded by making an HTTPS request in Storm.

```
$lib.print($lib.inet.http.get(<URL TO SERVER WITH CUSTOM CERTIFICATES>))
```

   On success, you should see an `inet:http:resp` with code 200 and reason OK:

```
inet:http:resp: {'code': 200, 'reason': 'OK', 'headers': ... }
```

   If the TLS CA certificates are not being loaded properly, a response similar to the following will be seen:

```
inet:http:resp: {'code': -1, 'reason': "Exception occurred during request:␣
↪ClientConnectorCertificateError ...", ...}
```

In this example, the volume with the configmap contains symlinks which are treated as directories. When the SSLContext is created with those additional files, Synapse attempts to load the directory, will fail and then log an exception. This does not stop the SSLContext from being created with the additonal CA files.

> **Note**
>
> For the Axon, the wget and wput API functionality can also be configured to use a TLS directory for loading additional certificates. The configuration is similar to the Cortex, but uses the `SYN_AXON_TLS_CA_DIR` environment variable.

6.2.17 Axon Blob Export and Import

For situations where an organization needs to synchronize Axon blobs between two Axons that do not connect directly to each other, due to network segmentation as an example, there are command line tools available to export blobs from a source Axon and then import those blobs into a different Axon. For Axons that can communicate directly, the `axon2axon` tool should be used for live synchronization.

- `synapse.tools.axon.dump`: Export blobs from a specified Axon into one or more tar.gz archive files.
- `synapse.tools.axon.load`: Import blobs from one or more tar.gz archive files into a specified Axon.

In these situations, an export is created using `synapse.tools.axon.dump`. The output of this tool is one or more tar.gz archive files that can then be manually copied over to the destination Axon environment. Once the files have been copied, the `synapse.tools.axon.load` tool can be used to import them into the destination Axon.

> **Note**
>
> The `synapse.tools.axon.dump` export tool creates a state tracking YAML file for recording the next expected offset from the Axon that was exported. The state tracking file allows the export tool to create incremental exports from the time of the last execution without requiring the offset to be separately tracked. By default, the state tracking file is saved in the output directory with name `<celliden>.yaml`.

Export blobs from an Axon

Exporting blobs from an Axon can be done with the `synapse.tools.axon.dump` command:

```
python -m synapse.tools.axon.dump --url <axonurl> <outputdir>
```

When running the export tool from within the Axon container, the `--url` option does not need to be provided as it will default to the local service.

Import blobs into an Axon

Importing blobs into an Axon can be done with the `synapse.tools.axon.load` command:

```
python -m synapse.tools.axon.load <axonurl> <archive1.tar.gz> [<archive2.tar.gz> ...]
```

The import tool will automatically process the provided tar.gz archive files, so there is no need to import them one at a time or specify them in a particular order.

6.2.18 Copying node edits between Cortexes

For situations where an organization may want to synchronize node edits between two unconnected (no direct network connection) Cortexes, there are command line tools available to export nodes edits from a layer on the source Cortex and then import those same edits into a layer on a different Cortex.

- `synapse.tools.cortex.layer.dump`: Export node edits from a specified layer on a Cortex.
- `synapse.tools.cortex.layer.load`: Import node edits to a specified layer on a Cortex.

In these situations, an export would be created using `synapse.tools.cortex.layer.dump`. The output of this tool is one or more export files that can then be manually copied over to the destination Cortex environment. Once the files have been copied, the `synapse.tools.cortex.layer.load` tool can be used to import them into the destination Cortex.

> **Note**
>
> The `synapse.tools.cortex.layer.dump` export tool creates a state tracking YAML file for recording the next expected offset from the layer that was exported. The state tracking files allows the export tool to create incremental exports from the time of the last execution without requiring the offset to be separately tracked.
>
> The filename for the state tracking file is automatically saved in the output directory and follows the name `<celliden>.<layriden>.yaml` but an alternate path can be specified using the `--statefile` command line option.

Export node edits from a Cortex

Exporting node edits from a layer can be done with the `synapse.tools.cortex.layer.dump` command:

```
python -m synapse.tools.cortex.layer.dump --url <cortexurl> <layriden> <outdir>
```

When running the export tool from within the Cortex container, the `--url` option does not need to be provided as it will default to the local service.

Import node edits into a Cortex

Importing node edits into a layer can be done with the `synapse.tools.cortex.layer.load` command:

```
python -m synapse.tools.cortex.layer.load <layriden> <nodeedits file(s)...>
```

The import tool will automatically order the node edit files based on starting offset so there is no need to import them one at a time or specify them in a particular order.

6.3 Synapse Services

6.3.1 AHA

The AHA service provides service discovery, provisioning, graceful mirror promotion, and certificate authority services to the other Synapse services. For a step-by-step guide to deploying an AHA instance, see the *Synapse Deployment Guide*. We will use `<yournetwork>` to specify locations where the value should be replaced with your chosen AHA network name.

Docker Image: `vertexproject/synapse-aha:v2.x.x`

Configuration

A typical AHA deployment requires some initial configuration options. At a minimum, you must specify the following:

```
aha:name: aha
aha:network: <yournetwork>
dmon:listen: ssl://aha.<yournetwork>&ca=<yournetwork>
```

To enable provisioning using AHA you must specify an alternate listener such as:

```
provision:listen: tcp://aha.<yournetwork>:27272
```

> **Note**
>
> The network connection from a Synapse service to the AHA service must NOT be passing through a Network Adress Translation (NAT) device.

For the full list supported options, see the *AHA Configuration Options*.

Using Aha with Custom Client Code

Loading the known AHA resolvers for use with custom python clients can be easily accomplished using the `withTeleEnv()` context manager:

```
import sys
import asyncio

import synapse.telepath as s_telepath

async def main(argv):

    # This context manager loads telepath.yaml
    async with s_telepath.withTeleEnv():

        async with await s_telepath.openurl(argv[0]) as proxy:

            # call service provided telepath APIs

            info = await proxy.getCellInfo()
            print(repr(info))

    return 0

sys.exit(asyncio.run(main(sys.argv[1:])))
```

6.3.2 Axon

> **Note**
>
> If you are a Synapse Enterprise customer you should consider deploying the Synapse-S3 Axon.

The Axon service provides binary / blob storage inside of the Synapse ecosystem. Binary objects are indexed based on the SHA-256 hash so that storage of the same set of bytes is not duplicated. The Axon exposes a set of Telepath / HTTP APIs that can be used to upload, download, and check for the existence of a binary blob. For a step-by-step guide to deploying an Axon, see the *Synapse Deployment Guide*.

Docker Image: `vertexproject/synapse-axon:v2.x.x`

> **Note**
>
> For ease of use in simple deployments, the Cortex contains an embedded Axon instance. For production deployments it is **highly** recommended that you install it as a separated service to help distribute load and allow direct access by other Advanced Power-Ups.

Configuration

A typical Axon deployment does not require any additional configuration. For the full list supported options, see the *Axon Configuration Options*.

Permissions

axon
: Controls access to all `axon.*` permissions.

axon.get
: Controls access to retrieve a binary blob from the Axon based on the SHA256 hash.

axon.has
: Controls access to check if bytes are present and return sizes based on the SHA256 hash.

axon.upload
: Controls access to upload a binary blob to the Axon.

For example, to allow the user `visi` to upload, download, and confirm files you would execute the following command from **inside the Axon container**:

```
python -m synapse.tools.moduser --add visi --allow axon
```

6.3.3 JSONStor

The JSONStor is a utility service that provides a mechanism for storing and retrieving arbitrary JSON objects using a hierarchical naming system. It is commonly used to store user preferences, cache API query responses, and hold data that is not part of the *Data Model*. For an example of deploying a JSONStor, see the *Synapse Deployment Guide*.

Docker Image: `vertexproject/synapse-jsonstor:v2.x.x`

> **Note**
>
> For ease of use in simple deployments, the Cortex contains an embedded JSONStor instance. For production deployments it is **highly** recommended that you install it as a separated service to help distribute load and allow direct access by other Advanced Power-Ups.

Configuration

A typical JSONStor deployment does not require any additional configuration. For the full list supported options, see the *JSONStor Configuration Options*.

6.3.4 Cortex

A Cortex is the hypergraph database and main component of the Synapse service architecture. The Cortex is also where the Storm query language runtimes and execute where all automation and enrichment occurs. For a step-by-step guide to deploying a Cortex, see the *Synapse Deployment Guide*.

Docker Image: `vertexproject/synapse-cortex:v2.x.x`

Configuration

Many of the configurations and permissions managed within the Cortex are the responsibility of the global admin rather than the devops team. See the *Synapse Admin Guide* for details on global admin tasks and details.

The Cortex can be configured to log Storm queries executed by users. This is done by setting the `storm:log` and `storm:log:level` configuration options. The `storm:log:level` option may be one of `DEBUG`, `INFO` , `WARNING`, `ERROR`, `CRITICAL` This allows an organization to set what log level their Storm queries are logged at.

When enabled, the log message contains the query text and username:

```
2021-06-28 16:17:55,775 [INFO] Executing storm query {inet:ipv4=1.2.3.4} as [root]
↪[cortex.py:_logStormQuery:MainThread:MainProcess]
```

When structured logging is also enabled for a Cortex, the query text, username, and user iden are included as individual fields in the logged message as well:

```
{
  "message": "Executing storm query {inet:ipv4=1.2.3.4} as [root]",
  "logger": {
    "name": "synapse.storm",
    "process": "MainProcess",
    "filename": "cortex.py",
    "func": "_logStormQuery"
  },
  "level": "INFO",
  "time": "2021-06-28 16:18:47,232",
  "text": "inet:ipv4=1.2.3.4",
  "username": "root",
  "user": "3189065f95d3ab0a6904e604260c0be2"
}
```

This logging does interplay with the underlying log configuration (*Configure Logging*). The `storm:log:level` value must be greater than or equal to the `SYN_LOG_LEVEL`, otherwise the Storm log will not be emitted.

For the full list supported options, see the *Cortex Configuration Options*.

Extended HTTP API

The Cortex can be configured (via Storm) to service custom HTTP API endpoints. These user defined endpoints execute Storm code in order to generate responses. This allows creating custom HTTP API responses or URL paths which may meet custom needs.

These endpoints have a base URL of `/api/ext/`. Additional path components in a request are used to resolve which API definition is used to handle the response.

The Storm queries which implement these endpoints will have a `$request` object (see *http:api:request*) added to them. This object is used to send custom data back to the caller. This object contains helpers to access the request data, as well as functions to send data back to the caller.

Note

Several examples show curl and jq being used to access endpoints or process data. These tools are not required in order to interact with the Extended HTTP API.

A Simple Example

The following simple example shows adding an API endpoint and setting the `GET` method on it that just returns a simple message embedded in a dictionary:

```
$api = $lib.cortex.httpapi.add('demo/path00')
$api.methods.get = ${
    $mesg=`Hello! I am a request made to {$request.path}`
    $headers = ({"Some": "Value"})
```

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```
    $body = ({"mesg": $mesg})
    $request.reply(200, headers=$headers, body=$body)
}
```

When accessing that HTTP API endpoint on the Cortex, the response data has the status code, custom headers, and custom body in the reponse:

```
$ curl -D - -sku "root:root" "https://127.0.0.1:4443/api/ext/demo/path00"
HTTP/1.1 200 OK
Content-Type: application/json; charset=utf8"
Date: Tue, 17 Oct 2023 16:21:32 GMT
Some: value
Content-Length: 53

{"mesg": "Hello! I am a request made to demo/path00"}
```

The `$request.reply()` method automatically will convert primitive objects into a JSON response, enabling rapid development of JSON based API endpoints.

Accessing Request Data

The `$request` object has information available about the request itself. The following API example shows access to all of that request data, and echoes it back to the caller:

```
$api = $lib.cortex.httpapi.add('demo/([a-z0-9]*)')
$api.methods.post = ${
    $body = ({
        "method": $request.method,        // The HTTP method
        "headers": $request.headers,      // Any request headers
        "params": $request.params,        // Any requets parameters
        "uri": $request.uri,              // The full URI requested
        "path": $request.path,            // The path component after /api/ext/
        "args": $request.args,            // Any capture groups matched from the path.
        "client": $request.client,        // Requester client IP
        "iden": $request.api.iden,        // The iden of the HTTP API handling the␣
↪request
        "nbyts": $lib.len($request.body), // The raw body is available as bytes
    })
    try {
        $body.json = $request.json        // Synapse will lazily load the request body␣
↪as json upon access
    } catch StormRuntimeError as err {    // But it may not be json!
        $body.json = 'err'
    }
    $headers = ({'Echo': 'hehe!'})
    $request.reply(200, headers=$headers, body=$body)
}
```

Accessing that endpoint shows that request information is echoed back to the caller:

```
$ curl -sku "root:secret" -XPOST -d '{"some":["json", "items"]}' "https://127.0.0.1:4443/
↪api/ext/demo/ohmy?hehe=haha" | jq
{
```

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```
  "method": "POST",
  "headers": {
    "host": "127.0.0.1:4443",
    "authorization": "Basic cm9vdDpzZWNyZXQ=",
    "user-agent": "curl/7.81.0",
    "accept": "*/*",
    "content-length": "26",
    "content-type": "application/x-www-form-urlencoded"
  },
  "params": {
    "hehe": "haha"
  },
  "uri": "/api/ext/demo/ohmy?hehe=haha",
  "path": "demo/ohmy",
  "args": [
    "ohmy"
  ],
  "client": "127.0.0.1",
  "iden": "50cf80d0e332a31608331490cd453103",
  "nbyts": 26,
  "json": {
    "some": [
      "json",
      "items"
    ]
  }
}
```

The `$request.headers` are accessed in a case-insensitive manner. `$request.parameters` are case sensitive. The following example shows that:

```
$api = $lib.cortex.httpapi.get(50cf80d0e332a31608331490cd453103)
$api.methods.get = ${
    $body=({
        "ua":   $request.headers."UseR-AGent",  // case insensitive match on the User-
↪Agent string
        "hehe": $request.params.hehe,
        "HEHE": $request.params.HEHE,
    })
    $request.reply(200, body=$body)
}
```

The output of that endpoint:

```
$ curl -s -k -u "root:secret" "https://127.0.0.1:4443/api/ext/demo/casemath?hehe=haha&
↪HEHE=uppercase"  | jq
{
  "ua": "curl/7.81.0",
  "hehe": "haha",
  "HEHE": "uppercase"
}
```

> **Note**
>
> Request headers and parameters are flattened into a single key / value mapping. Duplicate request headers or parameters are not exposed in the `$request` object.

Managing HTTP APIs

When creating an Extended HTTP API, the request path must be provided. This path component is matched against any path components after `/api/etx/*` when determing which API endpoint will service the request. The API endpoints are matched in order, comparing their `path` against the requested path using a case sensitive fullmatch regular expression comparison. Newly created API endpoints are added to the end of the list for matching. It is best for these endpoints to be ordered from most specific to least specific.

To list the registered APIs, their order, and path information, use the `cortex.httpapi.list` command:

```
storm> cortex.httpapi.list
 order | iden                             | owner                | auth  | runas  | path
=======|==================================|======================|=======|========|======
0      | 50cf80d0e332a31608331490cd453103 | root                 | true  | owner  | demo/
↪([a-z0-9]*)
1      | 586311d3a7a26d6138bdc07169e4cde5 | root                 | true  | owner  | demo/
↪path00
2      | 1896bda5dbd97615ee553059079620ba | root                 | true  | owner  | demo/
↪path01
3      | daaf33e23b16540acdc872fee2de1b61 | root                 | true  | owner  |␣
↪something/Else
```

In this example, there are four items listed. The `path` of the first item will match the paths for the second and third items. The index for the first item needs to be moved using the `cortex.httpapi.index` commmand. That command allows users to change the order in which the API endpoints are matched:

```
storm> cortex.httpapi.index 50cf80d0e332a31608331490cd453103 3
Set HTTP API 50cf80d0e332a31608331490cd453103 to index 3

storm> cortex.httpapi.list
 order | iden                             | owner                | auth  | runas  | path
=======|==================================|======================|=======|========|======
0      | 586311d3a7a26d6138bdc07169e4cde5 | root                 | true  | owner  | demo/
↪path00
1      | 1896bda5dbd97615ee553059079620ba | root                 | true  | owner  | demo/
↪path01
2      | daaf33e23b16540acdc872fee2de1b61 | root                 | true  | owner  |␣
↪something/Else
3      | 50cf80d0e332a31608331490cd453103 | root                 | true  | owner  | demo/
↪([a-z0-9]*)
```

The endpoints in the example are now checked in a "more specific" to "least specific" order.

The path of an endpoint can also be changed. This can be done by assigning a new value to the `path` attribute on the `http:api` object in Storm:

```
storm> $api=$lib.cortex.httpapi.get(1896bda5dbd97615ee553059079620ba) $api.path="demo/
↪mynew/path"
complete. 0 nodes in 8 ms (0/sec).
```

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```
storm> cortex.httpapi.list
 order | iden                             | owner                | auth  | runas   | path
=======|==================================|======================|=======|=========|======
0      | 586311d3a7a26d6138bdc07169e4cde5 | root                 | true  | owner   | demo/
↪path00
1      | 1896bda5dbd97615ee553059079620ba | root                 | true  | owner   | demo/
↪mynew/path
2      | daaf33e23b16540acdc872fee2de1b61 | root                 | true  | owner   |␣
↪something/Else
3      | 50cf80d0e332a31608331490cd453103 | root                 | true  | owner   | demo/
↪([a-z0-9]*)
```

The path components which match each regular expression capture group in the `path` will be set in the `$request.args` data. An endpoint can capture multiple args this way:

```
// Set the echo API handler defined earlier to have a path which has multiple capture␣
↪groups
$api = $lib.cortex.httpapi.get(50cf80d0e332a31608331490cd453103)
$api.path="demo/([a-z0-9]+)/(.*)"
```

The capture groups are then available:

```
$ curl -sku "root:secret" -XPOST "https://127.0.0.1:4443/api/ext/demo/foobar1/
↪AnotherArgument/inTheGroup"  | jq '.args'
[
  "foobar1",
  "AnotherArgument/inTheGroup"
]
```

Note

The Cortex does not make any attempt to do any inspection of path values which may conflict between the endpoints. This is because the paths for a given endpoint may be changed, they can contain regular expressions, and they may have their resolution order changed. Cortex users are responsible for configuring their endpoints with correct paths and order to meet their use cases.

The Extended HTTP APIs can also be given a name and a description. The following shows setting the `name` and `desc` fields, and then showing the details of the API using `cortex.httpapi.stat`. This command shows detailed information about the Extended HTTP API endpoint:

```
$api = $lib.cortex.httpapi.get(50cf80d0e332a31608331490cd453103)
$api.name="demo wildcard"
$api.desc='''This API endpoint is a wildcard example. It has a GET method and a POST␣
↪method available.'''

// Stat output
storm> cortex.httpapi.stat 50cf80d0e332a31608331490cd453103
Iden: 50cf80d0e332a31608331490cd453103
Creator: root (b13c21813628ac4464b78b5d7c55cd64)
Created: 2023/10/18 14:02:52.070
```

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```
Updated: 2023/10/18 14:07:29.448
Path: demo/([a-z0-9]+)/(.*)
Owner: root (b13c21813628ac4464b78b5d7c55cd64)
Runas: owner
View: default (a1877dd028915d90862e35e24b491bfc)
Readonly: false
Authenticated: true
Name: demo wildcard
Description: This API endpoint is a wildcard example. It has a GET method and a POST␣
↪method available.

No user permissions are required to run this HTTP API endpoint.
The handler defines the following HTTP methods:
Method: POST
$body = ({
            "method": $request.method,        // The HTTP method
            "headers": $request.headers,      // Any request headers
            "params": $request.params,        // Any requets parameters
            "uri": $request.uri,              // The full URI requested
            "path": $request.path,            // The path component after /api/ext/
            "args": $request.args,            // Any capture groups matched from the␣
↪path.
            "client": $request.client,        // Requester client IP
            "iden": $request.api.iden,        // The iden of the HTTP API handling the␣
↪request
            "nbyts": $lib.len($request.body), // The raw body is available as bytes
        })
        try {
            $body.json = $request.json        // Synapse will lazily load the request␣
↪body as json upon access
        } catch StormRuntimeError as err {    // But it may not be json!
            $body.json = 'err'
        }
        $headers = ({'Echo': 'hehe!'})
        $request.reply(200, headers=$headers, body=$body)

Method: GET
$body=({
            "ua":   $request.headers."UseR-AGent",  // case insensitive match on the␣
↪User-Agent string
            "hehe": $request.params.hehe,
            "HEHE": $request.params.HEHE,
        })
        $request.reply(200, body=$body)

No vars are set for the handler.
```

Supported Methods

The endpoints support the following HTTP Methods:

- GET

- PUT
- HEAD
- POST
- PATCH
- DELETE
- OPTIONS

The logic which implements these methods is set via Storm. The following example shows setting two simple methods for a given endpoint:

```
$api = $lib.cortex.httpapi.get(586311d3a7a26d6138bdc07169e4cde5)
$api.methods.get = ${ $request.reply(200, headers=({"X-Method": "GET"}))
$api.methods.put = ${ $request.reply(200, headers=({"X-Method": "PUT"}))
```

These methods can be removed as well by assigning `$lib.undef` to the value:

```
// Remove the GET method
$api = $lib.cortex.httpapi.get(586311d3a7a26d6138bdc07169e4cde5)
$api.methods.put = $lib.undef
```

Users are not required to implement their methods in any particular styles or conventions. The only method specific restriction on the endpoint logic is for the `HEAD` method. Any body content that is sent in response to the `HEAD` method will not be transmitted to the requester. This body content will be omitted from being transmitted without warning or error.

A request which is made with for method that a matching handler does not implement will return an HTTP 405 error.

Authentication, Permissions, and Users

Since the endpoints are executed by running Storm queries to generate responses, Synapse must resolve the associated *User* and a *View* which will be used to run the query. There are a few important properties of the endpoints that users configuring them must be aware of.

owner

By default, the user that creates an endpoint is marked as the `owner` for that endpoint. This is the default user that will execute the Storm queries which implement the HTTP Methods. This value can be changed by setting the `.owner` property on the endpoint object to a different User.

A user marked as the `owner` of an endpoint does not have any permissions granted that allows them to edit the endpoint.

view

The View that an Extended HTTP API endpoint is created in is recorded as the View that the Storm endpoints are executed in. This View can be changed by assigning the `.view` property on the endpoint object to a different View.

authenticated

By default, the endpoints require the requester to have an authenticated session. Information about API authentication can be found at *Authentication*. This authentication requirement can be disabled by setting the `.authenticated` property on the endpoint object to `$lib.false`. That will allow the endpoint to be resolved without presenting any sort of authentication information.

runas

By default, the Storm logic is run by the user that is marked as the `owner`. Endpoints can instead be configured to run as the authenticated user by setting the `.runas` property on the HTTP API object to `user`. In order to change the behavior to executing the queries as the owner, the value should be set to `owner`.

When an endpoint is configured with `runas` set to `user` and `authenticated` to `$lib.false` any calls to that API will be executed as the `owner`.

This allows creating endpoints that run in one of three modes:

- Authenticated & runs as the Owner
- Authenticated & runs as the User
- Unauthenticated & runs as the Owner

These three modes can be demonstrated by configuring endpoints that will echo back the current user:

```
// Create a query object that we will use for each handler
$echo=${ $request.reply(200, body=$lib.user.name()) }

// Create the first endpoint with a default configuration.
$api0 = $lib.cortex.httpapi.add('demo/owner')
$api0.methods.get=$echo

// Create the second endpoint which runs its logic as the requester.
$api1 = $lib.cortex.httpapi.add('demo/user')
$api1.runas=user
$api1.methods.get=$echo

// Create the third endpoint which does not require authentication.
$api2 = $lib.cortex.httpapi.add('demo/noauth')
$api2.authenticated=$lib.false  // Disable authentication
$api2.methods.get=$echo
```

Accessing those endpoints with different users gives various results:

```
# The demo/owner endpoint runs as the owner
$ curl -sku "root:secret" "https://127.0.0.1:4443/api/ext/demo/owner"  | jq
"root"

$ curl -sku "lowuser:demo" "https://127.0.0.1:4443/api/ext/demo/owner"  | jq
"root"

# The demo/user endpoint runs as the requester
$ curl -sku "root:secret" "https://127.0.0.1:4443/api/ext/demo/user"  | jq
"root"

$ curl -sku "lowuser:demo" "https://127.0.0.1:4443/api/ext/demo/user"  | jq
"lowuser"

# The demo/noauth endpoint runas the owner
$ curl -sk "https://127.0.0.1:4443/api/ext/demo/noauth"  | jq
"root"
```

If the owner or an authenticated user does not have permission to execute a Storm query in the configured View, or if the endpoints' View is deleted from the Cortex, this will raise a fatal error and return an HTTP 500 error. Once a query

has started executing, regular Storm permissions apply.

Endpoints can also have permissions defined for them. This allows locking down an endpoint such that while a user may still have access to the underlying view, they may lack the specific permissions required to execute the endpoint. These permissions are checked against the authenticated user, and not the endpoint owner. The following example shows setting a single permission on one of our earlier endpoints:

```
$api=$lib.cortex.httpapi.get(bd4679ab8e8a1fbc030b46e275ddba96)
$api.perms=(your.custom.permission,)
```

Accessing it as a user without the specified permission generates an `AuthDeny` error:

```
$ curl -sku "lowuser:demo" "https://127.0.0.1:4443/api/ext/demo/owner"  | jq
{
  "status": "err",
  "code": "AuthDeny",
  "mesg": "User (lowuser) must have permission your.custom.permission"
}
```

The user can have that permission granted via Storm:

```
storm> auth.user.addrule lowuser your.custom.permission
Added rule your.custom.permission to user lowuser.
```

Then the endpoint can be accessed:

```
$ curl -sku "lowuser:demo" "https://127.0.0.1:4443/api/ext/demo/owner"  | jq
"root"
```

For additional information about managing user permissions, see *Create and Manage Users and Roles*.

Note

When the Optic UI is used to proxy the `/api/ext` endpoint, authentication must be done using Optic's login endpoint. Basic auth is not available.

Readonly Mode

The Storm queries for a given handler may be executed in a `readonly` runtime. This is disabled by default. This can be changed by setting the `readonly` attribute on the `http:api` object:

```
// Enable the Storm queries to be readonly
$api = $lib.cortex.httpapi.get($yourIden)
$api.readonly = $lib.true
```

Endpoint Variables

User defined variables may be set for the queries as well. These variables are mapped into the runtime for each method. This can be used to provide constants or other information which may change, without needing to alter the underlying Storm code which defines a method. These can be read (or removed) by altering the `$api.vars` dictionary. This is an example of using a variable in a query:

```
// Set a variable that a method uses:

$api = $lib.cortex.httpapi.get($yourIden)
$api.methods.get = ${
    $mesg = `There are {$number} things available!`
    $request.reply(200, body=({"mesg": $mesg})
}
$api.vars.number = (5)
```

When executing this method, the JSON response would be the following:

```
{"mesg": "There are 5 things available!"}
```

If `$api.vars.number = "several"` was executed, the JSON response would now be the following:

```
{"mesg": "There are several things available!"}
```

Variables can be removed by assigning `$lib.undef` to them:

```
$api = $lib.cortex.httpapi.get($yourIden)
$api.vars.number = $lib.undef
```

Sending Custom Responses

Responses can be made which are not JSON formatted. The `$request.reply()` method can be used to send raw bytes. The user must provide any appropriate headers alongside their request.

HTML Example

The following example shows an endpoint which generates a small amount of HTML. It uses an HTML template stored in in the method `vars`. This template has a small string formatted in it, converted to bytes, and then the headers are set. The end result can be then rendered in a web browser:

```
$api = $lib.cortex.httpapi.add('demo/html')
$api.vars.template = '''<!DOCTYPE html>
<html>
<body>
<h1>A Header</h1>
<p>{mesg}</p>
</body>
</html>'''
$api.methods.get = ${
    $duration = $lib.model.type(duration).repr($lib.cell.uptime().uptime)
    $mesg = `The Cortex has been up for {$duration}`
    $html = $template.format(mesg=$mesg)
    $buf = $html.encode()
    $headers = ({
        "Content-Type": "text/html",
        "Content-Length": `{$lib.len($buf)}`
    })
    $request.reply(200, headers=$headers, body=$buf)
}
```

Accessing this endpoint with `curl` shows the following:

```
$ curl -D - -sku "root:secret" "https://127.0.0.1:4443/api/ext/demo/html"
HTTP/1.1 200 OK
Content-Type: text/html
Date: Wed, 18 Oct 2023 14:07:47 GMT
Content-Length: 137

<!DOCTYPE html>
<html>
<body>
<h1>A Header</h1>
<p>The Cortex has been up for 1D 00:59:12.704</p>
</body>
</html>f
```

Streaming Examples

The `http:request` object has methods that allow a user to send the response code, headers and body separately. One use for this is to create a streaming response. This can be used when the total response size may not be known or to avoid incurring memory pressure on the Cortex when computing results.

The following examples generates some JSONLines data:

```
$api = $lib.cortex.httpapi.add('demo/jsonlines')
$api.methods.get = ${
    $request.sendcode(200)
    // This allows a browser to view the response
    $request.sendheaders(({"Content-Type": "text/plain; charset=utf8"}))
    $values = ((1), (2), (3))
    for $i in $values {
        $data = ({'i': $i})
        $body=`{$lib.json.save($data)}\n`
        $request.sendbody($body.encode())
    }
}
```

Accessing this endpoint shows the JSONLines rows sent back:

```
$ curl -D - -sku "root:secret" "https://127.0.0.1:4443/api/ext/demo/jsonlines"
HTTP/1.1 200 OK
Content-Type: text/plain; charset=utf8
Date: Wed, 18 Oct 2023 14:31:29 GMT
 nosniff
Transfer-Encoding: chunked

{"i": 1}
{"i": 2}
{"i": 3}
```

In a similar fashion, a CSV can be generated. This example shows an integer and its square being computed:

```
$api = $lib.cortex.httpapi.add('demo/csv')
$api.methods.get = ${
    $request.sendcode(200)
    $request.sendheaders(({"Content-Type": "text/csv"}))
```

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```
    // Header row
    $header="i, square\n"
    $request.sendbody($header.encode())

    $n = 10  // Number of rows to compute
    for $i in $lib.range($n) {
        $square = ($i * $i)
        $body = `{$i}, {$square}\n`
        $request.sendbody($body.encode())
    }
}
```

Accessing this shows the CSV content being sent back:

```
$ curl -D - -sku "root:secret" "https://127.0.0.1:4443/api/ext/demo/csv"
HTTP/1.1 200 OK
Content-Type: text/csv
Date: Wed, 18 Oct 2023 14:43:37 GMT
Transfer-Encoding: chunked

i, square
0, 0
1, 1
2, 4
3, 9
4, 16
5, 25
6, 36
7, 49
8, 64
9, 81
```

When using the `sendcode()`, `sendheaders()`, and `sendbody()` APIs the order in which they are called does matter. The status code and headers can be set at any point before sending body data. They can even be set multiple times if the response logic needs to change a value it previously set.

Once the body data has been sent, the status code and headers will be sent to the HTTP client and cannot be changed. Attempting to change the status code or send additional headers will have no effect. This will generate a warning message on the Cortex.

The **minimum** data that the Extended HTTP API requires for a response to be considered valid is setting the status code. If the status code is not set by an endpoint, or if body content is sent prior to setting the endpoint, then an HTTP 500 status code will be sent to the caller.

Messages and Error Handling

Messages sent out of the Storm runtime using functions such as `$lib.print()`, `$lib.warn()`, or `$lib.fire()` are not available to HTTP API callers. The `$lib.log` Storm library can be used for doing out of band logging of messages that need to be generated while handling a response.

A Storm query which generates an error which tears down the Storm runtime with an `err` message will result in an HTTP 500 response being sent. The error will be encoded in the Synapse HTTP API error convention documented at *HTTP/REST API Conventions*.

For example, if the previous example where the handler sent a `mesg` about the `$number` of things available was run after the variable `$number` was removed, the code would generate the following response body:

```
{"status": "err", "code": "NoSuchVar", "mesg": "Missing variable: number"}
```

Custom error handling of issues that arise inside of the Storm query execution can be handled with the *Try... Catch Statement*. This allows a user to have finer control over their error codes, headers and error body content.

Note

The HTTP 500 response will not be sent if there has already been body data send by the endpoint.

6.4 Devops Details

6.4.1 Orchestration

Kubernetes

A popular option for Orchestration is Kubernetes. Kubernetes is an open-source system for automating the deployment, scaling and management of containerized applications. Synapse does work in Kubernetes environments.

Note

If you are using these examples to get started with Synapse on Kubernetes, you may need to adapt them to meet operational needs for your environment.

Example Deployment

The following examples walk through deploying an example Synapse deployment (based on *Synapse Deployment Guide*), but inside of a managed Kubernetes cluster managed by Digital Ocean. This deployment makes a few assumptions:

Synapse Deployment Guide
: This guide assumes a familiarity with the Synapse deployment guide. Concepts covered there are not repeated here.

namespace
: These examples use the Kubernetes `default` namespace.

PersistentVolumeClaim
: These examples use PersistentVolumeClaim (PVC) to create a persistent storage location. All Synapse services assume they have some persistent storage to read and write to. This example uses the `storageClass` of `do-block-storage`. You may need to alter these examples to provide a `storageClass` that is appropriate for your environment.

Aha naming
: In Kubernetes, we rely on the default naming behavior for services to find the Aha service via DNS. The Aha service uses a naming convention starting with `aha` followed by a two-digit number (e.g., `aha00`) to support multiple instances. The service's DNS name is configured using the `SYN_AHA_DNS_NAME` environment variable, which follows the pattern `<service-name>.<namespace>.svc.cluster.local`. For example, with the default namespace, the DNS name would be `aha00.default.svc.cluster.local`. The Aha service will automatically bind on `0.0.0.0` since we cannot bind the DNS label provided by Kubernetes prior to the Pod running Aha

being available. The `SYN_AHA_AHA_NETWORK` value can be set to any desired Certificate Authority name (e.g., `dev.synapse`) and is used for SSL certificate validation between Synapse services.

Aha

The following `aha.yaml` can be used to deploy an Aha service.

```yaml
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: example-aha00
  labels:
    app.kubernetes.io/name: "aha00"
    app.kubernetes.io/instance: "aha00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "aha"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: do-block-storage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: aha00
  labels:
    app.kubernetes.io/name: "aha00"
    app.kubernetes.io/instance: "aha00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "aha"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "aha00"
      app.kubernetes.io/instance: "aha00"
      app.kubernetes.io/version: "v2.x.x"
      app.kubernetes.io/component: "aha"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "aha00"
```

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```
        app.kubernetes.io/instance: "aha00"
        app.kubernetes.io/version: "v2.x.x"
        app.kubernetes.io/component: "aha"
        app.kubernetes.io/part-of: "synapse"
        environment: "dev"
    spec:
      securityContext:
        runAsUser: 999
        runAsGroup: 999
        fsGroup: 999
      volumes:
        - name: data
          persistentVolumeClaim:
            claimName: example-aha00
      containers:
      - name: aha00
        image: vertexproject/synapse-aha:v2.x.x
        env:
          - name: SYN_LOG_LEVEL
            value: DEBUG
          - name: SYN_LOG_STRUCT
            value: "false"
          - name: SYN_AHA_DNS_NAME
            value: aha00.default.svc.cluster.local
          - name: SYN_AHA_AHA_NETWORK
            # This is <namespace>.<cluster dns root> - it is used as Certificate␣
↪Authority name
            value: dev.synapse
          - name: SYN_AHA_HTTPS_PORT
            value: null
        volumeMounts:
          - mountPath: /vertex/storage
            name: data
        imagePullPolicy: Always
        startupProbe:
          failureThreshold: 2147483647
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
        readinessProbe:
          failureThreshold: 2
          initialDelaySeconds: 20
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
      restartPolicy: Always
---
apiVersion: v1
```

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```
kind: Service
metadata:
  name: aha00
  labels:
    app.kubernetes.io/name: "aha00"
    app.kubernetes.io/instance: "aha00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "aha"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  type: ClusterIP
  selector:
    app.kubernetes.io/instance: aha00
    environment: "dev"
  ports:
    - port: 27492
      protocol: TCP
      name: telepath
    - port: 27272
      protocol: TCP
      name: provisioning
```

This can be deployed via `kubectl apply`. That will create the PVC, deployment, and service.

```
$ kubectl apply -f aha.yaml
persistentvolumeclaim/example-aha00 created
deployment.apps/aha00 created
service/aha00 created
```

You can see the startup logs as well:

```
$ kubectl logs -l app.kubernetes.io/instance=aha00
2025-03-12 20:30:49,620 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
2025-03-12 20:30:49,620 [INFO] Starting ahacell version 2.202.0, Synapse version: 2.202.
↪0 [cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:30:49,621 [DEBUG] Set config valu from envar: [SYN_AHA_DNS_NAME] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:30:49,621 [DEBUG] Set config valu from envar: [SYN_AHA_HTTPS_PORT] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:30:49,621 [DEBUG] Set config valu from envar: [SYN_AHA_AHA_NETWORK]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:30:49,637 [INFO] Adding CA certificate for dev.synapse [aha.
↪py:initServiceRuntime:MainThread:MainProcess]
2025-03-12 20:30:49,637 [INFO] Generating CA certificate for dev.synapse [aha.
↪py:genCaCert:MainThread:MainProcess]
2025-03-12 20:30:49,782 [INFO] Adding user certificate for root@dev.synapse [aha.py:_
↪genUserCert:MainThread:MainProcess]
2025-03-12 20:30:50,654 [INFO] dmon listening: ssl://0.0.0.0?hostname=aha00.default.svc.
↪cluster.local&ca=dev.synapse [cell.py:_bindDmonListen:MainThread:MainProcess]
2025-03-12 20:30:50,656 [INFO] provision listening: ssl://0.0.0.0:27272?hostname=aha00.
```

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```
↪default.svc.cluster.local [aha.py:initServiceNetwork:MainThread:MainProcess]
2025-03-12 20:30:50,657 [INFO] ...ahacell API (telepath): ssl://0.0.0.0?hostname=aha00.
↪default.svc.cluster.local&ca=dev.synapse [cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:30:50,657 [INFO] ...ahacell API (https): disabled [cell.
↪py:initFromArgv:MainThread:MainProcess]
```

Axon

The following `axon.yaml` can be used as the basis to deploy an Axon service.

```
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: example-axon00
  labels:
    app.kubernetes.io/name: "axon"
    app.kubernetes.io/instance: "axon00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "axon"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: do-block-storage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: axon00
  labels:
    app.kubernetes.io/name: "axon"
    app.kubernetes.io/instance: "axon00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "axon"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "axon"
      app.kubernetes.io/instance: "axon00"
      app.kubernetes.io/version: "v2.x.x"
      app.kubernetes.io/component: "axon"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  strategy:
    type: Recreate
```

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```
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "axon"
        app.kubernetes.io/instance: "axon00"
        app.kubernetes.io/version: "v2.x.x"
        app.kubernetes.io/component: "axon"
        app.kubernetes.io/part-of: "synapse"
        environment: "dev"
    spec:
      securityContext:
        runAsUser: 999
        runAsGroup: 999
        fsGroup: 999
      volumes:
        - name: data
          persistentVolumeClaim:
            claimName: example-axon00
      containers:
      - name: axon
        image: vertexproject/synapse-axon:v2.x.x
        env:
          - name: SYN_LOG_LEVEL
            value: DEBUG
          - name: SYN_LOG_STRUCT
            value: "false"
          - name: SYN_AXON_AHA_PROVISION
            # This value is the Aha provisioning URL from the Aha service output, see␣
↪below for more details
            value: "ssl://aha00.default.svc.cluster.local:27272/..."
          - name: SYN_AXON_HTTPS_PORT
            value: null
        volumeMounts:
          - mountPath: /vertex/storage
            name: data
        imagePullPolicy: Always
        startupProbe:
          failureThreshold: 2147483647
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
        readinessProbe:
          failureThreshold: 2
          initialDelaySeconds: 20
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
      restartPolicy: Always
```

Before we deploy that, we need to create the Aha provisioning URL. We can do that via `kubectl exec`. That should look like the following:

```
$ kubectl exec deployment/aha00 -- python -m synapse.tools.aha.provision.service 00.axon
one-time use URL: ssl://aha00.default.svc.cluster.local:27272/
↪405f7b971824071aeb6ef01abca1a2c8?
↪certhash=2fc63156e8fde22dfa805901b11d80d19fac861f6ef3aac86180ad93a8dd77b7
```

We want to copy that URL into the `SYN_AXON_AHA_PROVISION` environment variable, so that block looks like the following:

```
- name: SYN_AXON_AHA_PROVISION
  value: "ssl://aha00.default.svc.cluster.local:27272/405f7b971824071aeb6ef01abca1a2c8?
↪certhash=2fc63156e8fde22dfa805901b11d80d19fac861f6ef3aac86180ad93a8dd77b7"
```

This can then be deployed via `kubectl apply`:

```
$ kubectl apply -f axon.yaml
persistentvolumeclaim/example-axon00 created
deployment.apps/axon00 created
```

You can see the Axon logs as well. These show provisioning and listening for traffic:

```
$ kubectl logs -l app.kubernetes.io/instance=axon00
2025-03-12 20:31:56,904 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
2025-03-12 20:31:56,904 [INFO] Starting axon version 2.202.0, Synapse version: 2.202.0␣
↪[cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:31:56,904 [DEBUG] Set config valu from envar: [SYN_AXON_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:31:56,904 [DEBUG] Set config valu from envar: [SYN_AXON_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:31:56,904 [INFO] Provisioning axon from AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:31:56,937 [DEBUG] Set config valu from envar: [SYN_AXON_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:31:56,937 [DEBUG] Set config valu from envar: [SYN_AXON_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:31:58,273 [INFO] Done provisioning axon AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:31:58,334 [INFO] dmon listening: ssl://0.0.0.0:0?hostname=00.axon.dev.
↪synapse&ca=dev.synapse [cell.py:_bindDmonListen:MainThread:MainProcess]
2025-03-12 20:31:58,335 [INFO] ...axon API (telepath): ssl://0.0.0.0:0?hostname=00.axon.
↪dev.synapse&ca=dev.synapse [cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:31:58,335 [INFO] ...axon API (https): disabled [cell.
↪py:initFromArgv:MainThread:MainProcess]
```

The hostname `00.axon.dev.synapse` seen in the logs is **not** a DNS label in Kubernetes. That is an internal label used by the service to resolve SSL certificates that it provisioned with the Aha service, and as the name that it uses to register with the Aha service.

JSONStor

The following `jsonstor.yaml` can be used as the basis to deploy a JSONStor service.

```
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: example-jsonstor00
  labels:
    app.kubernetes.io/name: "jsonstor"
    app.kubernetes.io/instance: "jsonstor00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "jsonstor"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: do-block-storage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: jsonstor00
  labels:
    app.kubernetes.io/name: "jsonstor"
    app.kubernetes.io/instance: "jsonstor00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "jsonstor"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "jsonstor"
      app.kubernetes.io/instance: "jsonstor00"
      app.kubernetes.io/version: "v2.x.x"
      app.kubernetes.io/component: "jsonstor"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "jsonstor"
        app.kubernetes.io/instance: "jsonstor00"
        app.kubernetes.io/version: "v2.x.x"
        app.kubernetes.io/component: "jsonstor"
        app.kubernetes.io/part-of: "synapse"
```

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```
        environment: "dev"
    spec:
      securityContext:
        runAsUser: 999
        runAsGroup: 999
        fsGroup: 999
      volumes:
        - name: data
          persistentVolumeClaim:
            claimName: example-jsonstor00
      containers:
      - name: jsonstor
        image: vertexproject/synapse-jsonstor:v2.x.x
        env:
          - name: SYN_LOG_LEVEL
            value: DEBUG
          - name: SYN_LOG_STRUCT
            value: "false"
          - name: SYN_JSONSTOR_AHA_PROVISION
            # This value is the Aha provisioning URL from the Aha service output, see␣
↪below for more details
            value: "ssl://aha00.default.svc.cluster.local:27272/..."
          - name: SYN_JSONSTOR_HTTPS_PORT
            value: null
        volumeMounts:
          - mountPath: /vertex/storage
            name: data
        imagePullPolicy: Always
        startupProbe:
          failureThreshold: 2147483647
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
        readinessProbe:
          failureThreshold: 2
          initialDelaySeconds: 20
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
      restartPolicy: Always
```

Before we deploy that, we need to create the Aha provisioning URL. We can do that via `kubectl exec`. That should look like the following:

```
$ kubectl exec deployment/aha00 -- python -m synapse.tools.aha.provision.service 00.
↪jsonstor
one-time use URL: ssl://aha00.default.svc.cluster.local:27272/
↪85941d2f2c3ffbe16605cff50d7dfc0d?
```

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```
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591
```

We want to copy that URL into the `SYN_JSONSTOR_AHA_PROVISION` environment variable, so that block looks like the following:

```
- name: SYN_JSONSTOR_AHA_PROVISION
  value: "ssl://aha00.default.svc.cluster.local:27272/85941d2f2c3ffbe16605cff50d7dfc0d?
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591"
```

This can then be deployed via `kubectl apply`:

```
$ kubectl apply -f jsonstor.yaml
persistentvolumeclaim/example-jsonstor00 created
deployment.apps/jsonstor00 created
```

You can see the JSONStor logs as well. These show provisioning and listening for traffic:

```
$ kubectl logs -l app.kubernetes.io/instance=jsonstor00
2025-03-12 20:32:29,606 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
2025-03-12 20:32:29,607 [INFO] Starting jsonstorcell version 2.202.0, Synapse version: 2.
↪202.0 [cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:32:29,607 [DEBUG] Set config valu from envar: [SYN_JSONSTOR_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:32:29,607 [DEBUG] Set config valu from envar: [SYN_JSONSTOR_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:32:29,607 [INFO] Provisioning jsonstorcell from AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:32:29,640 [DEBUG] Set config valu from envar: [SYN_JSONSTOR_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:32:29,640 [DEBUG] Set config valu from envar: [SYN_JSONSTOR_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:32:30,570 [INFO] Done provisioning jsonstorcell AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:32:30,633 [INFO] dmon listening: ssl://0.0.0.0:0?hostname=00.jsonstor.dev.
↪synapse&ca=dev.synapse [cell.py:_bindDmonListen:MainThread:MainProcess]
2025-03-12 20:32:30,635 [INFO] ...jsonstorcell API (telepath): ssl://0.0.0.0:0?
↪hostname=00.jsonstor.dev.synapse&ca=dev.synapse [cell.
↪py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:32:30,635 [INFO] ...jsonstorcell API (https): disabled [cell.
↪py:initFromArgv:MainThread:MainProcess]
```

The hostname `00.jsonstor.dev.synapse` seen in the logs is **not** a DNS label in Kubernetes. That is an internal label used by the service to resolve SSL certificates that it provisioned with the Aha service, and as the name that it uses to register with the Aha service.

Cortex

The following `cortex.yaml` can be used as the basis to deploy the Cortex.

```
---
apiVersion: v1
kind: PersistentVolumeClaim
```

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```
metadata:
  name: example-cortex00
  labels:
    app.kubernetes.io/name: "cortex"
    app.kubernetes.io/instance: "cortex00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "cortex"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: do-block-storage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: cortex00
  labels:
    app.kubernetes.io/name: "cortex"
    app.kubernetes.io/instance: "cortex00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "cortex"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "cortex"
      app.kubernetes.io/instance: "cortex00"
      app.kubernetes.io/version: "v2.x.x"
      app.kubernetes.io/component: "cortex"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "cortex"
        app.kubernetes.io/instance: "cortex00"
        app.kubernetes.io/version: "v2.x.x"
        app.kubernetes.io/component: "cortex"
        app.kubernetes.io/part-of: "synapse"
        environment: "dev"
    spec:
      securityContext:
        runAsUser: 999
        runAsGroup: 999
```

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```
        fsGroup: 999
      volumes:
        - name: data
          persistentVolumeClaim:
            claimName: example-cortex00
      containers:
      - name: cortex
        image: vertexproject/synapse-cortex:v2.x.x
        env:
          - name: SYN_LOG_LEVEL
            value: DEBUG
          - name: SYN_LOG_STRUCT
            value: "false"
          - name: SYN_CORTEX_AHA_PROVISION
            # This value is the Aha provisioning URL from the Aha service output, see␣
↪below for more details
            value: "ssl://aha00.default.svc.cluster.local:27272/..."
          - name: SYN_CORTEX_HTTPS_PORT
            value: null
          - name: SYN_CORTEX_STORM_LOG
            value: "true"
          - name: SYN_CORTEX_JSONSTOR
            value: "aha://jsonstor..."
          - name: SYN_CORTEX_AXON
            value: "aha://axon..."
        volumeMounts:
          - mountPath: /vertex/storage
            name: data
        imagePullPolicy: Always
        startupProbe:
          failureThreshold: 2147483647
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
        readinessProbe:
          failureThreshold: 2
          initialDelaySeconds: 20
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
      restartPolicy: Always
---
apiVersion: v1
kind: Service
metadata:
  name: cortex
  labels:
    app.kubernetes.io/name: "cortex"
```

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```
    app.kubernetes.io/instance: "cortex00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "cortex"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  type: ClusterIP
  selector:
    app.kubernetes.io/instance: cortex00
    environment: "dev"
  ports:
    - port: 27492
      protocol: TCP
      name: telepath
```

Before we deploy that, we need to create the Aha provisioning URL. This uses a fixed listening port for the Cortex, so that we can later use port-forwarding to access the Cortex service. We do this via `kubectl exec`. That should look like the following:

```
$ kubectl exec deployment/aha00 -- python -m synapse.tools.aha.provision.service 00.
↪cortex --dmon-port 27492
one-time use URL: ssl://aha00.default.svc.cluster.local:27272/
↪5aa07a461673424fa19dcf7d5e17f460?
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591
```

We want to copy that URL into the `SYN_CORTEX_AHA_PROVISION` environment variable, so that block looks like the following:

```
- name: SYN_CORTEX_AHA_PROVISION
  value: "ssl://aha00.default.svc.cluster.local:27272/5aa07a461673424fa19dcf7d5e17f460?
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591"
```

This can then be deployed via `kubectl apply`:

```
$ kubectl apply -f cortex.yaml
persistentvolumeclaim/example-cortex00 created
deployment.apps/cortex00 created
service/cortex created
```

You can see the Cortex logs as well. These show provisioning and listening for traffic, as well as the connection being made to the Axon and JSONStor services:

```
$ kubectl logs -l app.kubernetes.io/instance=cortex00
2025-03-12 20:33:52,998 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
2025-03-12 20:33:52,998 [INFO] Starting cortex version 2.202.0, Synapse version: 2.202.0␣
↪[cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:33:52,998 [DEBUG] Set config valu from envar: [SYN_CORTEX_AXON] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:52,998 [DEBUG] Set config valu from envar: [SYN_CORTEX_JSONSTOR]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:52,998 [DEBUG] Set config valu from envar: [SYN_CORTEX_STORM_LOG]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
```

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```
2025-03-12 20:33:52,998 [DEBUG] Set config valu from envar: [SYN_CORTEX_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:52,998 [DEBUG] Set config valu from envar: [SYN_CORTEX_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:52,998 [INFO] Provisioning cortex from AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:33:53,030 [DEBUG] Set config valu from envar: [SYN_CORTEX_AXON] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:53,030 [DEBUG] Set config valu from envar: [SYN_CORTEX_JSONSTOR]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:53,030 [DEBUG] Set config valu from envar: [SYN_CORTEX_STORM_LOG]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:53,030 [DEBUG] Set config valu from envar: [SYN_CORTEX_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:53,030 [DEBUG] Set config valu from envar: [SYN_CORTEX_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2025-03-12 20:33:55,169 [INFO] Done provisioning cortex AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2025-03-12 20:33:55,533 [WARNING] Detected 255 deprecated properties unlocked and not in␣
↪use, recommend locking (https://v.vtx.lk/deprlock). [cortex.py:_
↪warnDeprLocks:MainThread:MainProcess]
2025-03-12 20:33:55,660 [INFO] dmon listening: ssl://0.0.0.0:27492?hostname=00.cortex.
↪dev.synapse&ca=dev.synapse [cell.py:_bindDmonListen:MainThread:MainProcess]
2025-03-12 20:33:55,661 [INFO] ...cortex API (telepath): ssl://0.0.0.0:27492?hostname=00.
↪cortex.dev.synapse&ca=dev.synapse [cell.py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:33:55,661 [INFO] ...cortex API (https): disabled [cell.
↪py:initFromArgv:MainThread:MainProcess]
2025-03-12 20:33:55,664 [DEBUG] Connected to remote axon aha://axon... [cortex.
↪py:onlink:MainThread:MainProcess]
2025-03-12 20:33:55,697 [DEBUG] Connected to remote jsonstor aha://jsonstor... [cortex.
↪py:onlink:MainThread:MainProcess]
```

The hostname `00.cortex.dev.synapse` seen in the logs is **not** a DNS label in Kubernetes. That is an internal label used by the service to resolve SSL certificates that it provisioned with the Aha service, and as the name that it uses to register with the Aha service.

CLI Tooling Example

Synapse services and tooling assumes that IP and Port combinations registered with the AHA service are reachable. This example shows a way to connect to the Cortex from **outside** of the Kubernetes cluster without resolving service information via Aha. Communication between services inside of the cluster does not need to go through these steps. This does assume that your local environment has the Python synapse package available.

First add a user to the Cortex:

```
$ kubectl exec -it deployment/cortex00 -- python -m synapse.tools.moduser --add --admin␣
↪true visi
Adding user: visi
...setting admin: true
```

Then we need to generate a user provisioning URL:

```
$ kubectl exec -it deployment/aha00 -- python -m synapse.tools.aha.provision.user visi
one-time use URL: ssl://aha00.default.svc.cluster.local:27272/
↪95e9d45d9b0f0b259026f6044a26f1de?
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591
```

Port-forward the AHA provisioning service to your local environment:

```
$ kubectl port-forward service/aha00 27272:provisioning
```

Run the enroll tool to create a user certificate pair and have it signed by the Aha service. We replace the service DNS name of `aha00.default.svc.cluster.local` with `localhost` in this example.

```
$ python -m synapse.tools.aha.enroll ssl://localhost:27272/
↪95e9d45d9b0f0b259026f6044a26f1de?
↪certhash=e88f51ea894c9606fd610c4d46a46026fd25575d7f9851ea8b0ade4963207591
Saved CA certificate: /home/visi/.syn/certs/cas/dev.synapse.crt
Saved user certificate: /home/visi/.syn/certs/users/visi@dev.synapse.crt
Updating known AHA servers
```

The Aha service port-forward can be disabled, and replaced with a port-forward for the Cortex service:

```
kubectl port-forward service/cortex 27492:telepath
```

Then connect to the Cortex via the Storm CLI, using the URL `ssl://visi@localhost:27492/?hostname=00.cortex.dev.synapse`.

```
$ python -m synapse.tools.storm "ssl://visi@localhost:27492/?hostname=00.cortex.dev.
↪synapse"

Welcome to the Storm interpreter!

Local interpreter (non-storm) commands may be executed with a ! prefix:
    Use !quit to exit.
    Use !help to see local interpreter commands.

storm>
```

The Storm CLI tool can now be used to run Storm commands. We can validate our work from earlier by running the Storm command `aha.svc.list` to list the services that are registered with the Aha service:

```
storm> aha.svc.list
Name                                    Leader Online Ready Host            Port
00.axon.dev.synapse                     true   true   true  10.244.0.10    38417
00.cortex.dev.synapse                   true   true   true  10.244.0.12    27492
00.jsonstor.dev.synapse                 true   true   true  10.244.0.11    45681
axon.dev.synapse                        true   true   true  10.244.0.10    38417
cortex.dev.synapse                      true   true   true  10.244.0.12    27492
jsonstor.dev.synapse                    true   true   true  10.244.0.11    45681
```

Commercial Components

For Synapse-Enterprise users, deploying commercial components can follow a similar pattern. The following is an example of deploying Optic, the Synapse User Interface, as it is a common part of a Synapse deployment. This enables users to interact with Synapse via a web browser, instead of using the CLI tools. This example shows accessing the

service via a port-forward. This example does not contain the full configuration settings you will need for a production deployment of Optic, please see *Synapse User Interface* for more information.

> **Note**
>
> Optic is available as a part of the **Synapse Enterprise** commercial offering. This example assumes that the Kubernetes cluster has a valid `imagePullSecret` named `regcred` which can access commercial images.

The following `optic.yaml` can be used as the basis to deploy Optic.

```yaml
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: example-optic00
  labels:
    app.kubernetes.io/name: "optic"
    app.kubernetes.io/instance: "optic00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "optic"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  # You will need to use an appropriate storageClassName for your cluster.
  storageClassName: do-block-storage
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: optic00
  labels:
    app.kubernetes.io/name: "optic"
    app.kubernetes.io/instance: "optic00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "optic"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "optic"
      app.kubernetes.io/instance: "optic00"
      app.kubernetes.io/version: "v2.x.x"
      app.kubernetes.io/component: "optic"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  strategy:
```

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```
    type: Recreate
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "optic"
        app.kubernetes.io/instance: "optic00"
        app.kubernetes.io/version: "v2.x.x"
        app.kubernetes.io/component: "optic"
        app.kubernetes.io/part-of: "synapse"
        environment: "dev"
    spec:
      securityContext:
        runAsUser: 999
        runAsGroup: 999
        fsGroup: 999
      volumes:
        - name: data
          persistentVolumeClaim:
            claimName: example-optic00
      containers:
      - name: optic
        image: vertexproject/optic:v2.x.x
        securityContext:
          readOnlyRootFilesystem: true
        env:
          - name: SYN_LOG_LEVEL
            value: DEBUG
          - name: SYN_LOG_STRUCT
            value: "false"
          - name: SYN_OPTIC_AHA_PROVISION
            # This value is the Aha provisioning URL from the Aha service output, see␣
↪below for more details
            value: "ssl://aha00.default.svc.cluster.local:27272/..."
          - name: SYN_OPTIC_HTTPS_PORT
            value: "4443"
          - name: SYN_OPTIC_AXON
            value: "aha://axon..."
          - name: SYN_OPTIC_CORTEX
            value: "aha://cortex..."
        volumeMounts:
          - mountPath: /vertex/storage
            name: data
        imagePullPolicy: Always
        startupProbe:
          failureThreshold: 2147483647
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
        readinessProbe:
          failureThreshold: 2
```

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```
          initialDelaySeconds: 20
          timeoutSeconds: 20
          periodSeconds: 20
          exec:
            command: ['python', '-m', 'synapse.tools.healthcheck', '-c', 'cell:///vertex/
↪storage']
      restartPolicy: Always
      imagePullSecrets:
        - name: "regcred"
---
apiVersion: v1
kind: Service
metadata:
  name: optic
  labels:
    app.kubernetes.io/name: "optic"
    app.kubernetes.io/instance: "optic00"
    app.kubernetes.io/version: "v2.x.x"
    app.kubernetes.io/component: "optic"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  type: ClusterIP
  selector:
    app.kubernetes.io/name: optic
    environment: "dev"
  ports:
    - port: 4443
      protocol: TCP
      name: https
```

Before we deploy that, we need to create the Aha provisioning URL. We do this via `kubectl exec`. That should look like the following:

```
$ kubectl exec deployment/aha00 -- python -m synapse.tools.aha.provision.service 00.optic
one-time use URL: ssl://aha00.default.svc.cluster.local:27272/
↪3f692cda9dfb152f74a8a0251165bcc4?
↪certhash=09c8329ed29b89b77e0a2fdc23e64aea407ad4d7e71d67d3fea92ddd9466592f
```

We want to copy that URL into the `SYN_OPTIC_AHA_PROVISION` environment variable, so that block looks like the following:

```
- name: SYN_OPTIC_AHA_PROVISION
  value: "ssl://aha00.default.svc.cluster.local:27272/3f692cda9dfb152f74a8a0251165bcc4?
↪certhash=09c8329ed29b89b77e0a2fdc23e64aea407ad4d7e71d67d3fea92ddd9466592f"
```

This can then be deployed via `kubectl apply`:

```
$ kubectl apply -f optic.yaml
persistentvolumeclaim/example-optic00 created
deployment.apps/optic00 created
service/optic created
```

You can see the Optic logs as well. These show provisioning and listening for traffic, as well as the connection being made to the Axon, Cortex, and JSONStor services:

```
$ kubectl logs --tail 30 -l app.kubernetes.io/instance=optic00
2023-03-08 17:32:40,149 [INFO] log level set to DEBUG [common.
↪py:setlogging:MainThread:MainProcess]
2023-03-08 17:32:40,150 [DEBUG] Set config valu from envar: [SYN_OPTIC_CORTEX] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,150 [DEBUG] Set config valu from envar: [SYN_OPTIC_AXON] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,151 [DEBUG] Set config valu from envar: [SYN_OPTIC_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,152 [DEBUG] Set config valu from envar: [SYN_OPTIC_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,153 [INFO] Provisioning optic from AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2023-03-08 17:32:40,264 [DEBUG] Set config valu from envar: [SYN_OPTIC_CORTEX] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,265 [DEBUG] Set config valu from envar: [SYN_OPTIC_AXON] [config.
↪py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,265 [DEBUG] Set config valu from envar: [SYN_OPTIC_HTTPS_PORT]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:40,266 [DEBUG] Set config valu from envar: [SYN_OPTIC_AHA_PROVISION]␣
↪[config.py:setConfFromEnvs:MainThread:MainProcess]
2023-03-08 17:32:45,181 [INFO] Done provisioning optic AHA service. [cell.py:_
↪bootCellProv:MainThread:MainProcess]
2023-03-08 17:32:45,247 [INFO] optic wwwroot: /usr/local/lib/python3.10/dist-packages/
↪optic/site [app.py:initServiceStorage:MainThread:MainProcess]
2023-03-08 17:32:45,248 [WARNING] Waiting for remote jsonstor... [app.
↪py:initJsonStor:MainThread:MainProcess]
2023-03-08 17:32:45,502 [INFO] Connected to JsonStor at [aha://jsonstor...] [app.
↪py:initJsonStor:MainThread:MainProcess]
2023-03-08 17:32:45,504 [INFO] Waiting for connection to Cortex [app.py:_
↪initOpticCortex:MainThread:MainProcess]
2023-03-08 17:32:45,599 [INFO] Connected to Cortex at [aha://cortex...] [app.py:_
↪initOpticCortex:MainThread:MainProcess]
2023-03-08 17:32:45,930 [INFO] Connected to Axon at [aha://axon...] [app.
↪py:onaxonlink:MainThread:MainProcess]
2023-03-08 17:32:45,937 [DEBUG] Email settings/server not configured or invalid. [app.
↪py:initEmailApis:asyncio_0:MainProcess]
2023-03-08 17:32:45,975 [INFO] dmon listening: ssl://0.0.0.0:0?hostname=00.optic.default.
↪svc.cluster.local&ca=default.svc.cluster.local [cell.
↪py:initServiceNetwork:MainThread:MainProcess]
2023-03-08 17:32:45,976 [WARNING] NO CERTIFICATE FOUND! generating self-signed␣
↪certificate. [cell.py:addHttpsPort:MainThread:MainProcess]
2023-03-08 17:32:47,773 [INFO] https listening: 4443 [cell.
↪py:initServiceNetwork:MainThread:MainProcess]
2023-03-08 17:32:47,773 [INFO] ...optic API (telepath): ssl://0.0.0.0:0?hostname=00.
↪optic.default.svc.cluster.local&ca=default.svc.cluster.local [cell.
↪py:initFromArgv:MainThread:MainProcess]
2023-03-08 17:32:47,773 [INFO] ...optic API (https): 4443 [cell.
↪py:initFromArgv:MainThread:MainProcess]
```

Once Optic is connected, we will need to set a password for the user we previously created in order to log in. This can

be done via `kubectl exec`, setting the password for the user on the Cortex:

```
$ kubectl exec -it deployment/cortex00 -- python -m synapse.tools.moduser --passwd␣
↪secretPassword visi
Modifying user: visi
...setting passwd: secretPassword
```

Enable a port-forward to connect to the Optic service:

```
$ kubectl port-forward service/optic 4443:https
```

You can then use a Chrome browser to navigate to `https://localhost:4443` and you should be prompted with an Optic login screen. You can enter your username and password (`visi` and `secretPassword`) in order to login to Optic.

Practical Considerations

The following items should be considered for Kubernetes deployments intended for production use cases:

Healthchecks
: These examples use large `startupProbe` failure values. Vertex recommends these large values, since service updates may have automatic data migrations which they perform at startup. These will be performed before a service has enabled any listeners which would respond to healthcheck probes. The large value prevents a service from being terminated prior to a long running data migration completing.

Ingress and Load Balancing
: The use of `kubectl port-forward` may not be sustainable in a production environment. It is common to use a form of ingress controller or load balancer for external services to reach services such as the Cortex or Optic applications. It is common for the Optic UI or the Cortex HTTP API to be exposed to end users since that often has a simpler networking configuration than exposing Telepath services on Aha and the Cortex.

Log aggregation
: Many Kubernetes clusters may perform some sort of log aggregation for the containers running in them. If your log aggregation solution can parse JSON formatted container logs, you can set the `SYN_LOG_STRUCT` environment variable to `"true"` to enable structured log output. See *Configure Logging* for more information about that option.

Node Selectors
: These examples do not use any node selectors to bind pods to specific nodes or node types. Node selectors on the podspec can be used to constrain different services to different types of nodes. For example, they can be used to ensure the Cortex is deployed to a node which has been provisioned as a high memory node for that purpose.

PVC
: The previous examples used relatively small volume claim sizes for demonstration purposes. A `storageClass` which can be dynamically resized will be helpful in the event of needing to grow the storage used by a deployment. This is a common feature for managed Kubernetes instances.

Performance Tuning in Kubernetes

It is common for Kubernetes to be executed in a managed environment, where an operator may not have direct access to the underlying hosts. In that scenario, applying the system configurations detailed in *Performance Tuning* may be difficult. The following example shows a DaemonSet which runs a privileged pod, that ensures that the desired `sysctl` values are set on the host. You may need to modify this to meet any requirements which are specific to your deployment.

The following `sysctl.yaml` can be used as the basis to deploy these modifications.

```
apiVersion: "apps/v1"
kind: "DaemonSet"
metadata:
  name: "setsysctl"
  labels:
    app.kubernetes.io/name: "sysctl"
    app.kubernetes.io/instance: "sysctl"
    app.kubernetes.io/version: "1.36.0-glibc"
    app.kubernetes.io/component: "sysctl"
    app.kubernetes.io/part-of: "synapse"
    environment: "dev"
spec:
  selector:
    matchLabels:
      app.kubernetes.io/name: "sysctl"
      app.kubernetes.io/instance: "sysctl"
      app.kubernetes.io/version: "1.36.0-glibc"
      app.kubernetes.io/component: "sysctl"
      app.kubernetes.io/part-of: "synapse"
      environment: "dev"
  template:
    metadata:
      labels:
        app.kubernetes.io/name: "sysctl"
        app.kubernetes.io/instance: "sysctl"
        app.kubernetes.io/version: "1.36.0-glibc"
        app.kubernetes.io/component: "sysctl"
        app.kubernetes.io/part-of: "synapse"
        environment: "dev"
    spec:
      containers:
      - name: "apply-sysctl"
        image: "busybox:1.36.0-glibc"  # Latest glibc based busybox
        securityContext:
          privileged: true
        command:
        - "/bin/sh"
        - "-c"
        - |
          set -o errexit
          set -o xtrace
          while sysctl -w vm.swappiness=10 vm.dirty_expire_centisecs=20 vm.dirty_
↪writeback_centisecs=20 vm.dirty_background_ratio=2 vm.dirty_ratio=4
          do
            sleep 600s
          done
```

This can be deployed via `kubectl apply`. That will create the DaemonSet for you..

```
$ kubectl apply -f sysctl_dset.yaml
daemonset.apps/setsysctl created
```

You can see the sysctl pods by running the following command:

```
$ kubectl get pods -l app.kubernetes.io/component=sysctl -o wide
```

6.4.2 AHA Configuration Options

aha:admin

An AHA client certificate CN to register as a local admin user.

Type
`string`

Environment Variable
`SYN_AHA_AHA_ADMIN`

aha:leader

The AHA service name to claim as the active instance of a storm service.

Type
`string`

Environment Variable
`SYN_AHA_AHA_LEADER`

aha:name

The name of the cell service in the aha service registry.

Type
`string`

Environment Variable
`SYN_AHA_AHA_NAME`

aha:network

The AHA service network.

Type
`string`

Environment Variable
`SYN_AHA_AHA_NETWORK`

aha:promotable

Set to false to prevent this service from being promoted to leader.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_AHA_AHA_PROMOTABLE`

aha:provision

The telepath URL of the aha provisioning service.

Type
`['string', 'array']`

Environment Variable
`SYN_AHA_AHA_PROVISION`

aha:registry

The telepath URL of the aha service registry.

Type
`['string', 'array']`

Environment Variable
`SYN_AHA_AHA_REGISTRY`

aha:urls

Deprecated. AHA servers can now manage this automatically.

Type
`['string', 'array']`

Environment Variable
`SYN_AHA_AHA_URLS`

aha:user

The username of this service when connecting to others.

Type
`string`

Environment Variable
`SYN_AHA_AHA_USER`

auth:anon

Allow anonymous telepath access by mapping to the given user name.

Type
`string`

Environment Variable
`SYN_AHA_AUTH_ANON`

auth:passwd

Set to <passwd> (local only) to bootstrap the root user password.

Type
`string`

Environment Variable
`SYN_AHA_AUTH_PASSWD`

auth:passwd:policy

Specify password policy/complexity requirements.

Type
`object`

Environment Variable
`SYN_AHA_AUTH_PASSWD_POLICY`

backup:dir

A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.

Type
`string`

Environment Variable
`SYN_AHA_BACKUP_DIR`

clone

Bootstrap a clone from the AHA clone URL.

Type
`['string', 'null']`

Environment Variable
`SYN_AHA_CLONE`

dmon:listen

A config-driven way to specify the telepath bind URL.

Type
`['string', 'null']`

Environment Variable
`SYN_AHA_DMON_LISTEN`

dns:name

The registered DNS name used to reach the AHA service.

Type
`['string', 'null']`

Environment Variable
`SYN_AHA_DNS_NAME`

health:sysctl:checks

Enable sysctl parameter checks and warn if values are not optimal.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_AHA_HEALTH_SYSCTL_CHECKS`

https:headers

Headers to add to all HTTPS server responses.

Type
`object`

Environment Variable
`SYN_AHA_HTTPS_HEADERS`

https:parse:proxy:remoteip

Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_AHA_HTTPS_PARSE_PROXY_REMOTEIP`

https:port

A config-driven way to specify the HTTPS port.

Type
`['integer', 'null']`

Environment Variable
`SYN_AHA_HTTPS_PORT`

limit:disk:free

Minimum disk free space percentage before setting the cell read-only.

Type
`['integer', 'null']`

Default Value
`5`

Environment Variable
`SYN_AHA_LIMIT_DISK_FREE`

max:users

Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).

Type
`integer`

Default Value
`0`

Environment Variable
`SYN_AHA_MAX_USERS`

mirror

A telepath URL for our upstream mirror (we must be a backup!).

Type
`['string', 'null']`

Environment Variable
`SYN_AHA_MIRROR`

nexslog:en

Record all changes to a stream file on disk. Required for mirroring (on both sides).

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_AHA_NEXSLOG_EN`

onboot:optimize

Delay startup to optimize LMDB databases during boot to recover free space and increase performance. This may take a while.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_AHA_ONBOOT_OPTIMIZE`

provision:listen

A telepath URL for the AHA provisioning listener.

Type
`['string', 'null']`

Environment Variable
`SYN_AHA_PROVISION_LISTEN`

6.4.3 Axon Configuration Options

aha:admin

An AHA client certificate CN to register as a local admin user.

Type
`string`

Environment Variable
`SYN_AXON_AHA_ADMIN`

aha:leader

The AHA service name to claim as the active instance of a storm service.

Type
`string`

Environment Variable
`SYN_AXON_AHA_LEADER`

aha:name

The name of the cell service in the aha service registry.

Type
`string`

Environment Variable
`SYN_AXON_AHA_NAME`

aha:network

The AHA service network.

Type
`string`

Environment Variable
`SYN_AXON_AHA_NETWORK`

aha:promotable

Set to false to prevent this service from being promoted to leader.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_AXON_AHA_PROMOTABLE`

aha:provision

The telepath URL of the aha provisioning service.

Type
`['string', 'array']`

Environment Variable
`SYN_AXON_AHA_PROVISION`

aha:registry

The telepath URL of the aha service registry.

Type
`['string', 'array']`

Environment Variable
`SYN_AXON_AHA_REGISTRY`

aha:user

The username of this service when connecting to others.

Type
`string`

Environment Variable
`SYN_AXON_AHA_USER`

auth:anon

Allow anonymous telepath access by mapping to the given user name.

Type
`string`

Environment Variable
`SYN_AXON_AUTH_ANON`

auth:passwd

Set to <passwd> (local only) to bootstrap the root user password.

Type
`string`

Environment Variable
`SYN_AXON_AUTH_PASSWD`

auth:passwd:policy

Specify password policy/complexity requirements.

Type
`object`

Environment Variable
`SYN_AXON_AUTH_PASSWD_POLICY`

backup:dir

A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.

Type
`string`

Environment Variable
`SYN_AXON_BACKUP_DIR`

dmon:listen

A config-driven way to specify the telepath bind URL.

Type
`['string', 'null']`

Environment Variable
`SYN_AXON_DMON_LISTEN`

health:sysctl:checks

Enable sysctl parameter checks and warn if values are not optimal.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_AXON_HEALTH_SYSCTL_CHECKS`

http:proxy

An aiohttp-socks compatible proxy URL to use in the wget API.

Type
`string`

Environment Variable
`SYN_AXON_HTTP_PROXY`

https:headers

Headers to add to all HTTPS server responses.

Type
`object`

Environment Variable
`SYN_AXON_HTTPS_HEADERS`

https:parse:proxy:remoteip

Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_AXON_HTTPS_PARSE_PROXY_REMOTEIP`

https:port

A config-driven way to specify the HTTPS port.

Type
`['integer', 'null']`

Environment Variable
`SYN_AXON_HTTPS_PORT`

limit:disk:free

Minimum disk free space percentage before setting the cell read-only.

Type
`['integer', 'null']`

Default Value
`5`

Environment Variable
`SYN_AXON_LIMIT_DISK_FREE`

max:bytes

The maximum number of bytes that can be stored in the Axon.

Type
`integer`

Environment Variable
`SYN_AXON_MAX_BYTES`

max:count

The maximum number of files that can be stored in the Axon.

Type
`integer`

Environment Variable
`SYN_AXON_MAX_COUNT`

max:users

Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).

Type
`integer`

Default Value
`0`

Environment Variable
`SYN_AXON_MAX_USERS`

nexslog:en

Record all changes to a stream file on disk. Required for mirroring (on both sides).

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_AXON_NEXSLOG_EN`

onboot:optimize

Delay startup to optimize LMDB databases during boot to recover free space and increase performance. This may take a while.

Type
`boolean`

Default Value
`False`

Environment Variable
SYN_AXON_ONBOOT_OPTIMIZE

tls:ca:dir

An optional directory of CAs which are added to the TLS CA chain for wget and wput APIs.

Type
string

Environment Variable
SYN_AXON_TLS_CA_DIR

6.4.4 JSONStor Configuration Options

aha:admin

An AHA client certificate CN to register as a local admin user.

Type
string

Environment Variable
SYN_JSONSTOR_AHA_ADMIN

aha:leader

The AHA service name to claim as the active instance of a storm service.

Type
string

Environment Variable
SYN_JSONSTOR_AHA_LEADER

aha:name

The name of the cell service in the aha service registry.

Type
string

Environment Variable
SYN_JSONSTOR_AHA_NAME

aha:network

The AHA service network.

Type
string

Environment Variable
SYN_JSONSTOR_AHA_NETWORK

aha:promotable

Set to false to prevent this service from being promoted to leader.

Type
boolean

Default Value
`True`

Environment Variable
`SYN_JSONSTOR_AHA_PROMOTABLE`

aha:provision

The telepath URL of the aha provisioning service.

Type
`['string', 'array']`

Environment Variable
`SYN_JSONSTOR_AHA_PROVISION`

aha:registry

The telepath URL of the aha service registry.

Type
`['string', 'array']`

Environment Variable
`SYN_JSONSTOR_AHA_REGISTRY`

aha:user

The username of this service when connecting to others.

Type
`string`

Environment Variable
`SYN_JSONSTOR_AHA_USER`

auth:anon

Allow anonymous telepath access by mapping to the given user name.

Type
`string`

Environment Variable
`SYN_JSONSTOR_AUTH_ANON`

auth:passwd

Set to <passwd> (local only) to bootstrap the root user password.

Type
`string`

Environment Variable
`SYN_JSONSTOR_AUTH_PASSWD`

auth:passwd:policy

Specify password policy/complexity requirements.

Type
`object`

Environment Variable
SYN_JSONSTOR_AUTH_PASSWD_POLICY

backup:dir

A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.

Type
string

Environment Variable
SYN_JSONSTOR_BACKUP_DIR

dmon:listen

A config-driven way to specify the telepath bind URL.

Type
['string', 'null']

Environment Variable
SYN_JSONSTOR_DMON_LISTEN

health:sysctl:checks

Enable sysctl parameter checks and warn if values are not optimal.

Type
boolean

Default Value
True

Environment Variable
SYN_JSONSTOR_HEALTH_SYSCTL_CHECKS

https:headers

Headers to add to all HTTPS server responses.

Type
object

Environment Variable
SYN_JSONSTOR_HTTPS_HEADERS

https:parse:proxy:remoteip

Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.

Type
boolean

Default Value
False

Environment Variable
SYN_JSONSTOR_HTTPS_PARSE_PROXY_REMOTEIP

https:port

A config-driven way to specify the HTTPS port.

Type
`['integer', 'null']`

Environment Variable
`SYN_JSONSTOR_HTTPS_PORT`

limit:disk:free

Minimum disk free space percentage before setting the cell read-only.

Type
`['integer', 'null']`

Default Value
`5`

Environment Variable
`SYN_JSONSTOR_LIMIT_DISK_FREE`

max:users

Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).

Type
`integer`

Default Value
`0`

Environment Variable
`SYN_JSONSTOR_MAX_USERS`

nexslog:en

Record all changes to a stream file on disk. Required for mirroring (on both sides).

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_JSONSTOR_NEXSLOG_EN`

onboot:optimize

Delay startup to optimize LMDB databases during boot to recover free space and increase performance. This may take a while.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_JSONSTOR_ONBOOT_OPTIMIZE`

6.4.5 Cortex Configuration Options

aha:admin

An AHA client certificate CN to register as a local admin user.

Type
`string`

Environment Variable
`SYN_CORTEX_AHA_ADMIN`

aha:leader

The AHA service name to claim as the active instance of a storm service.

Type
`string`

Environment Variable
`SYN_CORTEX_AHA_LEADER`

aha:name

The name of the cell service in the aha service registry.

Type
`string`

Environment Variable
`SYN_CORTEX_AHA_NAME`

aha:network

The AHA service network.

Type
`string`

Environment Variable
`SYN_CORTEX_AHA_NETWORK`

aha:promotable

Set to false to prevent this service from being promoted to leader.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_CORTEX_AHA_PROMOTABLE`

aha:provision

The telepath URL of the aha provisioning service.

Type
`['string', 'array']`

Environment Variable
SYN_CORTEX_AHA_PROVISION

aha:registry

The telepath URL of the aha service registry.

Type
['string', 'array']

Environment Variable
SYN_CORTEX_AHA_REGISTRY

aha:user

The username of this service when connecting to others.

Type
string

Environment Variable
SYN_CORTEX_AHA_USER

auth:anon

Allow anonymous telepath access by mapping to the given user name.

Type
string

Environment Variable
SYN_CORTEX_AUTH_ANON

auth:passwd

Set to <passwd> (local only) to bootstrap the root user password.

Type
string

Environment Variable
SYN_CORTEX_AUTH_PASSWD

auth:passwd:policy

Specify password policy/complexity requirements.

Type
object

Environment Variable
SYN_CORTEX_AUTH_PASSWD_POLICY

axon

A telepath URL for a remote axon.

Type
string

Environment Variable
SYN_CORTEX_AXON

backup:dir

A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.

Type
`string`

Environment Variable
`SYN_CORTEX_BACKUP_DIR`

cron:enable

Deprecated. This option no longer controls cron execution and will be removed in Synapse 3.0.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_CORTEX_CRON_ENABLE`

dmon:listen

A config-driven way to specify the telepath bind URL.

Type
`['string', 'null']`

Environment Variable
`SYN_CORTEX_DMON_LISTEN`

health:sysctl:checks

Enable sysctl parameter checks and warn if values are not optimal.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_CORTEX_HEALTH_SYSCTL_CHECKS`

http:proxy

An aiohttp-socks compatible proxy URL to use storm HTTP API.

Type
`string`

Environment Variable
`SYN_CORTEX_HTTP_PROXY`

https:headers

Headers to add to all HTTPS server responses.

Type
`object`

Environment Variable
`SYN_CORTEX_HTTPS_HEADERS`

https:parse:proxy:remoteip

Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_CORTEX_HTTPS_PARSE_PROXY_REMOTEIP`

https:port

A config-driven way to specify the HTTPS port.

Type
`['integer', 'null']`

Environment Variable
`SYN_CORTEX_HTTPS_PORT`

jsonstor

A telepath URL for a remote jsonstor.

Type
`string`

Environment Variable
`SYN_CORTEX_JSONSTOR`

layers:lockmemory

Should new layers lock memory for performance by default.

Type
`boolean`

Default Value
`False`

Environment Variable
`SYN_CORTEX_LAYERS_LOCKMEMORY`

layers:logedits

Whether nodeedits are logged in each layer.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_CORTEX_LAYERS_LOGEDITS`

limit:disk:free

Minimum disk free space percentage before setting the cell read-only.

Type
`['integer', 'null']`

Default Value
`5`

Environment Variable
`SYN_CORTEX_LIMIT_DISK_FREE`

max:nodes

Maximum number of nodes which are allowed to be stored in a Cortex.

Type
`integer`

Environment Variable
`SYN_CORTEX_MAX_NODES`

max:users

Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).

Type
`integer`

Default Value
`0`

Environment Variable
`SYN_CORTEX_MAX_USERS`

mirror

A telepath URL for our upstream mirror (we must be a backup!).

Type
`['string', 'null']`

Environment Variable
`SYN_CORTEX_MIRROR`

modules

Deprecated. A list of module classes to load.

Type
`array`

Default Value
`[]`

Environment Variable
SYN_CORTEX_MODULES

nexslog:en

Record all changes to a stream file on disk. Required for mirroring (on both sides).

Type
boolean

Default Value
True

Environment Variable
SYN_CORTEX_NEXSLOG_EN

onboot:optimize

Delay startup to optimize LMDB databases during boot to recover free space and increase performance. This may take a while.

Type
boolean

Default Value
False

Environment Variable
SYN_CORTEX_ONBOOT_OPTIMIZE

storm:interface:scrape

Enable Storm scrape interfaces when using $lib.scrape APIs.

Type
boolean

Default Value
True

Environment Variable
SYN_CORTEX_STORM_INTERFACE_SCRAPE

storm:interface:search

Enable Storm search interfaces for lookup mode.

Type
boolean

Default Value
True

Environment Variable
SYN_CORTEX_STORM_INTERFACE_SEARCH

storm:log

Log storm queries via system logger.

Type
boolean

Default Value
`False`

Environment Variable
`SYN_CORTEX_STORM_LOG`

storm:log:level

Logging log level to emit storm logs at.

Type
`['integer', 'string']`

Default Value
`'INFO'`

Environment Variable
`SYN_CORTEX_STORM_LOG_LEVEL`

tls:ca:dir

An optional directory of CAs which are added to the TLS CA chain for Storm HTTP API calls.

Type
`string`

Environment Variable
`SYN_CORTEX_TLS_CA_DIR`

trigger:enable

Deprecated. This option no longer controls trigger execution and will be removed in Synapse 3.0.

Type
`boolean`

Default Value
`True`

Environment Variable
`SYN_CORTEX_TRIGGER_ENABLE`

CHAPTER

SEVEN

SYNAPSE DEVELOPER GUIDE

This Dev Guide is written by and for Synapse developers.

> **Note**
>
> Synapse as a library is under constant development. It is posssible that content here may become out of date. If you encounter issues with documentation in the Developers guides, please reach out to us on our Synapse Slack chat or file an issue in our projects Github page.

The Dev Guide is a living document and will continue to be updated and expanded as appropriate. The current sections are:

7.1 Rapid Power-Up Development

Developing Rapid Power-Ups allows Synapse power users to extend the capabilities of the Storm query language, provides ways to implement use-case specific commands, embed documentation, and even implement customized visual workflows in **Optic**, the commercial Synapse UI.

A Rapid Power-Up consists of a **Storm Package** which is a JSON object which defines everything used to extend the Storm language and provide additional documentation. **Storm Packages** can be loaded directly into your **Cortex**.

In this guide we will discuss the basics of **Storm Package** development and discuss a few best practices you can use to ensure they are secure, powerful, and easy to use.

The example `acme-hello` power-up discussed in this guide is included in the **Synapse** repository within the `examples/power-ups/rapid/acme-hello` folder. You can find that at Acme-Hello Example.

7.1.1 Anatomy of a Storm Package

A **Storm Package** consists of a YAML file which defines the various commands, modules, documentation, and workflows embedded within the package.

Minimal Example

As you can see in the minimal example below, the **Storm Package** is defined by a YAML file that gets processed and loaded into your Cortex.

`acme-hello.yaml`:

```
name: acme-hello
version: 0.0.1
```

(continues on next page)

(continued from previous page)

```
synapse_version: '>=2.144.0,<3.0.0'

genopts:
    dotstorm: true # Specify that storm command/module files end with ".storm"

author:
  url: https://acme.newp
  name: ACME Explosives and Anvils

desc: Acme-Hello is a minimal example of a Rapid Power-Up.

modules:
  - name: acme.hello
  - name: acme.hello.privsep
    asroot:perms:
        - [ acme, hello, user ]

commands:
  - name: acme.hello.sayhi
    descr: Print the hello message.
```

Note

First, a note on namespacing. To ensure your **Storm Package** is going to play well with other packages, it is important to choose an appropriate namespace for your power-up. In this case, the `acme` part of the name is meant to be replaced with your company name or an abbreviated version of it. The `hello` part is meant to be replaced with an indicator of the type of functionality the **Storm Package** contains.

Namespace now, thank yourself later.

When you define commands and modules, they will be loaded from files using the location of the **Storm Package** YAML file to locate their contents:

```
acme-hello.yaml
storm/

    modules/
        acme.hello.storm
        acme.hello.privsep.storm

    commands/
        acme.hello.sayhi.storm
```

`storm/modules/acme.hello.storm`:

```
function woot(text) {
    $lib.print($text)
    return($lib.null)
}
```

`storm/commands/acme.hello.sayhi.storm`:

```
$hello = $lib.import(acme.hello)
$hello.woot("hello storm!")
```

Building / Loading

To build and load **Storm Packages**, use the `genpkg` tool included within Synapse. For this example, we will assume you have deployed your Synapse environment according to the Deployment Guide:

```
python -m synapse.tools.genpkg acme-hello.yaml --push aha://cortex...
```

Note

If you added an alternate admin user or used a non-standard naming convention you may need to adjust the `aha://cortex...` telepath URL to connect to your Cortex.

Once your **Storm Package** has loaded successfully, you can use the **Storm** CLI to see it in action:

```
invisigoth@visi01:~$ python -m synapse.tools.storm aha://cortex...

Welcome to the Storm interpreter!

Local interpreter (non-storm) commands may be executed with a ! prefix:
    Use !quit to exit.
    Use !help to see local interpreter commands.

storm> acme.hello.sayhi
hello storm!
complete. 0 nodes in 1 ms (0/sec).
storm>
```

7.1.2 Storm Modules

Deploying **Storm Modules** allows you to author powerful library functions that you can use in automation or **Storm Commands** to facilitate code re-use and enforce privilege separation boundaries.

A **Storm Module** is specified within the `modules:` section of the **Storm Package** YAML file.

```
modules:

  - name: acme.hello
    modconf:
        varname: varvalu
        othervar: [1, 2, 3]
```

The `modconf:` key can be used to specify variables which will be mapped into the module's **Storm** runtime and accessible using the implicit variable `$modconf`:

```
function foo() {
    $lib.print($modconf.varname)
    return((10))
}
```

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```
function bar() {
    for $i in $modconf.othervar {
        // Do something using $i...
    }
}
```

Privileged Modules

In order to facilitate delegating permission for privileged operations, **Storm** modules may specify permissions which allow the module to be imported with admin privileges. It is a best-practice to declare these permissions within the **Storm** package using the `perms:` key before using them:

```
perms:
  - perm: [ acme, hello, user ]
    gate: cortex
    desc: Allows a user to call privileged APIs from Acme-Hello.

modules:

  - name: acme.hello.privsep
    asroot:perms:
        - [ acme, hello, user ]
```

To minimize risk, you must very carefully consider what functions to implement within a privileged **Storm** module! Privileged modules should contain the absolute minimum required functionality.

An excellent example use case for a privileged **Storm** module exists when you have an API key or password which you would like to use on a user's behalf without disclosing the actual API key. The **Storm** library `$lib.globals.set(<name>, <valu>)` and `$lib.globals.get(<name>)` can be used to access protected global variables which regular users may not access without special permissions. By implementing a privileged **Storm** module which retrieves the API key and uses it on the user's behalf without disclosing it, you may protect the API key from disclosure while also allowing users to use it. For example, `acme.hello.privsep.storm`:

```
function getFooByBar(bar) {

    // Retrieve an API key from protected storage
    $apikey = $lib.globals.get(acme:hello:apikey)

    $headers = ({
        "apikey": $apikey
    })

    $url = `https://acme.newp/api/v1/foo/{$bar}`

    // Use the API key on the callers behalf
    $resp = $lib.inet.http.get($url, headers=$headers)
    if ($resp.code != 200) {
        $lib.warn("/api/v1/foo returned HTTP code: {code}", code=$resp.code)
        return($lib.null)
    }

    // Return the JSON response (but not the API key)
```

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```
    return($resp.json())
}
```

Notice that the `$apikey` is being retrieved and used to call the HTTP API but is not returned to the caller.

7.1.3 Storm Commands

Adding **Storm Commands** to your Cortex via a **Storm Package** is a great way to extend the functionality of your Cortex in a CLI user-friendly way.

Command Line Options

Every **Storm** command has the `--help` option added automatically. This means that it is always safe to execute any command with `--help` to get a usage statement and enumerate command line arguments. The `desc` field specified in the command is included in the output:

```
storm> acme.hello.sayhi --help

Print the hello message.

Usage: acme.hello.sayhi [options]

Options:

  --help                      : Display the command usage.
complete. 0 nodes in 4 ms (0/sec).
storm>
```

Storm Commands may specify command line arguments using a convention which is similar (although not identical to) Python's `argparse` library.

A more complex command declaration:

```
commands:

  - name: acme.hello.omgopts
    descr: |
        This is a multi-line description containing usage examples.

        // Run the command with some nodes
        inet:fqdn=acme.newp | acme.hello.omgopts vertex.link

        // Run the command with some command line switches
        acme.hello.omgopts --debug --hehe haha vertex.link

    cmdargs:

      - - --hehe
        - type: str
          help: The value of the hehe optional input.

      - - --debug
        - type: bool
```

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```
          default: false
          action: store_true
          help: Enable debug output.

      - - fqdn
        - type: str
          help: A mandatory / positional command line argument.
```

A more complete example of help output:

```
storm> acme.hello.omgopts --help

This is a multi-line description containing usage examples.

// Run the command with some nodes
inet:fqdn=acme.newp | acme.hello.omgopts vertex.link

// Run the command with some command line switches
acme.hello.omgopts --debug --hehe haha vertex.link


Usage: acme.hello.omgopts [options] <fqdn>

Options:

  --help                      : Display the command usage.
  --hehe <hehe>               : The value of the hehe optional input.
  --debug                     : Enable debug output.

Arguments:

  <fqdn>                      : A mandatory / positional command line argument.
complete. 0 nodes in 6 ms (0/sec).
```

Command line options are available within the **Storm** command by accessing the implicit `$cmdopts` variable. The command example (`storm/commands/acme.hello.omgopts.storm`) can be seen below:

```
// An init {} block only runs once even if there are multiple nodes in the pipeline.

init {

    // Set global debug (once) if the user specified --debug
    if $cmdopts.debug { $lib.debug = $lib.true }

    if ($cmdopts.hehe) { $lib.print("User Specified hehe: {hehe}", hehe=$cmdopts.hehe) }

    // Normalize the FQDN in case we want to send it to an external system
    ($ok, $fqdn) = $lib.trycast(inet:fqdn, $cmdopts.fqdn)
    if (not $ok) {
        $lib.exit("Invalid FQDN Specified: {fqdn}", fqdn=$cmdopts.fqdn)
    }
```

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```
    // Maybe call an API here or something...
    $lib.print("FQDN: {fqdn}", fqdn=$fqdn)
}


// You may also act on nodes in the pipeline
$lib.print("GOT NODE: {repr}", repr=$node.repr())

if $lib.debug { $lib.print("debug mode detected!") }

// Any nodes still in the pipeline are sent as output
```

Command Option Conventions

--help This option is reserved and handled automatically to print a command usage statement which also enumerates any positional or optional arguments.

--debug This option is typically used to enable debug output in the **Storm** interpreter by setting the `$lib.debug` variable if it is specified. The `$lib.debug` variable has a recursive effect and will subsequently enable debug output in any command or functions called from the command.

--yield By default, a command is generally expected to yield the nodes that it received as input from the pipeline. In some instances it is useful to instruct the command to yield the nodes it creates. For example, if you specify `inet:fqdn` nodes as input to a DNS resolver command, it may be useful to tell the command to yield the newly created `inet:dns:a` records rather than the input `inet:fqdn` nodes. Commands frequently use the `divert` **Storm** command to implement `--yield` functionality.

--asof <time> To minimize duplicate API calls, many **Storm** packages cache results using the `$lib.jsonstor` API. When caching is in use, the `--asof <time>` option is used to control cache aging. Users may specify `--asof now` to disable caching.

7.1.4 Specifying Documentation

Documentation may be specified in the **Storm Package** file that will embed `markdown` documentation into the package. While there are not currently any CLI tools to view/use this documentation, it is presented in the **Power-Ups** tab in the **Help Tool** within the commercial *Synapse User Interface*.

Markdown documents may be specified for inclusion by adding a `docs:` section to the **Storm Package** YAML file:

```
docs:
    - title: User Guide
      path: docs/userguide.md
    - title: Admin Guide
      path: docs/adminguide.md
    - title: Changelog
      path: docs/changelog.md
```

7.1.5 Testing Storm Packages

It is **highly** recommended that any production **Storm Packages** use development "best practices" including version control and unit testing. For the `acme-hello` example, we have included a test file (`test_acme_hello.py`) that you can use as an example to expand on:

```
import os

import synapse.tests.utils as s_test

dirname = os.path.abspath(os.path.dirname(__file__))

class AcmeHelloTest(s_test.StormPkgTest):

    assetdir = os.path.join(dirname, 'testassets')
    pkgprotos = (os.path.join(dirname, 'acme-hello.yaml'),)

    async def test_acme_hello(self):

        async with self.getTestCore() as core:

            msgs = await core.stormlist('acme.hello.sayhi')
            self.stormIsInPrint('hello storm!', msgs)
            self.stormHasNoWarnErr(msgs)

    async def test_acme_hello_mayyield(self):

        async with self.getTestCore() as core:

            msgs = await core.stormlist('[ inet:fqdn=vertex.link ] | acme.hello.mayyield
↪')
            self.stormHasNoWarnErr(msgs)
            nodes = [m[1] for m in msgs if m[0] == 'node']
            self.len(1, nodes)
            self.eq(('inet:fqdn', 'vertex.link'), nodes[0][0])

            msgs = await core.stormlist('[ inet:fqdn=vertex.link ] | acme.hello.mayyield␣
↪--yield')
            self.stormHasNoWarnErr(msgs)
            nodes = [m[1] for m in msgs if m[0] == 'node']
            self.len(2, nodes)
            self.eq(('inet:dns:a', ('vertex.link', 0x01020304)), nodes[0][0])
            self.eq(('inet:dns:a', ('vertex.link', 0x7b7b7b7b)), nodes[1][0])
```

With the file `test_acme_hello.py` located in the same directory as `acme-hello.yaml` you can use the standard `pytest` invocation to run the test:

```
python -m pytest -svx test_acme_hello.py
```

7.1.6 Advanced Features

Using `divert` to implement `--yield`

The `--yield` option is typically used to allow a **Storm** command which takes nodes as input to optionally output the new nodes it added rather than the nodes it received as input. The `divert` command was added to **Storm** to simplify

implementing this convention.

To implement a command with a `--yield` option is typically accomplished via the following pattern:

```
commands:

  - name: acme.hello.mayyield
    descr: |
         Take in an FQDN and make DNS A records to demo --yield

         inet:fqdn=vertex.link | acme.hello.mayyield

    cmdargs:

      - - --yield
        - default: false
          action: store_true
          help: Yield the newly created inet:dns:a records rather than the input␣
↪inet:fqdn nodes.
```

Then within `storm/commands/acme.hello.mayyield.storm`:

```
function nodeGenrFunc(fqdn) {
    // Fake a DNS lookup and make a few inet:dns:a records...
    [ inet:dns:a=($fqdn, 1.2.3.4) ]
    [ inet:dns:a=($fqdn, 123.123.123.123) ]
}

divert $cmdopts.yield $nodeGenrFunc($node)
```

When executed, the `acme.hello.mayyield` command will output the nodes received as inputs which is useful for pipelining enrichments. If the user specifies `--yield` the command will output the resulting `inet:dns:a` nodes constructed by the `nodeGenrFunc()` function.

Optic Actions

If you have access to the **Synapse** commercial UI **Optic** you may find it helpful to embed **Optic** actions within your **Storm Package**. These actions will be presented to users in the context-menu when they right-click on nodes within **Optic**.

To define **Optic** actions, you declare them in the **Storm Package** YAML file:

```
optic:
    actions:
      - name: Hello Omgopts
        storm: acme.hello.omgopts --debug
        descr: This description is displayed as the tooltip in the menu
        forms: [ inet:ipv4, inet:fqdn ]
```

By specifying the `forms:` key, you can control which node actions will be presented on different forms. For example, if you are writing a DNS power-up, you may want to limit the specified actions to `inet:ipv4`, `inet:ipv6`, and `inet:fqdn` nodes.

When selected, the query specified in the `storm:` key will be run with the currently selected nodes as input. For example, if you right-click on the node `inet:fqdn=vertex.link` and select `actions -> acme-hello -> Hello Omgopts` it will execute the specified query as though it were run like this:

```
inet:fqdn=vertex.link | acme.hello.omgopts --debug
```

Any printed output, including warnings, will be displayed in the **Optic** `Console Tool`.

7.2 Synapse Architecture

When viewed as a library, not just an application, Synapse is made of up a few core components and concepts.

7.2.1 Library Architecture

The Synapse library is broken out in a hierarchical fashion. The root of the library contains application level code, such as the implementations of the Cortex, Axon, Cryotank, as well as the Telepath client and server components. There are also a set of common helper functions (common.py) and exceptions (exc.py). There are several submodules available as well:

synapse.cmds
: Command implementations for the Cmdr CLI tool

synapse.data
: Data files stored in the library.

synapse.lib
: The lib module contains many of the primitives used by applications in order to implement them.

synapse.lookup
: The lookup module contains various lookup definitions.

synapse.models
: The models directory contains the core Synapse data model definitions.

synapse.servers
: The servers module contains servers use to start and run Synapse applications.

synapse.tests
: This is test code. It also contains a useful helper `synapse.tests.utils` which defines our base test class.

synapse.tools
: The tools module contains various tools used to interact with the Synapse ecosystem.

synapse.vendor
: This contains third-party code and associated LICENSE files. This is for internal library use only; no external API stability is guaranteed for any libraries under this module.

7.2.2 Object hierarchies

There is one base class that many objects inherit from, the `Base` (base.py) class. The `Base` class provides a few useful components (including, but not limited too):

- A way to do asynchronous object construction by override the `__anit__` method. This method is executed inside the python ioloop, allowing the object construction to do async function calls. An implementer still needs to call `await s_base.Base.__anit__(self)` first in order to ensure that the `Base` is setup properly.
- A way to register object teardown methods and perform object teardowns via the `onfini()` and `fini()`. These allow us to keep more granular control over how things are shut down and resources are released, versus relying solely on the garbage collector to handle teardowns properly. Often times, order matters, so we need to be sure that things are torn down cleanly. These routines can be registered during `__anit__`.
- `Base` objects are made via await the call to the `Base.anit()` function. If the `__anit__` function completed then the `anitted` attribute on the object will be True, otherwise it will be False.

- Context manager support. The `Base` object has native async context manager support, and upon exiting the context it will call `fini()` to do teardown. This pattern is convenient since it allows us to freely create `Base` classes without having to remember to always have to tear them down.
- The `Base` contains helpers for implementing an observable design pattern, where functions can be registered as event handlers, and events can be fired on the object at will. This can be very powerful for signaling across disparate components which would be otherwise too heavy to have explicit callbacks for.
- The `Base` contains helpers for executing asyncio coroutines on the ioloop. This is most commonly done via the `schedCoroTask` routine. This will schedule the coroutine to run on the ioloop, register the task with the `Base` and return the asyncio future. During `Base` fini, any coroutines still executing will be cancelled. This makes it very easy to schedule free-running coroutines from any `Base` class.

There are a few very important classes which use the `Base` object:

- The Synapse `Cell`. This is a batteries included primitive for running an application.
- The Telepath `Daemon`. This serves as a RPC server component.
- The Telepath `Proxy`. This serves as a RPC client component.

The `Cell` (cell.py) is a `Base` implementation which has several components available to it:

- It is a `Base`, so it benefits from all the components a `Base` has.
- It contains support for configuration directives at start time, so a cell can have well defined configuration options availble to it.
- It has persistent storage available via two different mechanisms, a LMDB slab for arbitrary data that is local to the cell, and a `Hive` for key-value data storage that can be remotely read and written.
- It handles user authentication and authorization via user data stored in the `Hive`.
- The `Cell` is Telepath aware, and will start his own `Daemon` that allows remote access. By default, the `Cell` has a PF Unix socket available for access, so local telepath access is trivial.
- Since the `Cell` is Telepath aware, there is a base `CellApi` that implements his RPC routines. `Cell` implementers can easily sublcass the `CellApi` class to add additional RPC routines.
- The `Cell` also contains hooks for easily starting a Tornado webserver. This allows us to trivially add web API routes to an object.
- The `Cell` contains a `Boss` which can be used to remotely enumerate and cancel managed coroutines.

Since the cell contains so much core management functionality, adding functionality to the Synapse `Cell` allows **all** applications using a Cell to be immediately extended to take advantage of that functionality without having to re-visit multiple different implementations to update them. For this reason, our core application components (the `Axon`, `Cortex`, and `CryoCell`) all implement the `Cell` class. For example, if we add a new user management capability, that is now available to all those applications, as well as any others `Cell` implementations.

The application level components themselves have servers in the `synapse.servers` module, but there is also a generic server for starting any cell, `synapse.servers.cell`. These servers will create the `Cell`, and also add any additional RPC or HTTP API listening servers as necessary. Those are the preferred ways to run an application implemented via a `Cell`.

7.2.3 Telepath RPC

The Telepath RPC protocol is a lightweight RPC protocol used in Synapse. The server component, the previously mentioned `Daemon`, is used to share objects. An object may or may not be Telepath aware. In the case that it is not aware, all of its methods are exposed via Telepath. Objects which are Telepath aware, such as the `Cell`, implement an API interface that allows much more fine grained control over the the methods which are remotely available.

The base Telepath client is the `Proxy` class, this is used to connect to the Daemon. The `Proxy` intercepts attribute lookups to make and set remote method helpers at runtime, and sends those requests to the Daemon to be serviced. A *very* brief example of this is the following:

```
import synapse.telepath as s_telepath

url = 'tcp://user:secret@1.2.3.4:27492/someObject'

async with await s_telepath.openurl(url) as proxy:

    # Make attribute called "someMethod" on the proxy
    # then send a task to the server called "someMethod"
    # with the argument of somearg=1234
    resp = proxy.someMethod(somearg=1234)
    # The resp is the result of calling the someMethod argument on
    # the object named someObject on the daemon.
    print(resp)
```

A few notes about Telepath:

- Telepath remote call arguments and server responses must be able to be serialized using the msgpack protocol.
- Telepath supports generator protocols; so a server API may be a synchronous or asynchronous generator. From the proxy perspective, these are both considered asynchronous generators.
- The Telepath `Proxy` contains some helpers that allow is to be used from non-async code. These helpers run their API calls through the currently running ioloop, and will cause the client to make an ioloop if one is not currently running.
- Remote calls that raise exceptions on the server will have that exception serialized and sent back to the `Proxy`. The `Proxy` will then raise an exception to the caller.
- Methods calls prefixed with a underscore (`_somePrivatMethod()` for example) will be rejected by the `Daemon`. This does allow us to protect private methods on shared objects.

7.3 Synapse Docker Builds

This doc details the docker builds and scripts used by Synapse.

7.3.1 Images

There are several images provided by the Synapse repository. These are built from an external image that is periodically updated with core Synapse dependencies.

The images provided include the following:

vertexproject/synapse
: This container just contains Synapse installed into it. It does not start any services.

vertexproject/synapse-aha
: This container starts the Aha service.

vertexproject/synapse-axon
: This container starts the Axon service.

vertexproject/synapse-cortex
: This container starts the Cortex service.

vertexproject/synapse-cryotank
: This container starts the Cryotank service.

vertexproject/synapse-jsonstor
: This container starts the JSONStor service.

vertexproject/synapse-stemcell
: This container launches the Synapse stemcell server.

7.3.2 Building All Images

Images are built using Bash scripts. All of the images can be built directly with a single command:

```
$ ./docker/build_all.sh <optional_image_tag>
```

If the image tag is not provided, it will tag the images with `:dev_build`.

7.3.3 Building a Specific Application Image

A specific application images can be built as well.

```
$ ./docker/build_image.sh <application> <optional_image_tag>

# Example of building a local Cortex image.

$ ./docker/build_image.sh cortex my_test_image
```

If the image tag is not provided, it will tag the image with `:dev_build`.

7.3.4 Building the `vertexproject/synapse` image

The bare image with only Synapse installed on it can be built like the following:

```
$ docker build --progress plain --pull -t vertexproject/synapse:$TAG -f docker/
↪images/synapse/Dockerfile .

# Example of building directly with the tag mytag

$ docker build --progress plain --pull -t vertexproject/synapse:mytag -f␣
↪docker/images/synapse/Dockerfile .
```

7.3.5 Working with Synapse Images

Developers working with Synapse images should consider the following items:

- The Synapse images are not locked to a specific Python version. The underlying Python minor version or base distribution may change. If they do change, that will be noted in the Synapse changelog. If you are building containers off of a floating tag such as `vertexproject/synapse:v2.x.x`, make sure you are reviewing our *Synapse Changelog* for items which may affect your use cases. Python patch level updates will not be included in the changelogs.
- The `synapse` package and its dependencies are installed in an isolated Docker-managed Python environment. While our container's `pip` retains PEP668 compatibility checks, enforcement is not triggered as a result. If you are installing your own Python packages to the distribution, you can do so without any special flags:

```
python -m pip install yourTargetPackage
```

7.3.6 Verifying container image signatures

Synapse docker images which are release tagged (e.g. `v2.1.3` or `v2.x.x`) are accompanied with cosign signatures which can be used to assert that the image was produced by The Vertex Project. Branch builds, such as development `master` tags are not guaranteed to be signed.

You can use the Python script `synapse.tools.docker.validate` to confirm that a given image has a `cosign` signature which was signed by a Vertex Project code signing certificate; and then confirm that the `cosign` signature was signed by the certificate. This does require having `cosign` version v2.x.x available.

The following shows an example of verifying a signed image, referenced by its registry content hash:

```
$ python -m synapse.tools.docker.validate vertexproject/
↪synapse@sha256:4ec5d97e1bbdb49971f5c1d520a81371021ef4c84f932d9ef23a635a099cb53b
Verifying: vertexproject/
↪synapse@sha256:4ec5d97e1bbdb49971f5c1d520a81371021ef4c84f932d9ef23a635a099cb53b
Using Cosign with GitVersion:    v2.1.0
Loading certdir from /your/python/site-lib/synapse/synapse/data/certs
Verified certificate embedded in the signature.
Cosign output:
[{'critical': {'identity': {'docker-reference': 'index.docker.io/vertexproject/synapse'},
               'image': {'docker-manifest-digest':
↪'sha256:4ec5d97e1bbdb49971f5c1d520a81371021ef4c84f932d9ef23a635a099cb53b'},
               'type': 'cosign container image signature'},
  'optional': {'Subject': '',
               'commit': '07ab34bbeb04cf0e96e7ba7b65c5a7d7baeda151',
               'jobid': '9b78fab5-d364-43b3-8fb0-3f0c82a795cd'}}]
Verified: vertexproject/
↪synapse@sha256:4ec5d97e1bbdb49971f5c1d520a81371021ef4c84f932d9ef23a635a099cb53b
```

Devops teams can use this tool as the basis to create or update an admissions controller that can ensure that only signed images are allowed to be used in their environments.

7.4 Advanced Power-Up Development

An Advanced Power-Up is standalone application that extends the capabilities of the Cortex by implementing a Storm Service (see *Service*). One common use case for creating an Advanced Power-Up is to add a Storm command that will run custom Python to parse a file, translate the results into the Synapse datamodel, and then ingest them into the hypergraph.

In order to leverage core functionalities it is recommended that Storm services are created as Cell implementations. For additional details see the advanced-power-example repository, which contains an example that can be used as a reference for building an Advanced Power-Up.

7.5 Storm API Guide

7.5.1 Storm APIs

Storm is available over Telepath and HTTP API interfaces. Both interfaces require a Storm query string, and may take additional `opts` arguments.

Telepath

There are three Storm APIs exposed via Telepath.

storm(text, opts=None)
The Storm API returns a message stream. It can be found here storm.

callStorm(text, opts=None)
The callStorm API returns a message given by the Storm `return( )` syntax. It can be found here callStorm.

count(text, opts=None)
The count API returns a count of the number of nodes which would have been emitted by running a given query. It can be found here *Cortex*.

HTTP API

The HTTP API versions of the Storm APIs can be found here Cortex HTTP API.

/v1/api/storm
This API returns a message stream.

/v1/api/storm/call
This API returns a message given by the Storm `return( )` syntax.

/v1/api/storm/export
This API returns a stream of msgpack encoded data, which can be used as a *.nodes* file for later import.

7.5.2 Message Types

The Telepath `storm()` and HTTP `api/v1/storm` APIs yield messages from the Storm runtime to the caller. These are the messages that may be seen when consuming the message stream.

Each message has the following basic structure:

```
[ "type", { ..type specific info... } ]
```

init

First message sent by a Storm query runtime.

It includes the following keys:

task
The task identifier (which can be used for task cancellation).

tick
The epoch time the query execution started (in milliseconds). This value is computed from the host time and may be affected by any changes in the host clock.

abstick
The relative time that the query execution started (in milliseconds). This value is computed from a monotonic clock and can be used as a reference time.

text
The Storm query text.

hash
The md5sum of the Storm query text.

Example:

```
('init',
 {'task': '8c90c67e37a30101a2f6a7dfb2fa0805',
  'text': '.created | limit 3',
  'hash': '2d16e12e80be53e0e79e7c7af9bda12b',
  'tick': 1539221678859})
```

node

This represents a packed node. Each serialized node will have the following structure:

```
[
    [<form>, <valu>],       # The [ typename, typevalue ] definition of the node.
    {
        "iden": <hash>,     # A stable identifier for the node.
        "tags": {},         # The tags on the node.
        "props": {},        # The node's secondary properties.
        "path": {},         # Path related information in the node.
        "tagprops": {},     # The node's tag properties.

        # optional
        "repr": ...         # Presentation values for the type value.
        "reprs": {}         # Presentation values for props which need it.
        "tagpropreprs": {}  # Presentation values for tagprops which need it.

    }
]
```

Example:

This example is very simple - it does not include repr information, or things related to path data:

```
('node',
 (('inet:fqdn', 'icon.torrentart.com'),
  {'iden': 'ae6d871163980f82dc1d3b06e784a80e8085493f68fbf2813c9681cb3e2630a8',
   'props': {'.created': 1526590932444,
             '.seen': (1491771661000, 1538477660797),
             'domain': 'torrentart.com',
             'host': 'icon',
             'issuffix': 0,
             'iszone': 0,
             'zone': 'torrentart.com'},
   'tags': {'aka': (None, None),
            'aka.beep': (None, None),}}))
```

For path and repr information, see the examples in the opts documentation *Storm Opts*.

ping

A keepalive message. This is sent periodically when the `keepalive` options is set. See *Storm Opts* for more information.

print

The print event contains a message intended to be displayed to the caller.

It includes the following key:

mesg
: The message to be displayed to the user.

Example:

```
(print, {'mesg': 'I am a message!'})
```

This can be produced by users with the `$lib.print()` Storm API.

warn

The warn event contains data about issues encountered when performing an action.

It includes the following keys:

mesg
: The message to be displayed to the user.

The warn event may contain additional, arbitrary keys in it.

Example:

```
('warn',
 {'mesg': 'Unable to foo the bar.com domain',
  'domain': 'bar.com'})
```

This can be produced by users with the `$lib.warn()` Storm API.

err

The err event is sent if there is a fatal error encountered when executing a Storm query. There will be no further processing; only a `fini` message sent afterwards.

The err event does contain a marshalled exception in it. This contains the exception type as the identifier; and several attributes from the exception.

The following keys are usually present in the marshalled information:

esrc
: Source line that raised the exception.

efile
: File that the exception was raised from.

eline
: Line number from the raising file.

ename
: Name of the function where the exception was from.

mesg
: The `mesg` argument to a SynErr exception, if present; or the `str()` exception.

Additional keys may also be present, depending on the exception that was raised.

Example:

```
('err',
 ('BadTypeValu',
  {'efile': 'inet.py',
   'eline': 294,
   'form': 'inet:fqdn',
   'mesg': 'FQDN failed to match fqdnre [^[\\w._-]+$]',
   'name': 'inet:fqdn',
   'valu': '1234@#'}))
```

fini

The last message sent by a Storm query runtime. This can be used as a key to stop processing messages or finalize any sort of rollup of messages.

It includes the following keys:

tock
: The epoch time the query execution finished (in milliseconds). This value is computed from adding the `took` value to the `tick` value from the `init` message.

took
: The amount of time it took for the query to execute (in milliseconds). This value is computed from the `abstick` and `abstock` values.

abstock
: The relative time that the query execution finished at (in milliseconds). This value is computed from a monotonic clock and should always be equal to or greater than the `abstick` value from the `init` message.

count
: The number of nodes yielded by the runtime.

Example:

```
('fini', {'count': 1, 'tock': 1539221715240, 'took': 36381})
```

> **Note**
>
> If the Storm runtime is cancelled for some reason, there will be no `err` or `fini` messages sent. This is because the task cancellation may tear down the channel and we would have an async task blocking on attempting to send data to a closed channel.

node:edits

The `node:edits` message represents changes that are occurring to the underlying graph, as a result of running a Storm query.

It includes the following key:

edits
: A list of changes made to a set of nodes.

Example:

```
# Nodeedits produced by the following query: [(inet:ipv4=1.2.3.4 :asn=1)]

('node:edits',
```

(continues on next page)

(continued from previous page)

```
 {'edits': (('20153b758f9d5eaaa38e4f4a65c36da797c3e59e549620fa7c4895e1a920991f',
             'inet:ipv4',
             ((0, (16909060, 4), ()),
              (2, ('.created', 1662578208195, None, 21), ()),
              (2, ('type', 'unicast', None, 1), ()))),)})
('node:edits',
 {'edits': (('20153b758f9d5eaaa38e4f4a65c36da797c3e59e549620fa7c4895e1a920991f',
             'inet:ipv4',
             ((2, ('asn', 1, None, 9), ()),)),
            ('371bfbcd479fec0582d55e8cf1011c91c97f306cf66ceea994ac9c37e475a537',
             'inet:asn',
             ((0, (1, 9), ()),
              (2, ('.created', 1662578208196, None, 21), ())))})
```

node:edits:count

The `node:edits:count` message represents a summary of changes that are occurring to the underlying graph, as a result of running a Storm query. These are produced when the query `opts` set `editformat` to `count`.

It includes the following key:

count
: The number of changes made to the graph as a result of a single `node:edits` event.

Example:

```
# counts produced by the following query: [(inet:ipv4=1.2.3.4 :asn=1)]

('node:edits:count', {'count': 3})
('node:edits:count', {'count': 3})
```

storm:fire

The `storm:fire` message is a arbitrary user created message produced by the `$lib.fire()` Storm API. It includes the following keys:

type
: The type of the event.

data
: User provided data.

Example:

```
# The following query produces an event
$l = ((1), (2), (3)) $lib.fire('demo', key=valu, somelist=$l)

# The event produced.
('storm:fire', {'data': {'key': 'valu', 'somelist': (1, 2, 3)}, 'type': 'demo'})
```

look:miss

The `look:miss` message is sent when the Storm runtime is set to `lookup` mode and the node that was identified by the scrape logic is not present in the current View.

It includes the following key:

ndef
A tuple of the form and normalized value.

Example:

```
('look:miss', {'ndef': ('inet:fqdn', 'hehe.com')})

# The ipv4 value is presented in system mode.
('look:miss', {'ndef': ('inet:ipv4', 16909060)})
```

csv:row

The `csv:row` message is sent by the Storm runtime by the `$lib.csv.emit()` Storm API.

It includes the following keys:

row
A list of elements that make up the row.

table
A optional table name. This may be `None`.

Example:

```
# This query produces the following event: $lib.csv.emit(foo, bar, $lib.time.now())
('csv:row', {'row': ('foo', 'bar', 1662578057658), 'table': None})

# This query produces the following event: $lib.csv.emit(foo, bar, $lib.time.now(),␣
↪table=foo)
('csv:row', {'row': ('foo', 'bar', 1662578059282), 'table': 'foo'})
```

7.5.3 Storm Call APIs

The Telepath `callStorm()` and HTTP API `storm/call` interfaces are designed to return a single message to the caller, as opposed to a stream of messages. This is done using the Storm `return( )` syntax. Common uses for the call interfaces include getting and setting values where the full message stream would not be useful.

Example:

The following example shows retrieving a user definition.

```
# Prox is assumed to be a Telepath proxy to a Cortex.
>>> text = '$user = $lib.auth.users.byname($name) return ( $user )'
>>> opts = {'vars': {'name': 'root'}}
>>> ret = prox.callStorm(text, opts=opts)
>>> pprint(ret)
{'admin': True,
 'archived': False,
 'authgates': {'0b942d5f4309d70e5fa64423714e25aa': {'admin': True},
               'cdf6f1727da73dbac95e295e5d258847': {'admin': True}},
 'email': None,
 'iden': '933a320b7ce8134ba5abd93aa487e1b5',
 'locked': False,
 'name': 'root',
 'roles': (),
 'rules': (),
 'type': 'user'}
```

The following shows setting an API key for a Power-Up. There is no `return` statement, so the return value defaults to None.

```
# Prox is assumed to be a Telepath proxy to a Cortex.
>>> text = 'foobar.setup.apikey $apikey'
>>> opts = {'vars': {'apikey': 'secretKey'}}
>>> ret = prox.callStorm(text, opts=opts)
>>> print(ret)
None
```

7.5.4 Storm Opts

All Storm API endpoints take an `opts` argument. This is a dictionary that contains metadata that is used by the Storm runtime for various purposes. Examples are given using Python syntax.

debug

If this is set to True, the Storm runtime will be created with `$lib.debug` set to True.

Example:

```
opts = {'debug': True}
```

editformat

This is a string containing the format that node edits are streamed in. This may be `nodeedits` (the default value), `none`, or `count`. If the value is `none`, then no edit messages will be streamed. If the value is `count`, each `node:edits` message is replaced by a `node:edits:count` message, containing a summary of the number of edits made for a given message.

Examples:

```
# Turn node:edit messages into counts
opts = {'editformat': 'count'}

# Disable node edits
opts = {'editformat': 'none'}
```

idens

This is a list of node iden hashes to use as initial input to the Storm runtime. These nodes are lifted after any `ndefs` options are lifted, but prior to regular lift operations which may start a Storm query.

Example:

```
idens = ('ee6b92c9fd848a2cb00f3a3618148c512b58456b8b51fbed79251811597eeea3',
         'c5a67a095b71771d9663d691f0ab36b53ebdc14fbad18f23f95e923543156bd6',)
opts = {'idens': idens}
```

keepalive

This is the period (in seconds) in which to send a `ping` message from a Storm query which is streamiing results, such as the Telepath `.storm()` API or the HTTP `/v1/api/storm` API endpoint. This may be used with long-running Storm queries when behind a network proxy or load balancer which may terminate idle connections.

The keepalive value must be greater than zero.

Example:

```
keepalive = 2  # Send a keepalive message every 2 seconds
opts = {'keepalive': keepalive}
```

limit

Limit the total number of nodes that the Storm runtime produces. When this number is reached, the runtime will be stopped.

Example:

```
opts = {'limit': 100}
```

mode

This is the mode that a Storm query is parsed in. This value can be specified to `lookup`, `autoadd`, and `search` modes to get different behaviors.

Example:

```
# Using lookup mode, the query text, before switching to command mode with a |␣
↪character,
# will have its text scrapped for simple values such as FQDNs, IP Addresses,␣
↪and Hashes
# and attempt to lift any matching nodes.
opts = {'mode': 'lookup'}

# Using autoadds mode, the query text is scrapped like in lookup mode; and for␣
↪any
# values which we try to lift that do not produce nodes, those nodes will be␣
↪added
# in the current view.
opts = {'mode': 'autoadd'}

# Using search mode, the query will be run through the Storm search interface.
# This will lift nodes based on searching, which is enabled by the
# Synapse-Search Advanced Power-up.
opts = {'mode': 'search'}
```

ndefs

This is a list of form and value tuples to use as initial input to the Storm runtime. These are expected to be the already normalized, system mode, values for the nodes. These nodes are lifted before any other lift operators are run.

Example:

```
ndefs = (
    ('inet:fqdn', 'com'),
    ('inet:ipv4', 134744072),
)

opts = {'ndefs': ndefs}
```

nexsoffs

Wait for the Cortex to reach the specified Nexus offset before executing the query. This is intended for internal use when offloading queries to a mirror.

Example:

```
opts = {'nexsoffs': 7759195}
```

nexstimeout

Timeout (in seconds) to wait for the Cortex to reach the Nexus offset specified by `nexsoffs`. This is intended for internal use when offloading queries to a mirror.

Example:

```
opts = {'nexstimeout': 5}
```

mirror

If Storm query offloading is configured and `mirror` is `true` (the default value), the Cortex will attempt to offload the query to a mirror. Setting this to `false` will force the query to be run on the local Cortex rather than a mirror.

Example:

```
opts = {'mirror': False}
```

path

If this is set to True, the `path` key in the packed nodes will contain a `nodes` key, which contains a list of the node iden hashes that were used in pivot operations to get to the node.

Example:

```
opts = {'path': True}

# A Storm node message with a node path added to it, from the query inet:ipv4 ->␣
↪inet:asn.

('node',
 (('inet:asn', 1),
  {'iden': '371bfbcd479fec0582d55e8cf1011c91c97f306cf66ceea994ac9c37e475a537',
   'nodedata': {},
   'path': {'nodes': ('20153b758f9d5eaaa38e4f4a65c36da797c3e59e549620fa7c4895e1a920991f',
                      '371bfbcd479fec0582d55e8cf1011c91c97f306cf66ceea994ac9c37e475a537
↪')},
   'props': {'.created': 1662493825668},
   'tagprops': {},
   'tags': {}}))
```

readonly

Run the Storm query in a readonly mode. This prevents editing the graph data, and only allows a small subset of whitelisted Storm library functions to be used.

Examples:

```
opts = {'readonly': True}
```

repr

If this is set to True, the packed node will have a `repr` and `reprs` key populated, to contain human friendly representations of system mode values.

Example:

```
opts = {'repr': True}

# A Storm node message with reprs added to it.

('node',
 (('inet:ipv4', 134744072),
  {'iden': 'ee6b92c9fd848a2cb00f3a3618148c512b58456b8b51fbed79251811597eeea3',
   'nodedata': {},
   'path': {},
   'props': {'.created': 1662491423034, 'type': 'unicast'},
   'repr': '8.8.8.8',
   'reprs': {'.created': '2022/09/06 19:10:23.034'},
   'tagpropreprs': {},
   'tagprops': {},
   'tags': {}}))
```

scrub

This is a set of rules that can be provided to the Storm runtime which dictate which data should be included or excluded from nodes that are returned in the message stream. Currently the only rule type supported is `include` for `tags`.

Example:

```
# Only include tags which start with cno and rep.foo
scrub = {'include': {'tags': ['cno', 'rep.foo',]}}
opts = {'scrub': scrub}

# Do not include any tags in the output
scrub = {'include': {'tags': []}}
opts = {'scrub': scrub}
```

show

A list of message types to include in the output message stream. The `init`, `fini`, and `err` message types cannot be filtered with this option.

Example:

```
# Only node and warning messages.
opts = {'show': ['node', 'warning']}

# Only include required messages.
opts = {'show': []}
```

show:storage

A boolean option which, when set to `true`, instructs the Storm runtime to add a `storage` key to each yielded node which contains a raw breakdown of storage nodes which can be used to determine which parts of the node are stored in which layer within the view.

Example:

```
opts = {'show:storage': True}
```

task

A user provided guid that is used as the task identifier for the Storm runtime. This allows a user to have a predictable identifier that they can use for task cancellation.

The Storm runtime will raise a `BadArg` value if the `task` iden is associated with a currently running task.

Example:

```
# Generate a guid on the client side and provide it to the Cortex
import synapse.common as s_commmon
task_iden = s_common.guid()
opts = {'task': task_iden}
```

user

The User iden to run the Storm query as. This allows a user with the permission `impersonate` to run a Storm query as another user.

Example:

```
opts = {'user': 6e9c8de2f1aa39fee11c19d0974e0917}
```

vars

A dictionary of key - value pairs that are mapped into the Storm runtime as variables. Some uses of this include providing data to the runtime that is used with an ingest script, or to provide secrets to the Storm runtime so that they will not be logged.

Example:

```
# A secret key - A good example of this is configuring a Rapid Power-Up.
vars = {'secretkey': 'c8de2fe11c19d0974e091aa39fe176e9'}
opts = {'vars': vars}

# Some example data that could be used in a Storm ingest script.
records = (
    ('foobar.com', '8.8.8.8', '20210810'),
    ('bazplace.net', '1.2.3.4', '20210810'),
)
vars = {'records': records}
opts = {'vars': vars}
```

view

The View iden in which to run the Storm query in. If not specified, the query will run in the user's default view.

Example:

```
opts = {'view': 31ded629eea3c7221be0a61695862952}
```

CHAPTER

EIGHT

SYNAPSE GLOSSARY

This Glossary provides a quick reference for common terms related to Synapse technical and analytical concepts.

8.1 A

8.1.1 Addition, Automatic

See *Autoadd*.

8.1.2 Addition, Dependent

See *Depadd*.

8.1.3 Advanced Power-Up

See *Power-Up, Advanced*.

8.1.4 Admin Tool

See *Tool, Admin*.

8.1.5 Analytical Model

See *Model, Analytical*.

8.1.6 Auth Gate

An auth gate (short for "authorization gate", informally a "gate") is an object within a *Service* that may have its own set of permissions.

Both a *Layer* and a *View* are common examples of auth gates.

8.1.7 Autoadd

Short for "automatic addition". Within Synapse, a feature of node creation where any secondary properties that are derived from a node's primary property are automatically set when the node is created. Because these secondary properties are based on the node's primary property (which cannot be changed once set), the secondary properties are read-only.

For example, creating the node `inet:email=alice@mail.somecompany.org` will result in the autoadd of the secondary properties `inet:email:user=alice` and `inet:email:domain=mail.somecompany.org`.

See also the related concept *Depadd*.

8.1.8 Axon

The Axon is a *Synapse Service* that provides binary / blob ("file") storage within the Synapse ecosystem. An Axon indexes binaries based on their SHA-256 hash for deduplication. The default Axon implemenation stores the blobs in an LMDB *Slab*.

8.2 B

8.2.1 Base Tag

See *Tag, Base*.

8.2.2 Binary Unique Identifier

See *BUID*.

8.2.3 BUID

Short for Binary Unique Identifier. Within Synapse, a BUID is the globally unique (within a *Cortex*) SHA-256 digest of a node's msgpack-encoded *Ndef*.

8.3 C

8.3.1 Callable Function

See *Function, Callable*.

8.3.2 Cell

The Cell is a basic building block of a *Synapse Service*, including the *Cortex*. See *Synapse Architecture* for additional detail.

8.3.3 Column, Embed

In *Optic*, a column in Tabular display mode that displays a **property value from an adjacent or nearby node**.

8.3.4 Column, Path Variable

In *Optic*, a column in Tabular display mode that displays **arbitrary data in a column** by defining the data as a *Variable* (a path variable or "path var") within a Storm query.

8.3.5 Column, Property

In *Optic*, a column in Tabular display mode that displays a **property value** from the specified form.

8.3.6 Column, Tag

In *Optic*, a column in Tabular display mode that displays the **timestamps** associated with the specified tag. (Technically, Optic displays two columns - one for each of the min / max timestamps, if present).

8.3.7 Column, Tag Glob

In *Optic*, a column in Tabular display mode that displays any **tags** that match the specified tag or tag glob pattern.

8.3.8 Comparator

Short for *Comparison Operator*.

8.3.9 Comparison Operator

A symbol or set of symbols used in the Storm language to evaluate *Node* property values against one or more specified values. Comparison operators can be grouped into standard and extended operators.

8.3.10 Comparison Operator, Standard

The set of common operator symbols used to evaluate (compare) values in Storm. Standard comparison operators include equal to (=), greater than (>), less than (<), greater than or equal to (>=), and less than or equal to (<=).

8.3.11 Comparison Operator, Extended

The set of Storm-specific operator symbols or expressions used to evaluate (compare) values in Storm based on custom or Storm-specific criteria. Extended comparison operators include regular expression (~=), time/interval (@=), set membership (`*in=`), tag (#), and so on.

8.3.12 Composite Form

See *Form, Composite*.

8.3.13 Console Tool

See *Tool, Console*.

8.3.14 Constant

In Storm, a constant is a value that cannot be altered during normal execution, i.e., the value is constant.

Contrast with *Variable*. See also *Runtsafe* and *Non-Runtsafe*.

8.3.15 Constructor

Within Synapse, a constructor is code that defines how a *Property* value of a given *Type* can be constructed to ensure that the value is well-formed for its type. Also known as a *Ctor* for short. Constructors support *Type Normalization* and *Type Enforcement*.

8.3.16 Cortex

A Cortex is a *Synapse Service* that implements Synapse's primary data store (as an individual *Hypergraph*). Cortex features include scalability, key/value-based node properties, and a *Data Model* which facilitates normalization.

8.3.17 Cron

Within Synapse, cron jobs are used to create scheduled tasks, similar to the Linux/Unix "cron" utility. The task to be executed by the cron job is specified using the *Storm* query language.

See the Storm command reference for the *cron* command and the *Storm Reference - Automation* document for additional detail.

8.3.18 Ctor

Pronounced "see-tore". Short for *Constructor*.

8.4 D

8.4.1 Daemon

Similar to a traditional Linux or Unix daemon, a Synapse daemon ("dmon") is a long-running or recurring query or process that runs continuously in the background. A dmon is typically implemented by a Storm *Service* and may be used for tasks such as processing elements from a *Queue*. A dmon allows for non-blocking background processing of non-critical tasks. Dmons are persistent and will restart if they exit.

8.4.2 Data Emitter Function

See *Function, Data Emitter*.

8.4.3 Data Model

See *Model, Data*.

8.4.4 Data Model Explorer

In *Optic*, the Data Model Explorer (found in the *Help Tool*) documents and cross-references the current forms and lightweight edges in the Synapse *Data Model*.

8.4.5 Deconflictable

Within Synapse, a term typically used with respect to *Node* creation. A node is deconflictable if, upon node creation, Synapse can determine whether the node already exists within a Cortex (i.e., the node creation attempt is deconflicted against existing nodes). For example, on attempting to create the node `inet:fqdn=woot.com` Synapse can deconflict the node by checking whether a node of the same form with the same primary property already exists.

Most primary properties are sufficiently unique to be readily deconflictable. GUID forms (see *Form, GUID*) require additional considerations for deconfliction. See the *guid* section of the *Storm Reference - Type-Specific Storm Behavior* document for additional detail.

8.4.6 Depadd

Short for "dependent addition". Within Synapse, when a node's secondary property is set, if that secondary property is of a type that is also a form, Synapse will automatically create the node with the corresponding primary property value if it does not already exist. (You can look at this as the secondary property value being "dependent on" the existence of the node with the corresponding primary property value.)

For example, creating the node `inet:email=alice@mail.somecompany.org` will set (via *Autoadd*) the secondary property `inet:email:domain=mail.somecompany.org`. Synapse will automatically create the node `inet:fqdn=mail.somecompany.org` as a dependent addition if it does not exist.

(Note that limited recursion will occur between dependent additions (depadds) and automatic additions (autoadds). When `inet:fqdn=mail.somecompany.org` is created via depadd, Synapse will set (via autoadd) `inet:fqdn:domain=somecompany.org`, which will result in the creation (via depadd) of the node `inet:fqdn=somecompany.org` if it does not exist, etc.)

See also the related concept *Autoadd*.

8.4.7 Derived Property

See *Property, Derived*.

8.4.8 Directed Edge

See *Edge, Directed*.

8.4.9 Directed Graph

See *Graph, Directed*.

8.4.10 Display Mode

In *Optic*, a means of visualizing data using the *Research Tool*. Optic supports the following display modes:

- **Tabular mode,** which displays data and tags in tables (rows of results with configurable columns).
- **Force Graph mode,** which projects data into a directed graph-like view of nodes and their interconnections.
- **Statistics (stats) mode,** which automatically summarizes data using histogram (bar) and sunburst charts.
- **Geospatial mode,** which can be used to plot geolocation data on a map projection.
- **Tree Graph mode,** which displays nodes as a series of vertical "cards" and their property-based links to other nodes.
- **Timeline mode,** which displays nodes with a time property in time sequence order.

8.4.11 Dmon

Short for *Daemon*.

8.5 E

8.5.1 Easy Permissions

In Synapse, easy permissions ("easy perms" for short) are a simplified means to grant common sets of permissions for a particular object to users or roles. Easy perms specify four levels of access, each with a corresponding integer value:

- Deny = 0
- Read = 1
- Edit = 2
- Admin = 3

As an example, the *$lib.macro.grant(name, scope, iden, level)* Storm library can be used to assign easy perms to a *Macro*. Contrast with *Permission*.

8.5.2 Edge

In a traditional *Graph*, an edge is used to connect exactly two nodes (vertexes). Compare with *Hyperedge*.

8.5.3 Edge, Directed

In a *Directed Graph*, a directed edge is used to connect exactly two nodes (vertexes) in a one-way (directional) relationship. Compare with *Hyperedge*.

8.5.4 Edge, Lightweight (Light)

In Synapse, a lightweight (light) edge is a mechanism that links two arbitrary forms via a user-defined verb that describes the linking relationship. Light edges are not forms and so do not support secondary properties or tags. They are meant to simplify performance, representation of data, and Synapse hypergraph navigation for many use cases. Contrast with *Form, Edge*.

8.5.5 Embed Column

See *Column, Embed*.

8.5.6 Entity Resolution

Entity resolution is the process of determining whether different records or sets of data refer to the same real-world entity.

A number of data model elements in Synapse are designed to support entity resolution. For example:

- A `ps:contact` node can capture "a set of observed contact data" for a person (`ps:person`) or organization (`ou:org`). You can link sets of contact data that you assess represent "the same" entity via their `ps:contact:person` or `ps:contact:org` properties.
- A `risk:threat` node can capture "a set of reported data about a threat". If you assess that multiple sources are reporting on "the same" threat, you can link them to an authoritative threat organization via their `risk:threat:org` property.
- An `ou:industryname` node can capture a term used to refer to a commercial industry. You can link variations of a name (e.g., "finance", "financial", "financial services", "banking and finance") to a single `ou:industry` via the `ou:industry:name` and `ou:industry:names` properties.

8.5.7 Extended Comparison Operator

See *Comparison Operator, Extended*.

8.5.8 Extended Form

See *Form, Extended*.

8.5.9 Extended Property

See *Property, Extended*.

8.6 F

8.6.1 Feed

A feed is an ingest API consisting of a set of ingest formats (e.g., file formats, record formats) used to parse records directly into nodes. Feeds are typically used for bulk node creation, such as ingesting data from an external source or system.

8.6.2 Filter

Within Synapse, one of the primary methods for interacting with data in a *Cortex*. A filter operation downselects a subset of nodes from a set of results. Compare with *Lift*, *Pivot*, and *Traverse*.

See *Storm Reference - Filtering* for additional detail.

8.6.3 Filter, Subquery

Within Synapse, a subquery filter is a filter that consists of a *Storm* expression.

See *Subquery Filters* for additional detail.

8.6.4 Fork

Within Synapse, **fork** may refer to the process of forking a *View*, or to the forked view itself.

When you fork a view, you create a new, empty, writable *Layer* on top of the fork's original view. The writable layer from the original view becomes read-only with respect to the fork. Any changes made within a forked view are made within the new writable layer. These changes can optionally be merged back into the original view (in whole or in part), or discarded. (Note that any view-specific automation, such as triggers, dmons, or cron jobs, are **not** copied to the forked view. However, depending on the automation, it may be activated if / when data is merged down into the original view.

8.6.5 Form

A form is the definition of an object in the Synapse data model. A form acts as a "template" that specifies how to create an object (*Node*) within a Cortex. A form consists of (at minimum) a *Primary Property* and its associated *Type*. Depending on the form, it may also have various secondary properties with associated types.

See the *Form* section in the *Data Model Objects* document for additional detail.

8.6.6 Form, Composite

A category of form whose primary property is an ordered set of two or more comma-separated typed values. Examples include DNS A records (`inet:dns:a`) and web-based accounts (`inet:web:acct`).

See also *Form, Edge*.

8.6.7 Form, Edge

A specialized **composite form** (*Form, Composite*) whose primary property consists of two *Ndef* values. Edge forms can be used to link two arbitrary forms via a generic relationship where additional information needs to be captured about that relationship (i.e., via secondary properties and/or tags). Contrast with *Edge, Lightweight (Light)*.

8.6.8 Form, Extended

A custom form added outside of the base Synapse *Data Model* to represent specialized data. Extended forms can be added with the *$lib.model.ext* libraries. **Note** that whenever possible, it is preferable to expand the base Synapse data model to account for novel use cases instead of creating specialized extended forms.

8.6.9 Form, GUID

In the Synpase *Data Model*, a specialized case of a *Simple Form* whose primary property is a *GUID*. The GUID can be either arbitrary or constructed from a specified set of values. GUID forms have additional considerations as to whether or not they are *Deconflictable* in Synapse. Examples of GUID forms include file execution data (e.g., `inet:file:exec:read`) or articles (`media:news`).

8.6.10 Form, Simple

In the Synapse *Data Model*, a category of form whose primary property is a single typed value. Examples include domains (`inet:fqdn`) or hashes (e.g., `hash:md5`).

8.6.11 Function, Callable

In Storm, a callable function is a "regular" function that is invoked (called) and returns exactly one value. A callable function must include a `return()` statement and must not include the `emit` keyword.

8.6.12 Function, Data Emitter

In Storm, a data emitter function emits data. The function returns a generator object that can be iterated over. A data emitter function must include the `emit` keyword and must not include a `return()` statement.

8.6.13 Function, Node Yielder

In Storm, a node yielder function yields nodes. The function returns a generator object that can be iterated over. A node yielder function must not include either the `emit` keyword or a `return()` statement.

8.6.14 Fused Knowledge

See *Knowledge, Fused*.

8.7 G

8.7.1 Gate

See *Auth Gate*.

8.7.2 Global Default Workspace

See *Workspace, Global Default*.

8.7.3 Globally Unique Identifier

See *GUID*.

8.7.4 Graph

A graph is a mathematical structure used to model pairwise relations between objects. Graphs consist of vertices (or nodes) that represent objects and edges that connect exactly two vertices in some type of relationship. Nodes and edges in a graph are typically represented by dots or circles connected by lines.

See *Graphs and Hypergraphs* for additional detail on graphs and hypergraphs.

8.7.5 Graph, Directed

A directed graph is a *Graph* where the edges representing relationships between nodes have a "direction". Given node X and node Y connected by edge E, the relationship is valid for X -> E -> Y but not Y -> E -> X. For example, the relationship "Fred owns bank account #01234567" is valid, but "bank account #01234567 owns Fred" is not. Nodes and edges in a directed graph are typically represented by dots or circles connected by arrows.

See *Graphs and Hypergraphs* for additional detail on graphs and hypergraphs.

8.7.6 GUID

Short for Globally Unique Identifier. Within Synapse, a GUID is a *Type* specified as a 128-bit value that is unique within a given *Cortex*. GUIDs are used as primary properties for forms that cannot be uniquely represented by a specific value or set of values.

8.7.7 GUID Form

See *Form, GUID*.

8.8 H

8.8.1 Help Tool

See *Tool, Help*.

8.8.2 Hive

The Hive is a key/value storage mechanism which is used to persist various data structures required for operating a Synapse *Cell*.

8.8.3 Hyperedge

A hyperedge is an edge within a *Hypergraph* that can join any number of nodes (vs. a *Graph* or *Directed Graph* where an edge joins exactly two nodes). A hyperedge joining an arbitrary number of nodes can be difficult to visualize in flat, two-dimensional space; for this reason hyperedges are often represented as a line or "boundary" encircling a set of nodes, thus "joining" those nodes into a related group.

See *Graphs and Hypergraphs* for additional detail on graphs and hypergraphs.

8.8.4 Hypergraph

A hypergraph is a generalization of a *Graph* in which an edge can join any number of nodes. If a *Directed Graph* where edges join exactly two nodes is two-dimensional, then a hypergraph where a *Hyperedge* can join any number (n-number) of nodes is n-dimensional.

See *Graphs and Hypergraphs* for additional detail on graphs and hypergraphs.

8.9 I

8.9.1 Iden

Short for *Identifier*. Within Synapse, the hexadecimal representation of a unique identifier (e.g., for a node, a task, a trigger, etc.) The term "identifier" / "iden" is used regardless of how the specific identifier is generated.

8.9.2 Identifier

See *Iden*.

8.9.3 Ingest Tool

See *Tool, Ingest*.

8.9.4 Interface

In Synapse, an interface is a data model element that defines a set of secondary properties that are common to a set of related forms. Forms that should have these secondary properties can be defined so as to "inherit" the interface and its properties, as opposed to explicitly declaring each property on each form.

See the *Interface* section of the the *Data Model Objects* document for additional detail.

8.9.5 Instance Knowledge

See *Knowledge, Instance*.

8.10 K

8.10.1 Knowledge, Fused

If a form within the Synapse data model has a "range" of time elements (i.e., an interval such as "first seen"/"last seen"), the form typically represents **fused knowledge** – a period of time during which an object, relationship, or event was known to exist. Forms representing fused knowledge can be thought of as combining *n* number of instance knowledge observations. `inet:dns:query`, `inet:dns:a`, and `inet:whois:email` forms are examples of fused knowledge.

See *Instance Knowledge vs. Fused Knowledge* for a more detailed discussion.

8.10.2 Knowledge, Instance

If a form within the Synapse data model has a specific time element (i.e., a single date/time value), the form typically represents **instance knowledge** – a single instance or occurrence of an object, relationship, or event. `inet:dns:request` and `inet:whois:rec` forms are examples of instance knowledge.

See *Instance Knowledge vs. Fused Knowledge* for a more detailed discussion.

8.11 L

8.11.1 Layer

Within Synapse, a layer is the substrate that contains node data and where permissions enforcement occurs. Viewed another way, a layer is a storage and write permission boundary.

By default, a *Cortex* has a single layer and a single *View*, meaning that by default all nodes are stored in one layer and all changes are written to that layer. However, multiple layers can be created for various purposes such as:

- separating data from different data sources (e.g., a read-only layer consisting of third-party data and associated tags can be created underneath a "working" layer, so that the third-party data is visible but cannot be modified);
- providing users with a personal "scratch space" where they can make changes in their layer without affecting the underlying main Cortex layer; or
- segregating data sets that should be visible/accessible to some users but not others.

Layers are closely related to views (see *View*). The order in which layers are instantiated within a view matters; in a multi-layer view, typically only the topmost layer is writeable by that view's users, with subsequent (lower) layers read-only. Explicit actions can push upper-layer writes downward (merge) into lower layers.

8.11.2 Leaf Tag

See *Tag, Leaf*.

8.11.3 Lift

Within Synapse, one of the primary methods for interacting with data in a *Cortex*. A lift is a read operation that selects a set of nodes from the Cortex. Compare with *Pivot*, *Filter*, and *Traverse*.

See *Storm Reference - Lifting* for additional detail.

8.11.4 Lightweight (Light) Edge

See *Edge, Lightweight (Light)*.

8.12 M

8.12.1 Macro

A macro is a stored Storm query. Macros support the full range of Storm syntax and features.

See the Storm command reference for the *macro* command and the *Storm Reference - Automation* for additional detail.

8.12.2 Merge

Within Synapse, merge refers to the process of copying changes made within a forked (see *Fork*) *View* into the original view.

8.12.3 Model

Within Synapse, a system or systems used to represent data and/or assertions in a structured manner. A well-designed model allows efficient and meaningful exploration of the data to identify both known and potentially arbitrary or discoverable relationships.

8.12.4 Model, Analytical

Within Synapse, the set of tags (*Tag*) representing analytical assessments or assertions that can be applied to objects in a *Cortex*.

8.12.5 Model, Data

Within Synapse, the set of forms (*Form*) that define the objects that can be represented in a *Cortex*.

8.13 N

8.13.1 Ndef

Pronounced "en-deff". Short for **node definition.** A node's *Form* and associated value (i.e., <*form*> = <*valu*>) represented as comma-separated elements enclosed in parentheses: `(<form>,<valu>)`.

8.13.2 Node

A node is a unique object within a *Cortex*. Where a *Form* is a template that defines the charateristics of a given object, a node is a specific instance of that type of object. For example, `inet:fqdn` is a form; `inet:fqdn=woot.com` is a node.

See *Node* in the *Data Model Objects* document for additional detail.

8.13.3 Node Action

In *Optic*, a saved, named Storm query or command (action) that can be executed via a right-click context menu option for specified forms (nodes).

8.13.4 Node Data

Node data is a named set of structured metadata that may optionally be stored on a node in Synapse. Node data may be used for a variety of purposes. For example, a *Power-Up* may use node data to cache results returned by a third-party API along with the timestamp when the data was retrieved. If the same API is queried again for the same node within a specific time period, the Power-Up can use the cached node data instead of re-querying the API (helping to prevent using up any API query limits by re-querying the same data).

Node data can be accessed using the node:data type.

8.13.5 Node Definition

See *Ndef*.

8.13.6 Node, Runt

Short for "runtime node". A runt node is a node that does not persist within a Cortex but is created at runtime when a Cortex is initiated. Runt nodes are commonly used to represent metadata associated with Synapse, such as data model elements like forms (`syn:form`) and properties (`syn:prop`) or automation elements like triggers (`syn:trigger`) or cron jobs (`syn:cron`).

8.13.7 Node, Storage

A storage node ("sode") is a collection of data for a given node (i.e., the node's primary property, secondary / universal properties, tags, etc.) that is present in a specific *Layer*.

8.13.8 Node Yielder Function

See *Function, Node Yielder*.

8.13.9 Non-Runtime Safe

See *Non-Runtsafe*.

8.13.10 Non-Runtsafe

Short for "non-runtime safe". Non-runtsafe refers to the use of variables within Storm. A variable that is **non-runtsafe** has a value that may change based on the specific node passing through the Storm pipeline. A variable whose value is set to a node property, such as `$fqdn = :fqdn` is an example of a non-runtsafe variable (i.e., the value of the secondary property `:fqdn` may be different for different nodes, so the value of the variable will be different based on the specific node being operated on).

Contrast with *Runtsafe*.

8.14 O

8.14.1 Optic

The Synapse user interface (UI), available as part of the commercial Synapse offering.

8.15 P

8.15.1 Package

A package is a set of commands and library code used to implement a *Storm Service*. When a new Storm service is loaded into a Cortex, the Cortex verifies that the service is legitimate and then requests the service's packages in order

to load any extended Storm commands associated with the service and any library code used to implement the service.

8.15.2 Path Variable Column

See *Column, Path Variable*.

8.15.3 Permission

Within Synapse, a permission is a string (such as `node.add`) used to control access. A permission is assigned (granted or revoked) using a *Rule*.

Access to some objects in Synapse may be controlled by *Easy Permissions*.

8.15.4 Pivot

Within Synapse, one of the primary methods for interacting with data in a *Cortex*. A pivot moves from a set of nodes with one or more properties with specified value(s) to a set of nodes with a property having the same value(s). Compare with *Lift*, *Filter*, and *Traverse*.

See *Storm Reference - Pivoting* for additional detail.

8.15.5 Power-Up

Power-Ups provide specific add-on capabilities to Synapse. For example, Power-Ups may provide connectivity to external databases or third-party data sources, or enable functionality such as the ability to manage YARA rules, scans, and matches.

The term Power-Up is most commonly used to refer to Vertex-developed packages and services that are available as part of the commercial Synapse offering (only a few Power-Ups are available with open-source Synapse). However, many organizations write their own custom packages and services that may also be referred to as Power-Ups.

Vertex distinguishes between an *Advanced Power-Up* and a *Rapid Power-Up*.

8.15.6 Power-Up, Advanced

Advanced Power-Ups are implemented as Storm services (see *Service, Storm*). Vertex-developed Advanced Power-Ups are implemented as Docker containers and may require DevOps support and additional resources to deploy.

8.15.7 Power-Up, Rapid

Rapid Power-Ups are implemented as Storm packages (see *Package*). Rapid Power-Ups are written entirely in Storm and can be loaded directly into a *Cortex*.

8.15.8 Power-Ups Tool

See *Tool, Power-Ups*.

8.15.9 Primary Property

See *Property, Primary*.

8.15.10 Property

Within Synapse, properties are individual elements that define a *Form* or (along with their specific values) that comprise a *Node*. Every property in Synapse must have a defined *Type*.

See the *Property* section in the *Data Model Objects* document for additional detail.

8.15.11 Property Column

See *Column, Property*.

8.15.12 Property, Derived

Within Synapse, a derived property is a secondary property that can be extracted (derived) from a node's primary property. For example, the domain `inet:fqdn=www.google.com` can be used to derive `inet:fqdn:domain=google.com` and `inet:fqdn:host=www`; the DNS A record `inet:dns:a=(woot.com, 1.2.3.4)` can be used to derive `inet:dns:a:fqdn=woot.com` and `inet:dns:a:ipv4=1.2.3.4`.

Synapse will automatically set (*Autoadd*) any secondary properties that can be derived from a node's primary property. Because derived properties are based on primary property values, derived secondary properties are always read-only (i.e., cannot be modified once set).

8.15.13 Property, Extended

Within Synapse, an extended property is a custom property added to an existing form to capture specialized data. For example, extended properties may be added to the data model by a *Power-Up* in order to record vendor-specific data (such as a "risk" score).

Extended properties can be added with the *$lib.model.ext* libraries. **Note** that we strongly recommend that any extended properties be added within a custom namespace; specifically, that property names begin with an underscore and include a vendor or source name (if appropriate) as the first namespace element.

An example of an extended property is the `:_virustotal:reputation` score added to some forms to account for VirusTotal-specific data returned by that Power-Up (e.g., `inet:fqdn:_virustotal:reputation`).

8.15.14 Property, Primary

Within Synapse, a primary property is the property that defines a given *Form* in the data model. The primary property of a form must be defined such that the value of that property is unique across all possible instances of that form. Primary properties are always read-only (i.e., cannot be modified once set).

8.15.15 Property, Relative

Within Synapse, a relative property is a *Secondary Property* referenced using only the portion of the property's namespace that is relative to the form's *Primary Property*. For example, `inet:dns:a:fqdn` is the full name of the "domain" secondary property of a DNS A record form (`inet:dns:a`). `:fqdn` is the relative property / relative property name for that same property.

8.15.16 Property, Secondary

Within Synapse, secondary properties are optional properties that provide additional detail about a *Form*. Within the data model, secondary properties may be defined with optional constraints, such as:

- Whether the property is read-only once set.
- Any normalization (outside of type-specific normalization) that should occur for the property (such as converting a string to all lowercase).

8.15.17 Property, Universal

Within Synapse, a universal property is a *Secondary Property* that is applicable to all forms and may optionally be set for any form where the property is applicable. For example, `.created` is a universal property whose value is the date/time when the associated node was created in a Cortex.

8.16 Q

8.16.1 Queue

Within Synapse, a queue is a basic first-in, first-out (FIFO) data structure used to store and serve objects in a classic pub/sub (publish/subscribe) manner. Any primitive (such as a node iden) can be placed into a queue and then consumed from it. Queues can be used (for example) to support out-of-band processing by allowing non-critical tasks to be executed in the background. Queues are persistent; i.e., if a Cortex is restarted, the queue and any objects in the queue are retained.

8.17 R

8.17.1 Rapid Power-Up

See *Power-Up, Rapid*.

8.17.2 Relative Property

See *Property, Relative*.

8.17.3 Repr

Short for "representation". The repr of a *Property* defines how the property should be displayed in cases where the display format differs from the storage format. For example, date/time values in Synapse are stored in epoch milliseconds but are displayed in human-friendly "yyyy/mm/dd hh:mm:ss.mmm" format.

8.17.4 Research Tool

See *Tool, Research*.

8.17.5 Role

In Synapse, a role is used to group users with similar authorization needs. You can assign a set of rules (see *Rule*) to a role, and grant the role to users who need to perform those actions.

8.17.6 Root Tag

See *Tag, Root*.

8.17.7 Rule

Within Synapse, a rule is a structure used to assign (grant or prohibit) a specific *Permission* (e.g., `node.tag` or `!view.del`). A rule is assigned to a *User* or a *Role*.

8.17.8 Runt Node

See *Node, Runt*.

8.17.9 Runtime Safe

See *Runtsafe*.

8.17.10 Runtsafe

Short for "runtime safe". Runtsafe refers to the use of variables within Storm. A variable that is **runtsafe** has a value that will not change based on the specific node passing through the Storm pipeline. A variable whose value is explicitly set, such as `$fqdn = woot.com` is an example of a runtsafe varaible.

Contrast with *Non-Runtsafe*.

8.18 S

8.18.1 Secondary Property

See *Property, Secondary*.

8.18.2 Service

Synapse is designed as a modular set of services. Broadly speaking, a service can be thought of as a container used to run an application. We may informally differentiate between a *Synapse Service* and a *Storm Service*.

8.18.3 Service, Storm

A Storm service is a registerable remote component that can provide packages (*Package*) and additional APIs to Storm and Storm commands. A service resides on a *Telepath* API endpoint outside of the *Cortex*.

When the Cortex is connected to a service, the Cortex queries the endpoint to determine if the service is legitimate and, if so, loads the associated package to implement the service.

An advantage of Storm services (over, say, additional Python modules) is that services can be restarted to reload their service definitions and packages while a Cortex is still running – thus allowing a service to be updated without having to restart the entire Cortex.

8.18.4 Service, Synapse

Synapse services make up the core Synapse architecture and include the *Cortex* (data store), *Axon* (file storage), and the commercial *Optic* UI. Synapse services are built on the *Cell* object.

8.18.5 Simple Form

See *Form, Simple*.

8.18.6 Slab

A Slab is a core Synapse component which is used for persisting data on disk into a LMDB backed database. The Slab interface offers an asyncio friendly interface to LMDB objects, while allowing users to largely avoid having to handle native transactions themselves.

8.18.7 Sode

Short for "storage node". See *Node, Storage*.

8.18.8 Splice

A splice is an atomic change made to data within a Cortex, such as node creation or deletion, adding or removing a tag, or setting, modifying, or removing a property. All changes within a Cortex may be retrieved as individual splices within the Cortex's splice log.

8.18.9 Spotlight Tool

See *Tool, Spotlight*.

8.18.10 Standard Comparison Operator

See *Comparison Operator, Standard*.

8.18.11 Storage Node

See *Node, Storage*.

8.18.12 Stories Tool

See *Tool, Stories*.

8.18.13 Storm

Storm is the custom query language analysts use to interact with data in Synapse.

Storm can also be used as a programming language by advanced users and developers, though this level of expertise is not required for normal use. Many of Synapse's **Power-Ups** (see *Power-Up*) are written in Storm.

See *Storm Reference - Introduction* for additional detail.

8.18.14 Storm Editor

Also "Storm Editor Tool". See *Tool, Storm Editor*.

8.18.15 Storm Service

See *Service, Storm*.

8.18.16 Subquery

Within Synapse, a subquery is a *Storm* query that is executed inside of another Storm query.

See *Storm Reference - Subqueries* for additional detail.

8.18.17 Subquery Filter

See *Filter, Subquery*.

8.18.18 Synapse Service

See *Service, Synapse*.

8.19 T

8.19.1 Tag

Within Synapse, a tag is a label applied to a node that provides additional context about the node. Tags typically represent assessments or judgements about the data represented by the node.

See the *Tag* section in the *Data Model Objects* document for additional detail.

8.19.2 Tag, Base

Within Synapse, the lowest (rightmost) tag element in a tag hierarchy. For example, for the tag `#foo.bar.baz`, `baz` is the base tag.

8.19.3 Tag, Leaf

The full tag path / longest tag in a given tag hierarchy. For example, for the tag `#foo.bar.baz`, `foo.bar.baz` is the leaf tag.

8.19.4 Tag, Root

Within Synapse, the highest (leftmost) tag element in a tag hierarchy. For example, for the tag `#foo.bar.baz`, `foo` is the root tag.

8.19.5 Tag Column

See *Column, Tag*.

8.19.6 Tag Explorer

In *Optic*, the Tag Explorer (found in the *Help Tool*) provides an expandable, tree-based listing of all tags in your Synapse *Cortex*, along with their definitions (if present).

8.19.7 Tag Glob Column

See *Column, Tag Glob*.

8.19.8 Taxonomy

In Synapse, a taxonomy is a user-defined set of hierarchical categories that can optionally be used to further classify particular objects (forms). Taxonomies use a dotted namespace (similar to tags). Forms that support a taxonomy will have a secondary property whose *Type* is the taxonomy for that form (e.g., an `ou:industry` form has a `:type` secondary property whose type is `ou:industry:type:taxonomy`).

8.19.9 Telepath

Telepath is a lightweight remote procedure call (RPC) protocol used in Synapse. See *Telepath RPC* in the *Synapse Architecture* guide for additional detail.

8.19.10 Tool, Admin

In *Optic*, the Admin Tool provides a unified interface to perform basic management of users, roles, and permissions; views and layers; and triggers and cron jobs.

8.19.11 Tool, Console

In *Optic*, the Console Tool provides a CLI-like interface to Synapse. It can be used to run Storm queries in a manner similar to the Storm CLI (in the community version of Synapse). In Optic the Console Tool is more commonly used to display status, error, warning, and debug messages, or to view help for built-in Storm commands (see *Storm Reference - Storm Commands*) and / or Storm commands installed by Power-Ups.

8.19.12 Tool, Help

In *Optic*, the central repository for Synapse documentation and assistance. The Help Tool includes the *Data Model Explorer*, *Tag Explorer*, documentation for any installed Power-Ups (see *Power-Up*), links to the public Synapse, Storm, and Optic documents, and version / changelog information.

8.19.13 Tool, Ingest

In *Optic*, the primary tool used to load structured data in CSV, JSON, or JSONL format into Synapse using Storm. The Ingest Tool can also be used to prototype and test more formal ingest code.

8.19.14 Tool, Power-Ups

In *Optic*, the tool used to view, install, update, and remove Power-Ups (see *Power-Up*).

8.19.15 Tool, Research

In *Optic*, the primary tool used to ingest, enrich, explore, visualize, and annotate Synapse data.

8.19.16 Tool, Spotlight

Also known as simply "Spotlight". In *Optic*, a tool used to load and display PDF or HTML content, create an associated `media:news` node, and easily extract and link relevant indicators or other nodes.

8.19.17 Tool, Stories

Also known as simply "Stories". In *Optic*, a tool used to create, collaborate on, review, and publish finished reports. Stories allows you to integrate data directly from the *Research Tool* into your report ("Story").

8.19.18 Tool, Storm Editor

Also known as simply "Storm Editor". In *Optic*, a tool used to compose, test, and store Storm queries (including macros - see *Macro*). Storm Editor includes a number of integrated development environment (IDE) features, including syntax highlighting, auto-indenting, and auto-completion for the names of forms, properties, tags, and libraries.

8.19.19 Tool, Workflows

In *Optic*, the tool used to access and work with Workflows (see *Workflow*).

8.19.20 Tool, Workspaces

In *Optic*, the tool used to configure and manage a user's Workspaces (see *Workspace*).

8.19.21 Traverse

Within Synapse, one of the primary methods for interacting with data in a *Cortex*. Traversal refers to navigating the data by crossing ("walking") a lighweight (light) edge (*Edge, Lightweight (Light)*) betweeen nodes. Compare with *Lift*, *Pivot*, and *Filter*.

See *Traversal Operations* for additional detail.

8.19.22 Trigger

Within Synapse, a trigger is a Storm query that is executed automatically upon the occurrence of a specified event within a Cortex (such as adding a node or applying a tag). "Trigger" refers collectively to the event and the query fired ("triggered") by the event.

See the Storm command reference for the *trigger* command and the *Storm Reference - Automation* for additional detail.

8.19.23 Type

Within Synapse, a type is the definition of a data element within the data model. A type describes what the element is and enforces how it should look, including how it should be normalized.

See the *Type* section in the *Data Model Objects* document for additional detail.

8.19.24 Type, Base

Within Synapse, base types include standard types such as integers and strings, as well as common types defined within or specific to Synapse, including globally unique identifiers (`guid`), date/time values (`time`), time intervals (`ival`), and tags (`syn:tag`). Many forms within the Synapse data model are built upon (extensions of) a subset of common types.

8.19.25 Type, Model-Specific

Within Synapse, knowledge-domain-specific forms may themselves be specialized types. For example, an IPv4 address (`inet:ipv4`) is its own specialized type. While an IPv4 address is ultimately stored as an integer, the type has additional constraints, e.g., IPv4 values must fall within the allowable IPv4 address space.

8.19.26 Type Awareness

Type awareness is the feature of the *Storm* query language that facilitates and simplifies navigation through the *Hypergraph* when pivoting across nodes. Storm leverages knowledge of the Synapse *Data Model* (specifically knowledge of the type of each node property) to allow pivoting between primary and secondary properties of the same type across different nodes without the need to explicitly specify the properties involved in the pivot.

8.19.27 Type Enforcement

Within Synapse, the process by which property values are required to conform to value and format constraints defined for that *Type* within the data model before they can be set. Type enforcement helps to limit bad data being entered in to a Cortex by ensuring values entered make sense for the specified data type (e.g., that an IP address cannot be set as the value of a property defined as a domain (`inet:fqdn`) type, and that the integer value of the IP falls within the allowable set of values for IP address space).

8.19.28 Type Normalization

Within Synapse, the process by which properties of a particular type are standardized and formatted in order to ensure consistency in the data model. Normalization may include processes such as converting user-friendly input into a different format for storage (e.g., converting an IP address entered in dotted-decimal notation to an integer), converting certain string-based values to all lowercase, and so on.

8.20 U

8.20.1 Universal Property

See *Property, Universal*.

8.20.2 User

In Synapse, a user is represented by an account in the Cortex. An account is required to authenticate (log in) to the Cortex and is used for authorization (permissions) to access services and perform operations.

8.21 V

8.21.1 Variable

In Storm, a variable is an identifier with a value that can be defined and/or changed during normal execution, i.e., the value is variable.

Contrast with *Constant*. See also *Runtsafe* and *Non-Runtsafe*.

See *Storm Reference - Advanced - Variables* for a more detailed discussion of variables.

8.21.2 Vault

In Synapse, a vault is a protected storage mechanism that allows you to store secret values (such as API keys) and any associated configuration settings. Vaults support permissions and can be shared with other users or roles. Granting 'read' access to a vault allows someone to use the vault contents without allowing them to see the vault's secret values.

8.21.3 View

Within Synapse, a view is a ordered set of layers (see *Layer*) and associated permissions that are used to synthesize nodes from the *Cortex*, determining both the nodes that are visible to users via that view and where (i.e., in what layer) any changes made by a view's users are recorded. A default Cortex consists of a single layer and a single view, meaning that by default all nodes are stored in one layer, all changes are written to that layer, and all users have the same visibility (view) into Synapse's data.

In multi-layer systems, a view consists of the set of layers that should be visible to users of that view, and the order in which the layers should be instantiated for that view. Order matters because typically only the topmost layer is writeable by that view's users, with subsequent (lower) layers read-only. Explicit actions can push upper-layer writes downward (merge) into lower layers.

8.22 W

8.22.1 Workflow

In *Optic*, a Workflow is a customized set of UI elements that provides an intuitive way to perform particular tasks. Workflows may be installed by Synapse Power-Ups (see *Power-Up*) and give users a more tailored means (compared to the *Research Tool* or Storm query bar) to work with Power-Up Storm commands or associated analysis tasks.

8.22.2 Workflows Tool

See *Tool, Workflows*.

8.22.3 Workspace

In *Optic*, a Workspace is a customizable user environment. Users may configure one or more Workspaces; different Workspaces may be designed to support different analysis tasks.

8.22.4 Workspace, Global Default

In *Optic*, a Workspace that has been pre-configured with various custom settings and distributed for use. A Global Default Workspace can be used to share a set of baseline Workspace customizations with a particular group or team.

8.22.5 Workspaces Tool

See *Tool, Workspaces*.

CHAPTER

NINE

SYNAPSE CONTRIBUTORS GUIDE

This Contributors Guide is written for people who will be working on the Synapse code base, contributing to it via code patches, or maintaining written documentation.

The Contributors Guide is a living document and will continue to be updated and expanded. The current sections are:

9.1 Contributing to Synapse

- *Project Style Guide*.
- *Git Hook & Syntax Checking*.
- *Contribution Process*.

9.1.1 Project Style Guide

The following items should be considered when contributing to Synapse:

- The project is not currently strictly PEP8 compliant. Compliant sections include the following:
  - Whitespace in Expressions and Statements.
  - Programming Recommendations regarding singleton comparison (use 'is' instead of equality operators).
- Please keep line lengths under 120 characters.
- Use single quotes for string constants (including docstrings) unless double quotes are required.

```
# Do this
foo = '1234'
# NOT this
foo = "1234"
```

- Use a single line break between top level functions and class definitions, and class methods. This helps conserve vertical space.
  - Do this

```
import foo
import duck

def bar():
    return True

def baz():
    return False
```

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```
class Obj(object):

    def __init__(self, a):
        self.a = a

    def gimmeA(self):
        return self.a
```

* NOT this

```
import foo
import duck


def bar():
    return True


def baz():
    return False


class Obj(object):

    def __init__(self, a):
        self.a = a


    def gimmeA(self):
        return self.a
```

- Use Google style Python docstrings. This format is very readable and will allow type hinting for IDE users. See the following notes below about our slight twist on this convention.
  - Use ‘’’ quotes instead of “”” for starting/stoping doc strings.
  - Google Style typically has the summary line after the opening ‘’’ marker. Place this summary value on the new line following the opening ‘’’ marker.
  - More information about Google Style docstrings (and examples) can be found at the examples here.
  - We use Napoleon for parsing these doc strings. More info here.
  - Synapse as a project is not written using the Napoleon format currently but all new modules should adhere to that format.
  - Synapse acceptable example:

```
def fooTheBar(param1, param2, **kwargs):
    '''
    Summary line goes first.

    Longer description lives here. It can be a bunch of stuff across
    multiple blocks if necessary.
```

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```
    Example:
        Examples should be given using either the ``Example`` section.
        Sections support any reStructuredText formatting, including
        literal blocks::

            woah = fooTheBar('a', 'b', duck='quacker')

    Section breaks are created by resuming unindented text. Section breaks
    are also implicitly created anytime a new section starts.

    `PEP 484`_ type annotations are supported. If attribute, parameter, and
    return types are annotated according to `PEP 484`_, they do not need to be
    included in the docstring:

    Args:
        param1 (int): The first parameter.
        param2 (str): The second parameter.

    Keyword Arguments:
        duck (str): Optional keyword args which come in via **kwargs call␣
↪conventions,
                    which modify function behavior, should be documented under␣
↪the
                    Keyword Args section.

    Returns:
        bool: The return value. True for success, False otherwise.

              The ``Returns`` section supports any reStructuredText formatting,
              including literal blocks::

                  {
                      'param1': param1,
                      'param2': param2
                  }

    Raises:
        AttributeError: The ``Raises`` section is a list of all exceptions
            that are relevant to the interface.
        ValueError: If `param2` is equal to `param1`.


    .. _PEP 484:
        https://www.python.org/dev/peps/pep-0484/

    """
    # Do stuff the with args...
```

- Imports should first be sorted in order of shortest to longest import, then by alphabetical order (when lengths match). Imports should be ordered starting from the Python standard library first, then any third party packages, then any Synapse specific imports. The following example shows the recommended styling for imports:

```
# Stdlib
import logging
import collections
# Third Party Code
import barlib.duck as b_duck
import foolib.thing as f_thing
# Synapse Code
import synapse.common as s_common
import synapse.cortex as s_cortex
import synapse.lib.config as s_config
```

- Previously we used * imports in the Synapse codebase (especially around synapse.exc and synapse.common). If common functions or exceptions are needed, import synapse.common as noted above, and both the common functions and the entirety of synapse.exc exceptions will be available. This provides a consistent manner for referencing common functions and Synapse specific exception classes. New code should generally not use * imports. Here is an example:

```
# Do this
import synapse.common as s_common
tick = s_common.now()
if tick < 1000000000:
    raise s_common.HitMaxTime(mesg='We have gone too far!')

# NOT this
from synapse.common import *
tick = now()
if tick < 1000000000:
    raise HitMaxTime(mesg='We have gone too far!')
```

- Function names should follow the mixedCase format for anything which is exposed as a externally facing API on a object or module.

```
# Do this
fooTheBar()
# NOT this
foo_the_bar()
```

- Private methods should be marked as such with a proceeding underscore.

```
# Do this
_internalThing()
# NOT this
privateInternalThingDontUseMe()
```

  - The corollary to this is that any function which is not private may be called arbitrarily at any time, so avoid public API functions which are tightly bound to instance state. For example, if a processing routine is broken into smaller subroutines for readability or testability, these routines are likely private and should not be exposed to outside callers.

- Function calls with mandatory arguments should be called with positional arguments. Do not use keyword arguments unless necessary.

```
def foo(a, b, duck=None):
    print(a, b, duck)
```

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```
# Do this
foo('a', 'b', duck='quacker')
# Not this
foo(a='a', b='b', duck='quacker')
```

- Avoid the use of @property decorators. They do not reliably work over the telepath RMI.
- Logging should be setup on a per-module basis, with loggers created using calls to logging.getLogger(__name__). This allows for module level control of loggers as neccesary.
  - Logger calls should use logging string interpolation, instead of using % or .format() methods. See Python Logging module docs for reference.
  - Example:

```
# Get the module level logger
logger = logging.getLogger(__name__)
# Do this - it only forms the final string if the message is
# actually going to be logged
logger.info('I am a message from %s about %s', 'bob', 'a duck')
# NOT this - it performs the string format() call regardless of
# whether or not the message is going to be logged.
logger.info('I am a message from {} about {}'.format('bob', 'a duck'))
```

- Convenience methods are available for unit tests, primarily through the SynTest class. This is a subclass of unittest.TestCase and provides many short aliases for the assert* functions that TestCase provides.
  - Ensure you are closing resources which may be open with test cases. Many Synapse objects may be used as content managers which make this easy for test authors.
- Avoid the use of the built-in `re` module. Instead use the third-party `regex` module. `regex` is preferred due to known bugs with unicode in the `re` module. Additionally, `regex` does provide some performance benefits over `re`, especially when using pre-compiled regular expression statements.
- Whenever possible, regular expressions should be pre-compiled. String matches/comparisons should be performed against the pre-compiled regex instance.

```
# Do this
fqdnre = regex.compile(r'^[\w._-]+$', regex.U)

def checkValue(valu):
    if not fqdnre.match(valu):
        self._raiseBadValu(valu)

# NOT this
def checkValue(valu):
    if not regex.match(r'^[\w._-]+$', valu, regex.U)
        self._raiseBadValu(valu)
```

- Return values should be preferred over raising exceptions. Functions/methods that return a value should return None (or a default value) in the case of an error. The logic behind this is that it is much easier, cleaner, faster to check a return value than to handle an exception.

  Raising exceptions is reserved for "exceptional circumstances" and should not be used for normal program flow.

```
# Do this
def getWidgetById(self, wid):
    widget_hash = self._index.get(wid)
    if widget_hash is None:
        return None

    widget = self._widgets.get(widget_hash)
    return widget

# NOT this
def getWidgetById(self, wid):
    widget_hash = self._index.get(wid)
    if widget_hash is None:
        raise NotFoundError

    widget = self._widgets.get(widget_hash)
    if widget is None:
        raise NotFoundError

    return widget
```

Contributions to Synapse which do not follow the project style guidelines may not be accepted.

9.1.2 Git Hook & Syntax Checking

A set of helper scripts are available for doing python syntax checking. Basic syntax checking can be run with the `pycodestyle` tool; while a a git pre-commit hook; and a script to run autopep8 on staged git files also exist to make life easier.

The pre-commit hook does syntax checking on .py files which contain invalid syntax. The hook will **ALSO** run nbstripout on .ipynb files to remove output data from cells. This results in cleaner diffs for .ipynb files over time.

1. An example of running the generic syntax check script is seen below:

```
~/git/synapse$ python -m pycodestyle
./synapse/tests/test_lib_types.py:397: [E226] missing whitespace around arithmetic␣
↪operator
./synapse/tests/test_lib_types.py:398: [E226] missing whitespace around arithmetic␣
↪operator
```

2. Installing the git hook is easy:

```
cp scripts/githooks/pre-commit .git/hooks/pre-commit
chmod +x .git/hooks/pre-commit
```

3. After installing the hook, attempting a commit with a syntax error will fail

```
~/git/synapse$ git commit -m "Demo commit"
PEP8 style violations have been detected.  Please fix them
or force the commit with "git commit --no-verify".

./synapse/tests/test_lib_types.py:397: [E226] missing whitespace around arithmetic␣
↪operator
./synapse/tests/test_lib_types.py:398: [E226] missing whitespace around arithmetic␣
↪operator
```

4. This may be automatically fixed for you using the `pep8_staged_files.py` script. Note that **most**, but not **all** syntax errors may be fixed with the helper script.

```
# Run the pep8_staged_files.py script
~/git/synapse$ ./scripts/pep8_staged_files.py
# Check the diff
~/git/synapse$ git diff synapse/tests/test_lib_types.py
diff --git a/synapse/tests/test_lib_types.py b/synapse/tests/test_lib_types.py
index 0e3a7498..b81575ef 100644
--- a/synapse/tests/test_lib_types.py
+++ b/synapse/tests/test_lib_types.py
 class TypesTest(s_t_utils.SynTest):

     def test_type(self):
@@ -397,8 +395,8 @@ class TypesTest(s_t_utils.SynTest):
             self.eq({node.ndef[1] for node in nodes}, {'m'})
             nodes = await alist(core.eval('testcomp +testcomp*range=((1024,␣
↪grinch), (4096, zemeanone))'))
             self.eq({node.ndef[1] for node in nodes}, {(2048, 'horton'), (4096,
↪'whoville')})
-            guid0 = 'B'*32
-            guid1 = 'D'*32
+            guid0 = 'B' * 32
+            guid1 = 'D' * 32
             nodes = await alist(core.eval(f'testguid +testguid*range=({guid0},
↪{guid1})'))
             self.eq({node.ndef[1] for node in nodes}, {'c' * 32})
             nodes = await alist(core.eval('testint | noderefs |␣
↪+testcomp*range=((1000, grinch), (4000, whoville))'))

# Add the file and commit
~/git/synapse$ git add synapse/tests/test_lib_types.py
~/git/synapse$ git commit -m "Demo commit"
[some-branch f254f5bf] Demo commit
 1 file changed, 3 insertions(+), 2 deletions(-)
```

9.1.3 Contribution Process

The Vertex Project welcomes contributions to the Synapse Hypergraph framework in order to continue its growth!

In order to contribute to the project, do the following:

1. Fork the Synapse repository from the Vertex Project. Make a new branch in git with a descriptive name for your change. For example:

```
git checkout -b foohuman_new_widget
```

2. Make your changes. Changes should include the following information:
   - Clear documentation for new features or changed behavior
   - Unit tests for new features or changed behaviors
   - If possible, unit tests should also show minimal use examples of new features.
3. Ensure that both your tests and existing Synapse tests successfully run. You can do that manually via the python unittest module, or you can set up CircleCI to run tests for your fork (this is a exercise for the reader). The

following examples shows manual test runs:

```
pytest -v
pytest -v synapse/tests/your_test_file.py
```

If test coverage is desired, you can use the provided testrunner.sh shell script to run a test. This script will generate HTML coverage reports and attempt to open those reports using xdg-open. This requires the pytest, pytest-cov, pytest-xdist packages to be installed.

```
./scripts/testrunner.sh
./scripts/testrunner.sh synapse/tests/your_test_file.py
./scripts/testrunner.sh synapse/tests/your_test_file.py::YourTestClass
./scripts/testrunner.sh synapse/tests/your_test_file.py::YourTestClass::test_
↪function
```

4. Rebase your feature branch on top of the latest master branch of the Vertex Project Synapse repository. This may require you to add the Vertex Project repository to your git remotes. The following example of rebasing can be followed:

```
# Add the Vertex project repository as a remote named "upstream".
git remote add upstream https://github.com/vertexproject/synapse.git
# Grab data from the upstream repository
git fetch --all
# Change to your local git master branch
git checkout master
# Merge changes from upstream/master to your local master
git merge upstream/master
# Move back to your feature branch
git checkout foohuman_new_feature
# Rebase your feature branch ontop of master.
# This may require resolving merge conflicts.
git rebase master
# Push your branch up to to your fork - this may require a --force
# flag if you had previously pushed the branch prior to the rebase.
git push
```

5. Ensure your tests still pass with the rebased feature branch.
6. If your changes require extensive documentation, please very your API documentation builds properly and any additional user or devops docs are created as needed. See *Synapse Doc Mastering* for documentation mastering notes.
7. Create the Pull Request in Github, from your fork's feature branch to the master branch of the Vertex Project Synapse repository. Include a description and a reference to any open issues related to the PR.

9.2 Synapse Doc Mastering

Documentation for creation and generation of documentation for Synapse.

9.2.1 Generating Docs Locally

API documentation is automatically generated from docstrings, and additional docs may also be added to Synapse as well for more detailed discussions of Synapse subsystems. This is currently done via readthedocs.

In order to do local doc generation you can do the following steps:

1. Install the following packages (preferably in a virtualenv):

```
# cd to your synapse checkout
cd synapse
# Install additional packages - this assumes the environment already has
# any additional packages required for executing synapse code in it.
python -m pip install -U -r requirements_doc.txt
# Alternativly, you can install synapse directly in develop mode with pip
# python -m pip install .[docs]

# Install pandoc package, required for building HTML.
# This may require sudo access depending on your environment.
apt install pandoc
```

2. Build the docs using sphinx. A makefile is provided which makes this easy.

```
# Go to your synapse repo
cd synapse
# Go to the docs folder
cd docs
# Use the make command to build the HTML docs
make html
```

3. Now you can open the HTML docs for browsing them.

```
xdg-open _build/html/index.html
```

4. To rebuild documentation from scratch you can delete the _build directory and the `api` directories. Deleting the `api` directory will cause the automatic Synapse API documentation to be rebuilt.

```
# Delete the _build directory
make clean
# Remove all old files and remove the autodocs directory
rm -rf synapse/autodocs
```

9.2.2 Mastering Docs

Synapse documents are mastered using either raw ReStructuredText (.rst) files or Synapse RStorm files (.rstorm). RStorm allows for embedding Storm directives, and therefore should be used for documenting Storm examples, so that the code is run at the time of document generation.

In general, docs for Synapse fall into two categories: User guides and developer guides. User guides should be mastered in `./docs/synapse/userguides` and developer guides should be mastered in `./docs/synapse/devguides`. Additional top level sections may be added over time.

In some cases there may undesired Python syntax highlighting. In order to disable that, add the following to the first line of the RST body of a document:

```
.. highlight::  none
```

This will disable all code highlighting in a given document, until another `highlight` directive is encountered.

Once new documents are made, they will need to be added to the appropriate toctree directive. There are three index documents:

- index.rst - This controls top-level documentation ordering. It generally should not need to be edited unless adding a new top level document or adding an additional section to the second level Synapse directory.

- synapse/userguide.rst - This controls the TOC ordering for user guides.
- synapse/devguide.rst - The controls the TOC ordering for developer guides.

9.3 Synapse Release Process

This doc details the release process we use for Synapse.

9.3.1 Github Milestone Management

The current milestone and the next milestone should be created in github. For example, if the current release is v0.2.1, we should have a v0.2.2 and v0.2.3 milestones created. When PRs are created or issues are addressed (via PR), they should be added to the milestone. This allows us to easily pull stories and PRs for release note generation.

9.3.2 Release Notes Format

Release notes should be compiled from the issues and PRs assigned to the milestone being released. These can all be obtained via a issue search in github. For example, if we're releasing v0.2.2, we can pull all the stories via the following query in github:

```
milestone:v0.2.2
```

Release notes should break things out by the following categories:

1. New Features in Synapse & Enhancements to existing features
2. Bugfixes
3. Major documentation updates

Short text form is fine for describing these.

9.3.3 Cutting the Release

This includes three parts:

1. Preparing the release notes/changelog information.
2. Tagging the release and pushing to github.
3. Close out the milestone in Github.

Preparing The Release Notes

Changelog notes are kept in the `CHANGELOG.rst` file. This allows us to keep a copy of the release notes in the repository, as well as having them automatically built into our documentation. This file needs to be updated prior to the release tagging. The formatting for adding the content to the file is the following:

```
<git tag> - YYYY-MM-DD
======================

Features and Enhancements
-------------------------

- Add new features (`#XXX <https://github.com/vertexproject/synapse/pull/XXX>`_)

Bugfixes
--------
```

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```
- Fix old bugs (`#XXX <https://github.com/vertexproject/synapse/pull/XXX>`_)

Improved Documentation
----------------------

- Write awesome docs (`#XXX <https://github.com/vertexproject/synapse/pull/XXX>`_)
```

This also allows for machine parseable notes so that `pyup.io` can show our changelogs.

It is recommended that as new PRs are made, the PR includes an update to the `CHANGELOG.rst` file so that during a release, notes don't have to be updated. If that has been done; a simple double check of the issues in the Github milestone should show anything missing.

When prepping the release, it is okay to add a blank template with the tag set to the next patch value and TBD date, so that PRs have a place to put their changelogs as they come in.

Tagging the Release

Version tagging in Synapse is managed by bumpversion. This handles updating the .py files containing the version number in them, as well as creating git tags and commit messages. There should not be a need to manually edit version numbers or do git commits.

bumpversion is a python application, and can be installed via pip:

```
python -m pip install bumpversion
```

> **Warning**
>
> Do *not* use `bump2version`, the API compatible fork of bumpversion. It changed how tags are made which are incompatible with our current CircleCI based workflows.

Bumpversion is designed for projects which do semantic versioning. This can be done via the following (assuming the vertexproject/synapse remote is called 'upstream'):

```
# Ensure we're on master with the latest version
git checkout master && git fetch --all && git merge upstream/master
# Do a dry-run to ensure that we're updating things properly
bumpversion --dry-run --verbose patch
# Bump the patch version
bumpversion --verbose patch
# Ensure that no erroneous changes were introduced by bumvpersion
git show HEAD
# Push the new commit and tag up to github
git push upstream
# Push the new tag up explicitly. Do not use --tags
git push upstream <the new tag>
```

Next, go to github at https://github.com/vertexproject/synapse/tags and edit the release notes for the tag that was pushed up. Add a link to the release notes from the readthedocs changelog page for the current release.

Closing Milestone in Github

Close out the milestone associated with the just released version at the milestones page so no new issues are added to it.

Publishing on Pypi

Publishing packages to PyPI is done via CircleCi configuration.

Updating Docker images

Publishing docker images to DockerHub is done via CircleCi configuration.

CHAPTER

TEN

SYNAPSE PYTHON API

10.1 synapse package

The synapse intelligence analysis framework.

10.1.1 Subpackages

synapse.cmds package

Submodules

synapse.cmds.boss module

class synapse.cmds.boss.**KillCmd**(*cli*, ***opts*)

Bases: *Cmd*

Kill a running task/query within the cortex.

Syntax:
kill <iden>

Users may specify a partial iden GUID in order to kill exactly one matching process based on the partial guid.

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.cmds.boss.**PsCmd**(*cli*, ***opts*)

Bases: *Cmd*

List running tasks in the cortex.

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

synapse.cmds.cortex module

class synapse.cmds.cortex.**Log**(*cli*, ***opts*)

Bases: *Cmd*

Add a storm log to the local command session.

Notes

By default, the log file contains all messages received from the execution of a Storm query by the current CLI. By default, these messages are saved to a file located in ~/.syn/stormlogs/storm_(date).(format).

Examples

Enable logging all messages to mpk files (default) log –on

Disable logging and close the current file log –off

Enable logging, but only log edits. Log them as jsonl instead of mpk. log –on –edits-only –format jsonl

Enable logging, but log to a custom path: log –on –path /my/aweome/log/directory/storm20010203.mpk

Log only the node messages which come back from a storm cmd execution. log –on –nodes-only –path /my/awesome/log/directory/stormnodes20010203.mpk

closeLogFd()

encodeMsg(*mesg*)

Get byts for a message

onStormMesg(*mesg*)

openLogFd(*opts*)

queueLoop()

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

save(*mesg*)

class synapse.cmds.cortex.**StormCmd**(*cli*, ***opts*)

Bases: *Cmd*

Execute a storm query.

Syntax:
storm <query>

Parameters
query – The storm query

Optional Arguments:
–hide-tags: Do not print tags. –hide-props: Do not print secondary properties. –hide-unknown: Do not print messages which do not have known handlers. –show-nodeedits: Show full nodeedits (otherwise printed as a single . per edit). –editformat <format>: What format of edits the server shall emit.

Options are

- nodeedits (default),
- count (just counts of nodeedits), or
- none (no such messages emitted).

–show-prov: Deprecated. This no longer does anything. –raw: Print the nodes in their raw format. This overrides –hide-tags and –hide-props. –debug: Display cmd debug information along with nodes in raw format. This overrides other display arguments. –path: Get path information about returned nodes. –show <names>: Limit storm events (server-side) to the comma-separated list. –file <path>: Run the storm query specified in the given file path. –optsfile <path>: Run the query with the given options from a JSON/YAML file.

Examples

storm inet:ipv4=1.2.3.4 storm –debug inet:ipv4=1.2.3.4

editformat_enums = ('nodeedits', 'count', 'none')

printf(*mesg*, *addnl=True*, *color=None*)

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

synapse.cmds.hive module

class synapse.cmds.hive.**HiveCmd**(*cli*, ***opts*)

Bases: *Cmd*

Manipulates values in a cell's Hive.

A Hive is a hierarchy persistent storage mechanism typically used for configuration data.

static parsepath(*path*)

Turn a slash-delimited path into a list that hive takes

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

synapse.data package

synapse.data.**get**(*name*, *defval=None*)

Return an object from the embedded synapse data folder.

Example

for tld in synapse.data.get('iana.tlds'):
dostuff(tld)

NOTE: Files are named synapse/data/<name>.mpk

synapse.data.**getJSON**(*name*)

synapse.data.**path**(**names*)

synapse.lib package

Subpackages

synapse.lib.crypto package

Submodules

synapse.lib.crypto.coin module

synapse.lib.crypto.coin.**bch_check**(*match: Match*)

synapse.lib.crypto.coin.**btc_base58_check**(*match: Match*)

synapse.lib.crypto.coin.**btc_bech32_check**(*match: Match*)

synapse.lib.crypto.coin.**cardano_byron_check**(*match: Match*)

synapse.lib.crypto.coin.**cardano_shelly_check**(*match: Match*)

synapse.lib.crypto.coin.**eth_check**(*match: Match*)

synapse.lib.crypto.coin.**ether_eip55**(*body: str*)

synapse.lib.crypto.coin.**logger = <Logger synapse.lib.crypto.coin (WARNING)>**

synapse.lib.crypto.coin contains functions for verifying whether or not a given regex match containing a valu is valid for a given type of coin.

these functions are intended to be used with synapse.lib.scrape.

synapse.lib.crypto.coin.**substrate_check**(*match: Match*)

synapse.lib.crypto.coin.**xrp_check**(*match: Match*)

synapse.lib.crypto.ecc module

class synapse.lib.crypto.ecc.**PriKey**(*priv*)

Bases: `object`

A helper class for using ECC private keys.

dump()

Get the private key bytes in DER/PKCS8 format.

Returns
The DER/PKCS8 encoded private key.

Return type
bytes

exchange(*pubkey*)

Perform a ECDH key exchange with a public key.

Parameters
pubkey (PubKey) – A PubKey to perform the ECDH with.

Returns
The ECDH bytes. This is deterministic for a given pubkey and private key.

Return type
bytes

static generate()

Generate a new ECC PriKey instance.

Returns
A new PriKey instance.

Return type
PriKey

iden()

Return a SHA256 hash for the public key (to be used as a GUID).

Returns
The SHA256 hash of the public key bytes.

Return type
str

static load(*byts*)

Create a PriKey instance from DER/PKCS8 encoded bytes.

Parameters
byts (*bytes*) – Bytes to load

Returns
A new PubKey instance.

Return type
PriKey

public()

Get the PubKey which corresponds to the ECC PriKey.

Returns
A new PubKey object whose key corresponds to the private key.

Return type
PubKey

sign(*byts*)

Compute the ECC signature for the given bytestream.

Parameters
byts (*bytes*) – The bytes to sign.

Returns
The RSA Signature bytes.

Return type
bytes

class synapse.lib.crypto.ecc.**PubKey(*publ*)**

Bases: object

A helper class for using ECC public keys.

dump()

Get the public key bytes in DER/SubjectPublicKeyInfo format.

Returns
The DER/SubjectPublicKeyInfo encoded public key.

Return type
bytes

`iden()`

Return a SHA256 hash for the public key (to be used as a GUID).

Returns
The SHA256 hash of the public key bytes.

Return type
str

`static load(byts)`

Create a PubKey instance from DER/PKCS8 encoded bytes.

Parameters
byts (*bytes*) – Bytes to load

Returns
A new PubKey instance.

Return type
PubKey

`verify(byts, sign)`

Verify the signature for the given bytes using the ECC public key.

Parameters

- **byts** (*bytes*) – The data bytes.
- **sign** (*bytes*) – The signature bytes.

Returns
True if the data was verified, False otherwise.

Return type
bool

`synapse.lib.crypto.ecc.doECDHE(statprv_u, statpub_v, ephmprv_u, ephmpub_v, length=64, salt=None, info=None)`

Perform one side of an Ecliptic Curve Diffie Hellman Ephemeral key exchange.

Parameters

- **statprv_u** (PriKey) – Static Private Key for U
- **(PubKey** (*statpub_v*) – Static Public Key for V
- **ephmprv_u** (PriKey) – Ephemeral Private Key for U
- **ephmpub_v** (PubKey) – Ephemeral Public Key for V
- **length** (*int*) – Number of bytes to return
- **salt** (*bytes*) – Salt to use when computing the key.
- **info** (*bytes*) – Additional information to use when computing the key.

Notes

This makes no assumption about the reuse of the Ephemeral keys passed to the function. It is the caller's responsibility to destroy the keys after they are used for doing key generation. This implementation is the dhHybrid1 scheme described in NIST 800-56A Revision 2.

Returns
The derived key.

Return type
bytes

synapse.lib.crypto.passwd module

async synapse.lib.crypto.passwd.**checkShadowV2**(*passwd: AnyStr*, *shadow: Dict*) → bool

Check a password against a shadow dictionary.

Parameters

- **passwd** (*str*) – Password to check.
- **shadow** (*dict*) – Data to check the password against.

Returns
True if the password is valid, false otherwise.

Return type
bool

async synapse.lib.crypto.passwd.**generateApiKey**(*iden=None*)

async synapse.lib.crypto.passwd.**getPbkdf2**(*passwd: AnyStr*) → Dict

async synapse.lib.crypto.passwd.**getShadowV2**(*passwd: AnyStr*) → Dict

Get the shadow dictionary for a given password.

Parameters

- **passwd** (*str*) – Password to hash.
- **ptyp** (*str*) – The password hash type.

Returns
A dictionary containing shadowed password information.

Return type
dict

synapse.lib.crypto.passwd.**parseApiKey**(*valu*)

async synapse.lib.crypto.passwd.**verifyPbkdf2**(*passwd: AnyStr*, *shadow: Dict*) → bool

synapse.lib.crypto.rsa module

class synapse.lib.crypto.rsa.**PriKey**(*priv*)

Bases: object

A helper class for using RSA private keys.

Signing methods use RSA-PSS and MFG1 with sha256 hashing.

iden() → str

Return a SHA256 hash for the public key (to be used as a GUID).

Returns
The SHA256 hash of the public key bytes.

Return type
str

public()

Get the PubKey which corresponds to the RSA PriKey.

Returns
A new PubKey object whose key corresponds to the private key.

Return type
PubKey

sign(*byts: bytes*) → bytes

Compute the RSA signature for the given bytestream.

Parameters
byts (*bytes*) – The bytes to sign.

Returns
The RSA Signature bytes.

Return type
bytes

signitem(*item*) → bytes

Compute the RSA signature for the given python primitive.

Parameters
item – The item to sign. This will be flattened and msgpacked prior to signing.

Returns
The RSA Signature bytes.

Return type
bytes

class synapse.lib.crypto.rsa.**PubKey**(*publ*)

Bases: object

A helper class for using RSA public keys.

dump()

Get the public key bytes in DER/SubjectPublicKeyInfo format.

Returns
The DER/SubjectPublicKeyInfo encoded public key.

Return type
bytes

iden()

Return a SHA256 hash for the public key (to be used as a GUID).

Returns
The SHA256 hash of the public key bytes.

Return type
str

`static load`(*byts*)

Create a PubKey instance from DER/PKCS8 encoded bytes.

Parameters
byts (*bytes*) – Bytes to load

Returns
A new PubKey instance.

Return type
PubKey

`verify`(*byts*, *sign*)

Verify the signature for the given bytes using the RSA public key.

Parameters

- **byts** (*bytes*) – The data bytes.
- **sign** (*bytes*) – The signature bytes.

Returns
True if the data was verified, False otherwise.

Return type
bool

`verifyitem`(*item*, *sign*)

Verify the signature for the given item with the RSA public key.

Parameters

- **item** – The Python primitive to verify.
- **sign** (*bytes*) – The signature bytes.

Returns
True if the data was verified, False otherwise.

Return type
bool

synapse.lib.crypto.tinfoil module

`class synapse.lib.crypto.tinfoil.CryptSeq`(*rx_key*, *tx_key*, *initial_rx_seq=0*, *initial_tx_seq=0*)

Bases: `object`

Applies and verifies sequence numbers of encrypted messages coming and going

Parameters

- **rx_key** (*bytes*) – TX key (used with TinFoilHat).
- **tx_key** (*bytes*) – RX key (used with TinFoilHat).
- **initial_rx_seq** (*int*) – Starting rx sequence number.
- **initial_tx_seq** (*int*) – Starting tx sequence number.

decrypt(*ciphertext*)

Decrypt a message, validating its sequence number is as we expect.

Parameters
ciphertext (*bytes*) – The message to decrypt and verify.

Returns
A mesg.

Return type
mesg

Raises
s_exc.CryptoErr – If the message decryption fails or the sequence number was unexpected.

encrypt(*mesg*)

Wrap a message with a sequence number and encrypt it.

Parameters
mesg – The mesg to encrypt.

Returns
The encrypted message.

Return type
bytes

class synapse.lib.crypto.tinfoil.**TinFoilHat**(*ekey*)

Bases: object

The TinFoilHat class implements a GCM-AES encryption/decryption class.

Parameters

- **ekey** (*bytes*) – A 32 byte key used for doing encryption & decryption. It
- **manner.** (*is assumed the caller has generated the key in a safe*)

dec(*byts*)

Decode an envelope dict and decrypt the given bytes.

Parameters
byts (*bytes*) – Bytes to decrypt.

Returns
Decrypted message.

Return type
bytes

enc(*byts*, *asscd=None*)

Encrypt the given bytes and return an envelope dict in msgpack form.

Parameters

- **byts** (*bytes*) – The message to be encrypted.
- **asscd** (*bytes*) – Extra data that needs to be authenticated (but not encrypted).

Returns
The encrypted message. This is a msgpacked dictionary containing the IV, ciphertext, and associated data.

Return type
bytes

synapse.lib.crypto.tinfoil.**newkey**()
Generate a new, random 32 byte key.

Returns
32 random bytes

Return type
bytes

synapse.lib.platforms package

Home for platform specific code such as thishost info.

all platform modules *must* be importable from any platform.

(guard any platform specific code with appropriate conditionals)

Submodules

synapse.lib.platforms.common module

synapse.lib.platforms.common.**daemonize**()
For unix platforms, form a new process group using fork().

synapse.lib.platforms.common.**getLibC**()
Return a ctypes reference to libc

synapse.lib.platforms.common.**getTempDir**()

synapse.lib.platforms.common.**getVolInfo**(**paths*)
Retrieve volume usage info for the given path.

synapse.lib.platforms.common.**inet_ntop**(*afam*, *byts*)

synapse.lib.platforms.common.**inet_pton**(*afam*, *text*)

synapse.lib.platforms.common.**initHostInfo**()

synapse.lib.platforms.common.**setProcName**(*name*)
Set the process title/name for process listing.

synapse.lib.platforms.darwin module

synapse.lib.platforms.darwin.**initHostInfo**()

synapse.lib.platforms.freebsd module

synapse.lib.platforms.freebsd.**initHostInfo**()

synapse.lib.platforms.linux module

synapse.lib.platforms.linux.**getAvailableMemory**()
Returns the available memory of the system

synapse.lib.platforms.linux.**getCurrentLockedMemory**()

Return the amount of memory this process has locked

synapse.lib.platforms.linux.**getFileMappedRegion**(*filename*)

Return a tuple of address and length of a particular file memory mapped into this process

synapse.lib.platforms.linux.**getMaxLockedMemory**()

Returns the maximum amount of memory this process can lock

synapse.lib.platforms.linux.**getSysctls**()

synapse.lib.platforms.linux.**getTotalMemory**()

Get the total amount of memory in the system.

Notes

This attempts to get information from cgroup data before falling back to `/proc/meminfo` data.

Returns

The number of bytes of memory available in the system.

Return type

int

synapse.lib.platforms.linux.**initHostInfo**()

synapse.lib.platforms.linux.**maximizeMaxLockedMemory**()

Remove any discretionary (i.e. soft) limits

synapse.lib.platforms.linux.**mlock**(*address*, *length*)

Lock a chunk of memory to prevent it from being swapped out, raising an OSError on error

synapse.lib.platforms.linux.**mmap**(*address*, *length*, *prot*, *flags*, *fd*, *offset*)

A simple mmap context manager that releases the GIL while mapping and unmapping. It raises an OSError on error

synapse.lib.platforms.linux.**munlock**(*address*, *length*)

Unlock a chunk of memory, raising an OSError on error

synapse.lib.platforms.windows module

synapse.lib.platforms.windows.**daemonize**()

synapse.lib.platforms.windows.**getLibC**()

Override to account for python on windows not being able to find libc sometimes...

synapse.lib.platforms.windows.**initHostInfo**()

class synapse.lib.platforms.windows.**sockaddr**

Bases: `Structure`

ipv4

Structure/Union member

ipv6

Structure/Union member

sa_family

Structure/Union member

synapse.lib.stormlib package

Submodules

synapse.lib.stormlib.aha module

class synapse.lib.stormlib.aha.**AhaLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with AHA.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.aha.**AhaPool**(*runt*, *poolinfo*)

Bases: *StormType*

Implements the Storm API for an AHA pool.

async stormrepr()

class synapse.lib.stormlib.aha.**AhaPoolLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with AHA service pools.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.auth module

class synapse.lib.stormlib.auth.**Gate**(*runt*, *valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for an AuthGate.

class synapse.lib.stormlib.auth.**LibAuth**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Auth in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async getPermDef(*perm*)

async getPermDefs()

static ruleFromText(*text*)

async textFromRule(*rule*)

class synapse.lib.stormlib.auth.LibGates(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Auth Gates in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.auth.LibRoles(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Auth Roles in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.auth.LibUser(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with data about the current user.

addLibFuncs()

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.auth.LibUsers(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Auth Users in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.auth.**Role**(*runt*, *valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Role.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

async value()

class synapse.lib.stormlib.auth.**StormUserProfileDict**(*runt*, *valu*, *path=None*)

Bases: *Prim*

A Storm Primitive that maps the HiveDict interface to a user profile dictionary.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async value()

class synapse.lib.stormlib.auth.**StormUserVarsDict**(*runt*, *valu*, *path=None*)

Bases: *Prim*

A Storm Primitive that maps the HiveDict interface to a user vars dictionary.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async value()

class synapse.lib.stormlib.auth.**User**(*runt*, *valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a User.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

async value()

class synapse.lib.stormlib.auth.**UserJson**(*runt*, *valu*)

Bases: *Prim*

Implements per-user JSON storage.

async get(*path*, *prop=None*)

async has(*path*)

async iter(*path=None*)

async set(*path*, *valu*, *prop=None*)

class synapse.lib.stormlib.auth.**UserProfile**(*runt*, *valu*, *path=None*)

Bases: *Prim*

The Storm deref/setitem/iter convention on top of User profile information.

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

async value()

class synapse.lib.stormlib.auth.**UserVars**(*runt*, *valu*, *path=None*)

Bases: *Prim*

The Storm deref/setitem/iter convention on top of User vars information.

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

synapse.lib.stormlib.auth.**ruleFromText**(*text*)

Get a rule tuple from a text string.

Parameters
text (*str*) – The string to process.

Returns
A tuple containing a bool and a list of permission parts.

Return type
(bool, tuple)

synapse.lib.stormlib.backup module

class synapse.lib.stormlib.backup.**BackupLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with the backup APIs in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.basex module

class synapse.lib.stormlib.basex.**BaseXLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for encoding and decoding strings using an arbitrary charset.

async decode(*text*, *charset*)

async encode(*byts*, *charset*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.cache module

class synapse.lib.stormlib.cache.**FixedCache**(*runt*, *query*, *size=10000*)

Bases: *StormType*

A StormLib API instance of a Storm Fixed Cache.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

class synapse.lib.stormlib.cache.**LibCache**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Cache Objects.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.cell module

class synapse.lib.stormlib.cell.**CellLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.cell.**getMaxHotFixes**()

synapse.lib.stormlib.cell.**prepHotfixDesc**(*txt*)

synapse.lib.stormlib.compression module

class synapse.lib.stormlib.compression.**Bzip2Lib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for bzip2 compression.

async en(*valu*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async un(*valu*)

class synapse.lib.stormlib.compression.**GzipLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for gzip compression.

async en(*valu*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async un(*valu*)

class synapse.lib.stormlib.compression.**ZlibLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for zlib compression.

async en(*valu*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async un(*valu*)

synapse.lib.stormlib.cortex module

class synapse.lib.stormlib.cortex.**CortexHttpApi**(*runt*, *name=()*)

Bases: *Lib*

Library for interacting with the Extended HTTP API.

async addHttpApi(*path*, *name=''*, *desc=''*, *runas='owner'*, *authenticated=True*, *readonly=False*, *iden=None*)

async delHttpApi(*iden*)

async getHttpApi(*iden*)

async getHttpApiByPath(*path*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async listHttpApis()

async makeHttpResponse(*requestinfo*)

async setHttpApiIndx(*iden*, *index=0*)

class synapse.lib.stormlib.cortex.**HttpApi**(*runt*, *info*)

Bases: *StormType*

Extended HTTP API object.

This object represents an extended HTTP API that has been configured on the Cortex.

`getObjLocals()`

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

`async stormrepr()`

`class synapse.lib.stormlib.cortex.HttpApiMethods(httpapi: HttpApi)`

Bases: *Prim*

Accessor dictionary for getting and setting Extended HTTP API methods.

Notes:
The Storm code used to run these methods will have a $request object injected into them. This allows the method to send data back to the caller when it is run.

Examples:
Setting a simple GET method:

```
$api.methods.get = ${
    $data = ({"someKey": "someValue})
    $headers = ({"someHeader": "someOtherValue"})
    $request.reply(200, headers=$headers, body=$data)
}
```

Removing a PUT method:

```
$api.methods.put = $lib.undef
```

Crafting a custom text response:

```
$api.methods.get = ${
    // Create the body
    $data = 'some value'
    // Encode the response as bytes
    $data = $data.encode()
    // Set the headers
    $headers = ({"Content-Type": "text/plain", "Content-Length": $lib.
↪len($data)})
    $request.reply(200, headers=$headers, body=$data)
}
```

Streaming multiple chunks of data as JSON lines. This sends the code, headers and body separately:

```
$api.methods.get = ${
    $request.sendcode(200)
    $request.sendheaders(({"Content-Type": "text/plain; charset=utf8"}))
    $values = ((1), (2), (3))
    for $i in $values {
        $body=`{$lib.json.save(({"value": $i}))}
```

`

```
            $request.sendbody($body.encode())
        }
    }
```

async iter()

class synapse.lib.stormlib.cortex.**HttpApiVars**(*httpapi*, *path=None*)

Bases: *Dict*

Accessor dictionary for getting and setting Extended HTTP API variables.

This can be used to set, unset or iterate over the runtime variables that are set for an Extended HTTP API endpoint. These variables are set in the Storm runtime for all of the HTTP methods configured to be executed by the endpoint.

Example

Set a few variables on a given API:

```
$api.vars.foo = 'the foo string'
$api.vars.bar = (1234)
```

Remove a variable:

```
$api.vars.foo = $lib.undef
```

Iterate over the variables set for the endpoint:

```
for ($key, $valu) in $api.vars {
    $lib.print(`{$key) -> {$valu}`)
}
```

Overwrite all of the variables for a given API with a new dictionary:

```
$api.vars = ({"foo": "a new string", "bar": (137)})
```

async setitem(*name*, *valu*)

class synapse.lib.stormlib.cortex.**HttpHeaderDict**(*valu*, *path=None*)

Bases: *Dict*

Immutable lowercase key access dictionary for HTTP request headers.

Example

Request headers can be accessed in a case insensitive manner:

```
$valu = $request.headers.Cookie
// or the lower case value
$valu = $request.headers.cookie
```

async deref(*name*)

async setitem(*name*, *valu*)

class synapse.lib.stormlib.cortex.**HttpPermsList**(*httpapi*, *path=None*)

Bases: *List*

Accessor list for getting and setting http:api permissions.

async setitem(*name*, *valu*)

class synapse.lib.stormlib.cortex.**HttpReq**(*runt*, *rnfo*)

Bases: *StormType*

Extended HTTP API Request object.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.cortex.**StormPoolDelCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Remove a Storm query offload mirror pool configuration.

Notes

This will result in tearing down any Storm queries currently being serviced by the Storm pool. This may result in this command raising an exception if it was offloaded to a pool member. That would be an expected behavior.

async execStormCmd(*runt*, *genr*)

Abstract base method

name = 'cortex.storm.pool.del'

class synapse.lib.stormlib.cortex.**StormPoolGetCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Display the current Storm query offload mirror pool configuration.

async execStormCmd(*runt*, *genr*)

Abstract base method

name = 'cortex.storm.pool.get'

class synapse.lib.stormlib.cortex.**StormPoolSetCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Setup a Storm query offload mirror pool for the Cortex.

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'cortex.storm.pool.set'

synapse.lib.stormlib.easyperm module

class synapse.lib.stormlib.easyperm.**LibEasyPerm**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with easy perm dictionaries.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.env module

class synapse.lib.stormlib.env.**LibEnv**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for accessing environment vars.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.ethereum module

class synapse.lib.stormlib.ethereum.**EthereumLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for Ethereum.

async eip55(*addr*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.gen module

class synapse.lib.stormlib.gen.**LibGen**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for secondary property based deconfliction.

synapse.lib.stormlib.gis module

class synapse.lib.stormlib.gis.**GisLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for earth based geospatial calculations.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.graph module

class synapse.lib.stormlib.graph.**GraphLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with graph projections in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.hashes module

class synapse.lib.stormlib.hashes.**LibHashes**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for hashing bytes

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.hashes.**LibHmac**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for computing RFC2104 HMAC values.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.hex module

class synapse.lib.stormlib.hex.**HexLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements helpers for hexadecimal encoded strings.

async decode(*valu*)

async encode(*valu*)

async fromint(*valu*, *length*, *signed=False*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async signext(*valu*, *length*)

async toint(*valu*, *signed=False*)

async trimext(*valu*)

synapse.lib.stormlib.imap module

class synapse.lib.stormlib.imap.**ImapLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library to connect to an IMAP server.

async connect(*host*, *port=993*, *timeout=30*, *ssl=True*, *ssl_verify=True*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.imap.**ImapServer**(*runt*, *imap_cli*, *path=None*)

Bases: *StormType*

An IMAP server for retrieving email messages.

async delete(*uid_set*)

async fetch(*uid*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async list(*reference_name=''''*, *pattern='*'*)

async login(*user*, *passwd*)

async markSeen(*uid_set*)

async search(**args*, *charset='utf-8'*)

async select(*mailbox='INBOX'*)

async synapse.lib.stormlib.imap.**run_imap_coro**(*coro*)

Raises or returns data.

synapse.lib.stormlib.index module

synapse.lib.stormlib.infosec module

synapse.lib.stormlib.infosec.**CVSS2_calc**(*vdict*)

synapse.lib.stormlib.infosec.**CVSS2_round**(*x*)

synapse.lib.stormlib.infosec.**CVSS3_0_calc**(*vdict*)

synapse.lib.stormlib.infosec.**CVSS3_0_round**(*x*)

Round up to the nearest one decimal place. From the JS reference implementation: https://www.first.org/cvss/calculator/cvsscalc30.js

synapse.lib.stormlib.infosec.**CVSS3_1_calc**(*vdict*)

synapse.lib.stormlib.infosec.**CVSS3_1_round**(*x*)

Round up to the nearest one decimal place. From the JS reference implementation: https://www.first.org/cvss/calculator/cvsscalc31.js

synapse.lib.stormlib.infosec.**CVSS_get_coefficients**(*vdict*, *vers*)

class synapse.lib.stormlib.infosec.**CvssLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements CVSS score calculations.

async calculate(*node*, *save=True*, *vers='3.1'*)

async calculateFromProps(*props*, *vers='3.1'*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async saveVectToNode(*node*, *text*)

async vectToProps(*text*)

async vectToScore(*vect*, *vers=None*)

class synapse.lib.stormlib.infosec.MitreAttackFlowLib(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements modeling MITRE ATT&CK Flow diagrams.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.infosec.roundup(*x*)

synapse.lib.stormlib.ipv6 module

class synapse.lib.stormlib.ipv6.LibIpv6(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for providing ipv6 helpers.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.iters module

class synapse.lib.stormlib.iters.LibIters(*runt*, *name=()*)

Bases: *Lib*

A Storm library for providing iterator helpers.

async enum(*genr*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.json module

class synapse.lib.stormlib.json.JsonLib(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Json data.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.json.**JsonSchema**(*runt*, *schema*, *use_default=True*)

Bases: *StormType*

A JsonSchema validation object for use in validating data structures in Storm.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

synapse.lib.stormlib.json.**compileJsSchema**(*schema*, *use_default=True*)

synapse.lib.stormlib.json.**runJsSchema**(*schema*, *item*, *use_default=True*)

synapse.lib.stormlib.log module

class synapse.lib.stormlib.log.**LoggerLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library which implements server side logging. These messages are logged to the `synapse.storm.log` logger.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.macro module

class synapse.lib.stormlib.macro.**LibMacro**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with the Storm Macros in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.macro.**MacroExecCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute a named macro.

Example

inet:ipv4#cno.threat.t80 | macro.exec enrich_foo

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'macro.exec'

readonly = True

synapse.lib.stormlib.math module

class synapse.lib.stormlib.math.**MathLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for performing math operations.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.mime module

class synapse.lib.stormlib.mime.**LibMimeHtml**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for manipulating HTML text.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async totext(*html*)

synapse.lib.stormlib.mime.**htmlToText**(*html*)

synapse.lib.stormlib.model module

class synapse.lib.stormlib.model.**LibModel**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with the Data Model in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**LibModelDeprecated**(*runt*, *name=()*)

Bases: *Lib*

A storm library for interacting with the model deprecation mechanism.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**LibModelEdge**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with light edges and manipulating their key-value attributes. This Library is deprecated.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

hivepath = ('cortex', 'model', 'edges')

validedgekeys = ('doc',)

class synapse.lib.stormlib.model.**LibModelMigration**(*runt*, *name=()*)

Bases: *Lib*, *MigrationEditorMixin*

A Storm library containing migration tools.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**LibModelMigrations**(*runt*, *name=()*)

Bases: *Lib*, *MigrationEditorMixin*

A Storm library for selectively migrating nodes in the current view.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**LibModelMigrations_0_2_31**(*runt*, *name=()*)

Bases: *Lib*

A Storm library with helper functions for the 0.2.31 model it:sec:cpe migration.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**LibModelTags**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with tag specifications in the Cortex Data Model.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.model.**MigrationEditorMixin**

Bases: `object`

Mixin helpers for migrating data within an editor context.

async copyData(*src*, *proto*, *overwrite=False*)

async copyEdges(*editor*, *src*, *proto*)

async copyExtProps(*src*, *proto*)

async copyTags(*src*, *proto*, *overwrite=False*)

class synapse.lib.stormlib.model.**ModelForm**(*form*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Form.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

value()

class synapse.lib.stormlib.model.**ModelProp**(*prop*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Property.

value()

class synapse.lib.stormlib.model.**ModelTagProp**(*tagprop*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Tag Property.

value()

class synapse.lib.stormlib.model.**ModelType**(*valu*, *path=None*)

Bases: *Prim*

A Storm types wrapper around a lib.types.Type

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

value()

synapse.lib.stormlib.modelext module

class synapse.lib.stormlib.modelext.**LibModelExt**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for manipulating extended model elements.

async addEdge(*n1form*, *verb*, *n2form*, *edgeinfo*)

async addExtModel(*model*)

async addForm(*formname*, *basetype*, *typeopts*, *typeinfo*)

async addFormProp(*formname*, *propname*, *typedef* , *propinfo*)

async addTagProp(*propname*, *typedef* , *propinfo*)

async addType(*typename*, *basetype*, *typeopts*, *typeinfo*)

async addUnivProp(*propname*, *typedef* , *propinfo*)

async **delEdge**(*n1form*, *verb*, *n2form*)

async **delForm**(*formname*)

async **delFormProp**(*formname*, *propname*, *force=False*)

async **delTagProp**(*propname*, *force=False*)

async **delType**(*typename*)

async **delUnivProp**(*propname*, *force=False*)

async **getExtModel**()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.notifications module

class synapse.lib.stormlib.notifications.**NotifyLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for a user interacting with their notifications.

async **get**(*indx*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **list**(*size=None*)

synapse.lib.stormlib.oauth module

class synapse.lib.stormlib.oauth.**OAuthV1Client**(*runt*, *ckey*, *csecret*, *atoken*, *asecret*, *sigtype*, *path=None*)

Bases: *StormType*

A client for doing OAuth V1 Authentication from Storm.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.oauth.**OAuthV1Lib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library to handle OAuth v1 authentication.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.oauth.**OAuthV2Lib**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for managing OAuth V2 clients.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.pack module

class synapse.lib.stormlib.pack.**LibPack**(*runt*, *name=()*)

Bases: *Lib*

Packing / unpacking structured bytes.

async en(*fmt*, *items*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async un(*fmt*, *byts*, *offs=0*)

synapse.lib.stormlib.project module

class synapse.lib.stormlib.project.**LibProjects**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Projects in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

class synapse.lib.stormlib.project.**Project**(*runt*, *node*, *path=None*)

Bases: *Prim*

Implements the Storm API for Project objects, which are used for managing a scrum style project in the Cortex

confirm(*perm*)

async nodes()

value()

class synapse.lib.stormlib.project.**ProjectEpic**(*proj*, *node*)

Bases: *Prim*

Implements the Storm API for a ProjectEpic

async nodes()

async value()

class synapse.lib.stormlib.project.**ProjectEpics**(*proj*)

Bases: *Prim*

Implements the Storm API for ProjectEpics objects, which are collections of ProjectEpic objects associated with a particular Project

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

class synapse.lib.stormlib.project.**ProjectSprint**(*proj*, *node*)

Bases: *Prim*

Implements the Storm API for a ProjectSprint

async nodes()

async value()

class synapse.lib.stormlib.project.**ProjectSprints**(*proj*)

Bases: *Prim*

Implements the Storm API for ProjectSprints objects, which are collections of sprints associated with a single project

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

class synapse.lib.stormlib.project.**ProjectTicket**(*proj*, *node*)

Bases: *Prim*

Implements the Storm API for a ProjectTicket.

async nodes()

async value()

class synapse.lib.stormlib.project.**ProjectTicketComment**(*ticket*, *node*)

Bases: *Prim*

Implements the Storm API for a ProjectTicketComment

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async nodes()

async value()

class synapse.lib.stormlib.project.**ProjectTicketComments**(*ticket*)

Bases: *Prim*

Implements the Storm API for ProjectTicketComments objects, which are collections of comments associated with a ticket.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

class synapse.lib.stormlib.project.**ProjectTickets**(*proj*)

Bases: *Prim*

Implements the Storm API for ProjectTickets objects, which are collections of tickets associated with a project

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

synapse.lib.stormlib.random module

class synapse.lib.stormlib.random.**LibRandom**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for generating random values.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.random.**Random**(*runt*, *seed: str | None = None*)

Bases: *StormType*

A random number generator.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

synapse.lib.stormlib.scrape module

class synapse.lib.stormlib.scrape.**LibScrape**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for providing helpers for scraping nodes from text.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.smtp module

class synapse.lib.stormlib.smtp.**SmtpLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for sending email messages via SMTP.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async message()

class synapse.lib.stormlib.smtp.**SmtpMessage**(*runt*)

Bases: *StormType*

An SMTP message to compose and send.

async send(*host*, *port=25*, *user=None*, *passwd=None*, *usetls=False*, *starttls=False*, *timeout=60*, *ssl_verify=True*)

synapse.lib.stormlib.spooled module

class synapse.lib.stormlib.spooled.**LibSpooled**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Spooled Objects.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.spooled.**SpooledSet**(*valu*, *path=None*)

Bases: *Set*

A StormLib API instance of a Storm Set object that can fallback to lmdb.

async bool()

async iter()

async stormrepr()

async value()

synapse.lib.stormlib.stats module

class synapse.lib.stormlib.stats.**LibStats**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for statistics related functionality.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async tally()

class synapse.lib.stormlib.stats.**StatTally**(*path=None*)

Bases: *Prim*

A tally object.

An example of using it:

```
$tally = $lib.stats.tally()

$tally.inc(foo)

for $name, $total in $tally {
    $doStuff($name, $total)
}
```

async get(*name*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async inc(*name*, *valu=1*)

async iter()

async sorted(*byname=False*, *reverse=False*)

value()

class synapse.lib.stormlib.stats.**StatsCountByCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Tally occurrences of values and display a bar chart of the results.

Examples

// Show counts of geo:name values referenced by media:news nodes. media:news -(refs)> geo:name | stats.countby

// Show counts of ASN values in a set of IPs. inet:ipv4#myips | stats.countby :asn

// Show counts of attacker names for risk:compromise nodes. risk:compromise | stats.countby :attacker::name

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'stats.countby'

readonly = True

synapse.lib.stormlib.stix module

class synapse.lib.stormlib.stix.**LibStix**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Stix Version 2.1 CS02.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async liftBundle(*bundle*)

async validateBundle(*bundle*)

class synapse.lib.stormlib.stix.**LibStixExport**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for exporting to STIX version 2.1 CS02.

async bundle(*config=None*)

async config()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

timestamp(*tick*)

class synapse.lib.stormlib.stix.**LibStixImport**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for importing Stix Version 2.1 data.

async config()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async ingest(*bundle*, *config=None*)

class synapse.lib.stormlib.stix.**StixBundle**(*libstix*, *runt*, *config*, *path=None*)

Bases: *Prim*

Implements the Storm API for creating and packing a STIX bundle for v2.1

async add(*node*, *stixtype=None*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

pack()

size()

async value()

synapse.lib.stormlib.stix.**uuid4**(*valu=None*)

synapse.lib.stormlib.stix.**uuid5**(*valu=None*)

synapse.lib.stormlib.stix.**validateStix**(*bundle*, *version='2.1'*)

synapse.lib.stormlib.storm module

class synapse.lib.stormlib.storm.**LibStorm**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for evaluating dynamic storm expressions.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.storm.**StormExecCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute text or an embedded query object as Storm in the current pipeline.

NOTE: It is recommended to avoid using this where possible to avoid potential query injection risks. If you must use this, take care to ensure any values being executed have been properly sanitized.

Examples

// Add nodes using text in a variable $query = '[inet:fqdn=foo.com inet:fqdn=bar.net]' storm.exec $query

// Filter nodes in the pipeline using text in a variable $filter = '-:asn=10' inet:ipv4:asn storm.exec $filter

// Pivot using an embedded query $pivot = ${ -> inet:asn } inet:ipv4:asn storm.exec $pivot

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'storm.exec'

synapse.lib.stormlib.tabular module

class synapse.lib.stormlib.tabular.**LibTabular**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for creating printable tables.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.tabular.**TabularPrinter**(*runt*, *conf*)

Bases: *StormType*

A Storm object for printing tabular data using a defined configuration.

async header()

async row(*data*)

synapse.lib.stormlib.utils module

class synapse.lib.stormlib.utils.**LibUtils**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for working with utility functions.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.stormlib.vault module

class synapse.lib.stormlib.vault.**LibVault**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with vaults.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormlib.vault.**Vault**(*runt*, *valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Vault.

Callers (instantiation) of this class must have already checked that the user has at least PERM_READ to the vault.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

value()

class synapse.lib.stormlib.vault.**VaultConfigs**(*runt*, *valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for Vault data. This is used for both vault configs and vault secrets.

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

async stormrepr()

value()

class synapse.lib.stormlib.vault.**VaultSecrets**(*runt*, *valu*, *path=None*)

Bases: *VaultConfigs*

async setitem(*name*, *valu*)

synapse.lib.stormlib.version module

class synapse.lib.stormlib.version.**VersionLib**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with version information.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async matches(*vertup*, *reqstr*)

synapse.lib.stormlib.xml module

class synapse.lib.stormlib.xml.**LibXml**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for parsing XML.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async parse(*valu*)

class synapse.lib.stormlib.xml.**XmlElement**(*runt*, *elem*)

Bases: *Prim*

A Storm object for dealing with elements in an XML tree.

async find(*name*, *nested=True*)

async get(*name*)

async iter()

synapse.lib.stormlib.yaml module

class synapse.lib.stormlib.yaml.**LibYaml**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for saving/loading YAML data.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async load(*valu*)

async save(*valu*, *sort_keys=True*)

Submodules

synapse.lib.agenda module

class synapse.lib.agenda.**Agenda**

Bases: *Base*

Organize and execute all the scheduled storm queries in a cortex.

async add(*cdef*)

Persistently adds an appointment

Parameters
cdef (*dict*) – Dictionary containing the Cron definition.

Notes

The cron definition may contain the following keys:

creator (str)
Iden of the creating user.

iden (str)
Iden of the appointment.

storm (str)
The Storm query to run.

reqs (Union[None, Dict[TimeUnit, Union[int, Tuple[int]], List[...])
One or more dicts of the fixed aspects of the appointment. dict value may be a single or multiple. May be an empty dict or None.

incunit (Union[None, TimeUnit])
The unit that changes for recurring, or None for non-recurring. It is an error for this value to match a key in reqdict.

incvals (Union[None, int, Iterable[int])
Count of units of incunit or explicit day of week or day of month. Not allowed for incunit == None, required for others (1 would be a typical value)

If the values for req and incvals are both lists, all combinations of all values (the product) are used.

Returns
Packed appointment definition

async clearRunningStatus()

Used for clearing the running state at startup or change of leadership.

async delete(*iden*)

Delete an appointment

async disable(*iden*)

async enable(*iden*)

async get(*iden*)

list()

async mod(*iden*, *query*)

Change the query of an appointment

async move(*croniden*, *viewiden*)

Move a cronjob from one view to another

async runloop()

Task loop to issue query tasks at the right times.

class synapse.lib.agenda.**ApptRec**(*reqdict*, *incunit=None*, *incval=1*)

Bases: object

Represents a single element of a single combination of an appointment

nexttime(*lastts*)

Returns next timestamp that meets requirements, incrementing by (self.incunit * incval) if not increasing, or 0.0 if there are no future matches

pack()

Make ApptRec json/msgpack-friendly

classmethod unpack(*val*)

Convert from json/msgpack-friendly

class synapse.lib.agenda.**TimeUnit**(*value*)

Bases: IntEnum

Unit of time that recurring and required parts of appointments are made of

DAY = 5

DAYOFMONTH = 3

DAYOFWEEK = 4

HOUR = 6

MINUTE = 7

MONTH = 2

NOW = 8

YEAR = 1

classmethod fromString(*s*)

synapse.lib.aha module

class synapse.lib.aha.**AhaApi**

Bases: *CellApi*

addAhaClone(*host*, *port=27492*, *conf=None*)

addAhaPool(*name*, *info*)

addAhaPoolSvc(*poolname*, *svcname*, *info*)

addAhaServer(*server*)

async addAhaSvc(*name*, *info*, *network=None*)

Register a service with the AHA discovery server.

NOTE: In order for the service to remain marked "up" a caller
must maintain the telepath link.

addAhaSvcProv(*name*, *provinfo=None*)

Provision the given relative service name within the configured network name.

addAhaUserEnroll(*name*, *userinfo=None*, *again=False*)

Create and return a one-time user enroll key.

callAhaPeerApi(*iden*, *todo*, *timeout=None*, *skiprun=None*)

callAhaPeerGenr(*iden*, *todo*, *timeout=None*, *skiprun=None*)

clearAhaClones()

Remove all unused AHA clone provisioning values.

clearAhaSvcProvs()

Remove all unused service provisioning values.

clearAhaUserEnrolls()

Remove all unused user enrollment provisioning values.

delAhaPool(*name*)

delAhaPoolSvc(*poolname*, *svcname*)

delAhaServer(*host*, *port*)

async delAhaSvc(*name*, *network=None*)

Remove an AHA service entry.

delAhaSvcProv(*iden*)

Remove a previously added provisioning entry by iden.

delAhaUserEnroll(*iden*)

Remove a previously added enrollment entry by iden.

async genCaCert(*network*)

async getAhaPool(*name*)

async getAhaPools()

async getAhaServer(*host*, *port*)

async getAhaServers()

async getAhaSvc(*name*, *filters=None*)

Return an AHA service description dictionary for a service name.

async getAhaSvcMirrors(*name*)

Return list of AHA svcinfo dictionaries for mirrors of a service.

async getAhaSvcs(*network=None*)

Yield AHA svcinfo dictionaries.

Parameters

network (*str*) – Optionally specify a network to filter on.

async getAhaSvcsByIden(*iden*, *online=True*, *skiprun=None*)

async getAhaUrls(*user='root'*)

async getCaCert(*network*)

async iterPoolTopo(*name*)

async **modAhaSvcInfo**(*name*, *svcinfo*)

async **signHostCsr**(*csrtext*, *signas=None*, *sans=None*)

async **signUserCsr**(*csrtext*, *signas=None*)

class synapse.lib.aha.**AhaCell**

Bases: *Cell*

async **addAhaClone**(*host*, *port=27492*, *conf=None*)

async **addAhaPool**(*name*, *info*)

async **addAhaPoolSvc**(*poolname*, *svcname*, *info*)

async **addAhaServer**(*server*)

async **addAhaSvc**(*name*, *info*, *network=None*)

async **addAhaSvcProv**(*name*, *provinfo=None*)

async **addAhaUserEnroll**(*name*, *userinfo=None*, *again=False*)

async **callAhaPeerApi**(*iden*, *todo*, *timeout=None*, *skiprun=None*)

async **callAhaPeerGenr**(*iden*, *todo*, *timeout=None*, *skiprun=None*)

async **callAhaSvcApi**(*name*, *todo*, *timeout=None*)

cellapi

alias of *AhaApi*

async **clearAhaClones**()

async **clearAhaSvcProvs**()

async **clearAhaUserEnrolls**()

confbase = {'_log_conf': {'description': 'Opaque structure used for logging by spawned processes.', 'hideconf': True, 'type': 'object'}, 'aha:admin': {'description': 'An AHA client certificate CN to register as a local admin user.', 'type': 'string'}, 'aha:leader': {'description': 'The AHA service name to claim as the active instance of a storm service.', 'type': 'string'}, 'aha:name': {'description': 'The name of the cell service in the aha service registry.', 'type': 'string'}, 'aha:network': {'description': 'The AHA service network.', 'type': 'string'}, 'aha:promotable': {'default': True, 'description': 'Set to false to prevent this service from being promoted to leader.', 'type': 'boolean'}, 'aha:provision': {'description': 'The telepath URL of the aha provisioning service.', 'items': {'type': 'string'}, 'type': ['string', 'array']}, 'aha:registry': {'description': 'The telepath URL of the aha service registry.', 'items': {'type': 'string'}, 'type': ['string', 'array']}, 'aha:svcinfo': {'description': 'An AHA svcinfo object. If set, this overrides self discovered Aha service information.', 'hidecmdl': True, 'hidedocs': True, 'properties': {'urlinfo': {'properties': {'host': {'type': 'string'}, 'port': {'type': 'integer'}, 'schema': {'type': 'string'}}, 'required': ('host', 'port', 'scheme'), 'type': 'object'}}, 'required': ('urlinfo',), 'type': 'object'}, 'aha:user': {'description': 'The username of this service when connecting to others.', 'type': 'string'}, 'auth:anon': {'description': 'Allow anonymous telepath access by mapping to the given user name.', 'type': 'string'}, 'auth:conf': {'description': 'Extended configuration to be used by an alternate auth constructor.', 'hideconf': True, 'type': 'object'}, 'auth:ctor': {'description': 'Allow the construction of the cell auth object to be hooked at runtime.', 'hideconf': True, 'type': 'string'}, 'auth:passwd': {'description': 'Set to <passwd> (local only) to bootstrap the root user password.', 'type': 'string'}, 'auth:passwd:policy': {'description': 'Specify password policy/complexity requirements.', 'type': 'object'}, 'backup:dir': {'description': 'A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.', 'type': 'string'}, 'cell:ctor': {'description': 'An optional python path to the Cell class. Used by stemcell.', 'hideconf': True, 'type': 'string'}, 'cell:guid': {'description': 'An optional hard-coded GUID to store as the permanent GUID for the service.', 'hideconf': True, 'type': 'string'}, 'dmon:listen': {'description': 'A config-driven way to specify the telepath bind URL.', 'type': ['string', 'null']}, 'health:sysctl:checks': {'default': True, 'description': 'Enable sysctl parameter checks and warn if values are not optimal.', 'type': 'boolean'}, 'https:headers': {'description': 'Headers to add to all HTTPS server responses.', 'hidecmdl': True, 'type': 'object'}, 'https:parse:proxy:remoteip': {'default': False, 'description': 'Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.', 'type': 'boolean'}, 'https:port': {'description': 'A config-driven way to specify the HTTPS port.', 'type': ['integer', 'null']}, 'inaugural': {'description': 'Data used to drive configuration of the service upon first startup.', 'hidedocs': True, 'properties': {'roles': {'items': {'additionalProperties': False, 'properties': {'name': {'pattern': '^(?!all$).+$', 'type': 'string'}, 'rules': {'items': {'items': [{'type': 'boolean'}, {'items': {'type': 'string'}, 'type': 'array'}], 'maxItems': 2, 'minItems': 2, 'type': 'array'}, 'type': 'array'}}, 'required': ['name'], 'type': 'object'}, 'type': 'array'}, 'users': {'items': {'additionalProperties': False, 'properties': {'admin': {'default': False, 'type': 'boolean'}, 'email': {'type': 'string'}, 'name': {'pattern': '^(?!root$).+$', 'type': 'string'}, 'roles': {'items': {'type': 'string'}, 'type': 'array'}, 'rules': {'items': {'items': [{'type': 'boolean'}, {'items': {'type': 'string'}, 'type': 'array'}], 'maxItems': 2, 'minItems': 2, 'type': 'array'}, 'type': 'array'}}, 'required': ['name'], 'type': 'object'}, 'type': 'array'}}, 'type': 'object'}, 'limit:disk:free': {'default': 5, 'description': 'Minimum disk free space percentage before setting the cell read-only.', 'maximum': 100, 'minimum': 0, 'type': ['integer', 'null']}, 'max:users': {'default': 0, 'description': 'Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).', 'minimum': 0, 'type': 'integer'}, 'mirror':

confdefs = {'aha:urls': {'description': 'Deprecated. AHA servers can now manage this automatically.', 'items': {'type': 'string'}, 'type': ['string', 'array']}, 'clone': {'description': 'Bootstrap a clone from the AHA clone URL.', 'hidecmdl': True, 'type': ['string', 'null']}, 'dns:name': {'description': 'The registered DNS name used to reach the AHA service.', 'type': ['string', 'null']}, 'provision:listen': {'description': 'A telepath URL for the AHA provisioning listener.', 'type': ['string', 'null']}}

async delAhaPool(*name*)

async delAhaPoolSvc(*poolname*, *svcname*)

async delAhaServer(*host*, *port*)

async delAhaSvc(*name*, *network=None*)

async delAhaSvcProv(*iden*)

async delAhaUserEnroll(*iden*)

async genCaCert(*network*)

async getAhaClone(*iden*)

async getAhaPool(*name*)

async getAhaPools()

async getAhaServer(*host*, *port*)

async getAhaServers()

async getAhaSvc(*name*, *filters=None*)

async getAhaSvcClient(*svcdef*)

async getAhaSvcMirrors(*iden*, *network=None*)

async getAhaSvcProv(*iden*)

async getAhaSvcProxy(*svcdef*, *timeout=None*)

getAhaSvcUrl(*svcdef*, *user='root'*)

async getAhaSvcs(*network=None*)

async getAhaSvcsByIden(*iden*, *online=True*, *skiprun=None*)

async getAhaUrls(*user='root'*)

async getAhaUserEnroll(*iden*)

async getCaCert(*network*)

classmethod getEnvPrefix()

Get a list of envar prefixes for config resolution.

getMyUrl(*user='root'*)

async **initServiceNetwork**()

async **initServicePassive**()

async **initServiceRuntime**()

async **initServiceStorage**()

async **iterPoolTopo**(*name*)

async **modAhaSvcInfo**(*name*, *svcinfo*)

async **saveCaCert**(*name*, *cakey*, *cacert*)

async **saveHostCert**(*name*, *hostkey*, *hostcert*)

async **saveUserCert**(*name*, *userkey*, *usercert*)

async **setAhaSvcDown**(*name*, *linkiden*, *network=None*)

async **signHostCsr**(*csrtext*, *signas=None*, *sans=None*)

async **signUserCsr**(*csrtext*, *signas=None*)

class synapse.lib.aha.**AhaProvisionServiceV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async **post**()

class synapse.lib.aha.**AhaServicesV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async **get**()

class synapse.lib.aha.**CloneApi**(*aha*, *clone*)

Bases: object

async **getCloneDef**()

async **iterNewBackupArchive**(*name=None*, *remove=False*)

async **readyToMirror**()

class synapse.lib.aha.**EnrollApi**(*aha*, *userinfo*)

Bases: object

async **getCaCert**()

async **getUserInfo**()

async **signUserCsr**(*byts*)

class synapse.lib.aha.**ProvApi**(*aha*, *provinfo*)

Bases: object

async **getCaCert**()

async **getProvInfo**()

async signHostCsr(*byts*)

async signUserCsr(*byts*)

class synapse.lib.aha.**ProvDmon**

Bases: *Daemon*

synapse.lib.ast module

class synapse.lib.ast.**AbsPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**AndCond**(*astinfo*, *kids=()*)

Bases: *Cond*

<cond> and <cond>

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

async getLiftHints(*runt*, *path*)

class synapse.lib.ast.**ArgvQuery**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

isRuntSafe(*runt*)

runtopaque = True

validate(*runt*)

class synapse.lib.ast.**ArrayCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**AstNode**(*astinfo*, *kids=()*)

Bases: `object`

Base class for all nodes in the Storm abstract syntax tree.

addExcInfo(*exc*)

addKid(*astn*)

format(*depth=0*)

getAstText()

getPosInfo()

getRuntVars(*runt*)

hasAstClass(*clss*)

hasVarName(*name*)

init(*core*)

isRuntSafe(*runt*)

isRuntSafeAtom(*runt*)

iterright()
Yield "rightward" siblings until None.

optimize()

prepare()

repr()

reqNotReadOnly(*runt*, *mesg=None*)

reqRuntSafe(*runt*, *mesg*)

runtopaque = False

sibling(*offs=1*)
Return sibling node by relative offset from self.

validate(*runt*)

class synapse.lib.ast.**Bool**(*astinfo*, *valu*, *kids=()*)
Bases: *Const*

class synapse.lib.ast.**BreakOper**(*astinfo*, *kids=()*)
Bases: *AstNode*

async run(*runt*, *genr*)

class synapse.lib.ast.**CallArgs**(*astinfo*, *kids=()*)
Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.**CallKwarg**(*astinfo*, *kids=()*)
Bases: *CallArgs*

class synapse.lib.ast.**CallKwargs**(*astinfo*, *kids=()*)
Bases: *CallArgs*

class synapse.lib.ast.**CaseEntry**(*astinfo*, *kids=()*, *defcase=False*)
Bases: *AstNode*

class synapse.lib.ast.**CatchBlock**(*astinfo*, *kids=()*)
Bases: *AstNode*

async catches(*name*, *runt*, *path=None*)

errvar()

getRuntVars(*runt*)

async run(*runt*, *genr*)

class synapse.lib.ast.**CmdOper**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

class synapse.lib.ast.**Cmpr**(*astinfo*, *valu*, *kids=()*)

Bases: *Const*

class synapse.lib.ast.**Cond**(*astinfo*, *kids=()*)

Bases: *Value*

A condition that is evaluated to filter nodes.

class synapse.lib.ast.**CondSetOper**(*astinfo*, *kids*, *errok=False*)

Bases: *Oper*

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.**Const**(*astinfo*, *valu*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

isRuntSafe(*runt*)

repr()

value()

class synapse.lib.ast.**ContinueOper**(*astinfo*, *kids=()*)

Bases: *AstNode*

async run(*runt*, *genr*)

class synapse.lib.ast.**DollarExpr**(*astinfo*, *kids=()*)

Bases: *Value*

Top level node for $(...) expressions

async compute(*runt*, *path*)

class synapse.lib.ast.**Edit**(*astinfo*, *kids=()*)

Bases: *Oper*

class synapse.lib.ast.**EditCondPropSet**(*astinfo*, *kids=()*)

Bases: *Edit*

async run(*runt*, *genr*)

class synapse.lib.ast.**EditEdgeAdd**(*astinfo*, *kids=()*, *n2=False*)

Bases: *Edit*

async run(*runt*, *genr*)

class synapse.lib.ast.**EditEdgeDel**(*astinfo*, *kids=()*, *n2=False*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditNodeAdd**(*astinfo*, *kids=()*)

Bases: *Edit*

async **addFromPath**(*form*, *runt*, *path*)

Add a node using the context from path.

NOTE: CALLER MUST CHECK PERMS

prepare()

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditParens**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditPropDel**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditPropSet**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditPropSetMulti**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditTagAdd**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditTagDel**(*astinfo*, *kids=()*)

Bases: *Edit*

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditTagPropDel**(*astinfo*, *kids=()*)

Bases: *Edit*

[-#foo.bar:baz]

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditTagPropSet**(*astinfo*, *kids=()*)

Bases: *Edit*

[#foo.bar:baz=10]

async **run**(*runt*, *genr*)

class synapse.lib.ast.**EditUnivDel**(*astinfo*, *kids=()*)

Bases: *Edit*

async run(*runt*, *genr*)

class synapse.lib.ast.**EmbedQuery**(*astinfo*, *valu*, *kids=()*)

Bases: *Const*

async compute(*runt*, *path*)

getRuntVars(*runt*)

hasVarName(*name*)

runtopaque = True

validate(*runt*)

class synapse.lib.ast.**Emit**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

class synapse.lib.ast.**EmptyBlock**(*astinfo*, *kids=()*)

Bases: *AstNode*

An AST node that only runs if there are not inbound nodes in the pipeline. It is capable of yielding nodes into the pipeline.

Example

Using an empty block:

```
empty {
    // the pipeline is empty so this block will execute
}

[foo:bar=*]
empty {
    // there is a node in the pipeline so this block will not run
}
```

async run(*runt*, *genr*)

class synapse.lib.ast.**ExprAndNode**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.**ExprDict**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.**ExprList**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.**ExprNode**(*astinfo*, *kids=()*)

Bases: *Value*

A binary (i.e. two argument) expression node

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.**ExprOrNode**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.**FiltByArray**(*astinfo*, *kids=()*)

Bases: *FiltOper*

+:foo*[^=visi]

class synapse.lib.ast.**FiltOper**(*astinfo*, *kids=()*)

Bases: *Oper*

async getLiftHints(*runt*, *path*)

async run(*runt*, *genr*)

class synapse.lib.ast.**FiniBlock**(*astinfo*, *kids=()*)

Bases: *AstNode*

An AST node that runs only once after all nodes have been consumed.

Example

Using a fini block:

```
fini {
   // stuff here runs *once* after the last node yield (even if there are no nodes)
}
```

Notes

A fini block must be runtsafe.

async run(*runt*, *genr*)

class synapse.lib.ast.**ForLoop**(*astinfo*, *kids=()*)

Bases: *Oper*

getRuntVars(*runt*)

async run(*runt*, *genr*)

class synapse.lib.ast.**FormName**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.FormPivot(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

-> foo:bar

buildgenr(*runt*, *name*)

pivogenr(*runt*, *prop*)

async run(*runt*, *genr*)

class synapse.lib.ast.FormTagProp(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.FormatString(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.FuncArgs(*astinfo*, *kids=()*)

Bases: *AstNode*

Represents the function arguments in a function definition

async compute(*runt*, *path*)

class synapse.lib.ast.FuncCall(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.Function(*astinfo*, *kids=()*)

Bases: *AstNode*

(name, args, body)

// use args/kwargs syntax function bar(x, v=$(30)) { }

we auto-detect the behavior of the target function

return a value function bar(x, y) { return ($(x + y)) }

a function that produces nodes function bar(x, y) { [baz:faz=(x, y)] }

$foo = $bar(10, v=20)

async callfunc(*runt*, *argdefs*, *args*, *kwargs*, *funcpath*)

Execute a function call using the given runtime.

This function may return a value / generator / async generator

getRuntVars(*runt*)

isRuntSafe(*runt*)

prepare()

async run(*runt*, *genr*)

runtopaque = True

validate(*runt*)

class synapse.lib.ast.**HasAbsPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**HasRelPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

async getLiftHints(*runt*, *path*)

async hasProp(*node*, *runt*, *name*)

class synapse.lib.ast.**HasTagPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**IfClause**(*astinfo*, *kids=()*)

Bases: *AstNode*

class synapse.lib.ast.**IfStmt**(*astinfo*, *kids=()*)

Bases: *Oper*

prepare()

async run(*runt*, *genr*)

class synapse.lib.ast.**InitBlock**(*astinfo*, *kids=()*)

Bases: *AstNode*

An AST node that runs only once before yielding nodes.

Example

Using a init block:

```
init {
    // stuff here runs *once* before the first node yield (even if there are no␣
↪nodes)
}
```

async run(*runt*, *genr*)

class synapse.lib.ast.**LiftByArray**(*astinfo*, *kids=()*)

Bases: *LiftOper*

:prop*[range=(200, 400)]

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftFormTag**(*astinfo*, *kids=()*)

Bases: *LiftOper*

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftFormTagProp**(*astinfo*, *kids=()*)

Bases: *LiftOper*

hehe:haha#foo.bar:baz [= x]

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftOper**(*astinfo*, *kids=()*)

Bases: *Oper*

getPivNames(*runt*, *prop*, *pivs*)

async lift(*runt*, *path*)

async pivlift(*runt*, *props*, *pivnames*, *genr*)

reverseLift(*astinfo*)

async run(*runt*, *genr*)

class synapse.lib.ast.**LiftProp**(*astinfo*, *kids=()*)

Bases: *LiftOper*

async getRightHints(*runt*, *path*)

async lift(*runt*, *path*)

async proplift(*prop*, *runt*, *path*)

class synapse.lib.ast.**LiftPropBy**(*astinfo*, *kids=()*)

Bases: *LiftOper*

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftTag**(*astinfo*, *kids=()*)

Bases: *LiftOper*

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftTagProp**(*astinfo*, *kids=()*)

Bases: *LiftOper*

#foo.bar:baz [= x]

async lift(*runt*, *path*)

class synapse.lib.ast.**LiftTagTag**(*astinfo*, *kids=()*)

Bases: *LiftOper*

##foo.bar

async lift(*runt*, *path*)

class synapse.lib.ast.List(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

prepare()

repr()

class synapse.lib.ast.LookList(*astinfo*, *kids=()*)

Bases: *AstNode*

class synapse.lib.ast.Lookup(*astinfo*, *kids*, *autoadd=False*)

Bases: *Query*

When storm input mode is "lookup"

async run(*runt*, *genr*)

class synapse.lib.ast.N1Walk(*astinfo*, *kids=()*, *isjoin=False*, *reverse=False*)

Bases: *Oper*

buildfilter(*runt*, *destforms*, *cmpr*)

repr()

async run(*runt*, *genr*)

async walkNodeEdges(*runt*, *node*, *verb=None*)

class synapse.lib.ast.N1WalkNPivo(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOut*

async run(*runt*, *genr*)

class synapse.lib.ast.N2Walk(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *N1Walk*

async walkNodeEdges(*runt*, *node*, *verb=None*)

class synapse.lib.ast.N2WalkNPivo(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotIn*

async run(*runt*, *genr*)

class synapse.lib.ast.NotCond(*astinfo*, *kids=()*)

Bases: *Cond*

not <cond>

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.Oper(*astinfo*, *kids=()*)

Bases: *AstNode*

async yieldFromValu(*runt*, *valu*, *vkid*)

class synapse.lib.ast.**OrCond**(*astinfo*, *kids=()*)

Bases: *Cond*

<cond> or <cond>

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**PivotIn**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

<- *

async getPivsIn(*runt*, *node*, *path*)

async run(*runt*, *genr*)

class synapse.lib.ast.**PivotInFrom**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

<- foo:edge

async run(*runt*, *genr*)

class synapse.lib.ast.**PivotOper**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *Oper*

repr()

class synapse.lib.ast.**PivotOut**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

-> *

async getPivsOut(*runt*, *node*, *path*)

async run(*runt*, *genr*)

class synapse.lib.ast.**PivotToTags**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

-> # pivot to all leaf tag nodes -> #* pivot to all tag nodes -> #cno.* pivot to all tag nodes which match cno.* -> #foo.bar pivot to the tag node foo.bar if present

async run(*runt*, *genr*)

class synapse.lib.ast.**PropName**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

prepare()

class synapse.lib.ast.**PropPivot**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

:foo -> bar:foo

buildgenr(*runt*, *name*)

pivogenr(*runt*, *prop*)

async run(*runt*, *genr*)

class synapse.lib.ast.**PropPivotOut**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

:prop -> *

async run(*runt*, *genr*)

class synapse.lib.ast.**PropValue**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

async getPropAndValu(*runt*, *path*)

isRuntSafe(*runt*)

isRuntSafeAtom(*runt*)

prepare()

class synapse.lib.ast.**Query**(*astinfo*, *kids=()*)

Bases: *AstNode*

async iterNodePaths(*runt*, *genr=None*)

async run(*runt*, *genr*)

class synapse.lib.ast.**RawPivot**(*astinfo*, *kids=()*, *isjoin=False*)

Bases: *PivotOper*

-> { <varsfrompath> }

async run(*runt*, *genr*)

class synapse.lib.ast.**RelProp**(*astinfo*, *kids=()*)

Bases: *PropName*

class synapse.lib.ast.**RelPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

(:foo:bar or .univ) <cmpr> <value>

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

async getLiftHints(*runt*, *path*)

class synapse.lib.ast.**RelPropValue**(*astinfo*, *kids=()*)

Bases: *PropValue*

class synapse.lib.ast.**Return**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

class synapse.lib.ast.**Search**(*astinfo*, *kids=()*)

Bases: *Query*

async run(*runt*, *genr*)

class synapse.lib.ast.**SetItemOper**(*astinfo*, *kids=()*)

Bases: *Oper*

$foo.bar = baz $foo."bar baz" = faz $foo.$bar = baz

async run(*runt*, *genr*)

class synapse.lib.ast.**SetVarOper**(*astinfo*, *kids=()*)

Bases: *Oper*

getRuntVars(*runt*)

async run(*runt*, *genr*)

class synapse.lib.ast.**Stop**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

class synapse.lib.ast.**SubGraph**(*rules*)

Bases: `object`

An Oper like object which generates a subgraph.

Notes

The rules format for the subgraph is shaped like the following:

```
rules = {

    'degrees': 1,

    'edges': True,
    'edgelimit': 3000,
    'filterinput': True,
    'yieldfiltered': False,

    'filters': [
        '-(#foo or #bar)',
        '-(foo:bar or baz:faz)',
    ],

    'pivots': [
        '-> * | limit 100',
        '<- * | limit 100',
    ]

    'forms': {

        'inet:fqdn':{
            'filters': [],
            'pivots': [],
```

(continues on next page)

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```
        }

        '*': {
            'filters': [],
            'pivots': [],
        },
    },
}
```

Nodes which were original seeds have path.meta('graph:seed').

All nodes have path.meta('edges') which is a list of (iden, info) tuples.

async omit(*runt*, *node*)

async pivots(*runt*, *node*, *path*, *existing*)

async run(*runt*, *genr*)

class synapse.lib.ast.**SubQuery**(*astinfo*, *kids=()*)

Bases: *Oper*

async compute(*runt*, *path*)

Use subquery as a value. It is error if the subquery used in this way doesn't yield exactly one node or has a return statement.

Its value is the primary property of the node yielded, or the returned value.

async compute_array(*runt*, *path*)

Use subquery as an array.

async inline(*runt*, *genr*)

Operate subquery as if it were inlined

isRuntSafe(*runt*)

async run(*runt*, *genr*)

class synapse.lib.ast.**SubqCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**SwitchCase**(*astinfo*, *kids=()*)

Bases: *Oper*

prepare()

async run(*runt*, *genr*)

class synapse.lib.ast.**TagCond**(*astinfo*, *kids=()*)

Bases: *Cond*

#foo.bar

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

async getLiftHints(*runt*, *path*)

class synapse.lib.ast.**TagMatch**(*astinfo*, *kids=()*)

Bases: *TagName*

Like TagName, but can have asterisks

async compute(*runt*, *path*)

hasglob()

class synapse.lib.ast.**TagName**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

async computeTagArray(*runt*, *path*, *excignore=()*)

prepare()

class synapse.lib.ast.**TagProp**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.**TagPropCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**TagPropValue**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

class synapse.lib.ast.**TagValuCond**(*astinfo*, *kids=()*)

Bases: *Cond*

async getCondEval(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

class synapse.lib.ast.**TagValue**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

isRuntSafe(*runt*)

isRuntSafeAtom(*runt*)

class synapse.lib.ast.**TryCatch**(*astinfo*, *kids=()*)

Bases: *AstNode*

async **getCatchBlock**(*name*, *runt*, *path=None*)

async **getErrValu**(*e*)

async **run**(*runt*, *genr*)

class synapse.lib.ast.**UnaryExprNode**(*astinfo*, *kids=()*)

Bases: *Value*

A unary (i.e. single-argument) expression node

async **compute**(*runt*, *path*)

prepare()

class synapse.lib.ast.**UnivProp**(*astinfo*, *kids=()*)

Bases: *RelProp*

async **compute**(*runt*, *path*)

class synapse.lib.ast.**UnivPropValue**(*astinfo*, *kids=()*)

Bases: *PropValue*

class synapse.lib.ast.**Value**(*astinfo*, *kids=()*)

Bases: *AstNode*

The base class for all values and value expressions.

async **compute**(*runt*, *path*)

async **getCondEval**(*runt*)

Return a function that may be used to evaluate the boolean truth of the value expression using a runtime and optional node path.

async **getLiftHints**(*runt*, *path*)

isRuntSafe(*runt*)

class synapse.lib.ast.**VarDeref**(*astinfo*, *kids=()*)

Bases: *Value*

async **compute**(*runt*, *path*)

class synapse.lib.ast.**VarEvalOper**(*astinfo*, *kids=()*)

Bases: *Oper*

Facilitate a stand-alone operator that evaluates a var. $foo.bar("baz")

async **run**(*runt*, *genr*)

class synapse.lib.ast.**VarList**(*astinfo*, *valu*, *kids=()*)

Bases: *Const*

class synapse.lib.ast.**VarListSetOper**(*astinfo*, *kids=()*)

Bases: *Oper*

getRuntVars(*runt*)

async **run**(*runt*, *genr*)

class synapse.lib.ast.**VarValue**(*astinfo*, *kids=()*)

Bases: *Value*

async compute(*runt*, *path*)

hasVarName(*name*)

isRuntSafe(*runt*)

isRuntSafeAtom(*runt*)

prepare()

validate(*runt*)

class synapse.lib.ast.**WhileLoop**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

class synapse.lib.ast.**YieldValu**(*astinfo*, *kids=()*)

Bases: *Oper*

async run(*runt*, *genr*)

async synapse.lib.ast.**expr_add**(*x*, *y*)

async synapse.lib.ast.**expr_div**(*x*, *y*)

async synapse.lib.ast.**expr_eq**(*x*, *y*)

async synapse.lib.ast.**expr_ge**(*x*, *y*)

async synapse.lib.ast.**expr_gt**(*x*, *y*)

async synapse.lib.ast.**expr_le**(*x*, *y*)

async synapse.lib.ast.**expr_lt**(*x*, *y*)

async synapse.lib.ast.**expr_mod**(*x*, *y*)

async synapse.lib.ast.**expr_mul**(*x*, *y*)

async synapse.lib.ast.**expr_ne**(*x*, *y*)

async synapse.lib.ast.**expr_neg**(*x*)

async synapse.lib.ast.**expr_not**(*x*)

async synapse.lib.ast.**expr_pow**(*x*, *y*)

async synapse.lib.ast.**expr_prefix**(*x*, *y*)

async synapse.lib.ast.**expr_re**(*x*, *y*)

async synapse.lib.ast.**expr_sub**(*x*, *y*)

synapse.lib.ast.**parseNumber**(*x*)

async synapse.lib.ast.**pullone**(*genr*)

synapse.lib.auth module

class synapse.lib.auth.**Auth**

Bases: *Pusher*

Auth is a user authentication and authorization stored in a Slab. Users correspond to separate logins with different passwords and potentially different privileges.

Users are assigned "rules". These rules are evaluated in order until a rule matches. Each rule is a tuple of boolean, and a rule path (a sequence of strings). Rules that are prefixes of a privilege match, i.e. a rule ('foo',) will match ('foo', 'bar').

Roles are just collections of rules. When a user is "granted" a role those rules are assigned to that user. Unlike in an RBAC system, users don't explicitly assume a role; they are merely a convenience mechanism to easily assign the same rules to multiple users.

AuthGates are objects that manage their own authorization. Each AuthGate has roles and users subkeys which contain rules specific to that user or role for that AuthGate. The roles and users of an AuthGate, called GateRole and GateUser respectively, contain the iden of a role or user defined prior and rules specific to that role or user; they do not duplicate the metadata of the role or user.

Layout:

```
Auth root (passed into constructor)
├ roles
│    ├ <role iden 1>
│    ├ ...
│    └ last role
├ users
│    ├ <user iden 1>
│    ├ ...
│    └ last user
└ authgates
     ├ <iden 1>
     │    ├ roles
     │    │    ├ <role iden 1>
     │    │    ├ ...
     │    │    └ last role
     │    └ users
     │         ├ <user iden 1>
     │         ├ ...
     │         └ last user
     ├ <iden 2>
     │    ├ ...
     └ ... last authgate
```

async addAuthGate(*iden*, *authgatetype*)

Retrieve AuthGate by iden. Create if not present.

> **Note**
>
> Not change distributed

Returns

(AuthGate)

async addRole(*name*, *iden=None*)

Add a Role to the Auth system.

Parameters

- **name** (*str*) – The name of the role.
- **iden** (*str*) – A optional iden to use as the role iden.

Returns
A Role.

Return type
Role

async addUser(*name*, *passwd=None*, *email=None*, *iden=None*)

Add a User to the Auth system.

Parameters

- **name** (*str*) – The name of the User.
- **passwd** (*str*) – A optional password for the user.
- **email** (*str*) – A optional email for the user.
- **iden** (*str*) – A optional iden to use as the user iden.

Returns
A User.

Return type
User

checkUserLimit()

Check if we're at the specified user limit.

This should be called right before adding/unlocking/unarchiving a user.

Raises: s_exc.HitLimit if the number of active users is at the maximum.

clearAuthCache()

Clear all auth caches.

async delAuthGate(*iden*)

Delete AuthGate by iden.

> **Note**
>
> Not change distributed

async delRole(*iden*)

async delUser(*iden*)

async feedBeholder(*evnt*, *info*, *gateiden=None*, *logged=True*)

getAuthGate(*iden*)

getAuthGates()

async **getRoleByName**(*name*)

async **getUserByName**(*name*)

Get a user by their username.

Parameters
name (*str*) – Name of the user to get.

Returns
A User. May return None if there is no user by the requested name.

Return type
User

async **getUserIdenByName**(*name*)

async **popUserProfileValu**(*iden*, *name*, *default=None*)

async **popUserVarValu**(*iden*, *name*, *default=None*)

reqAuthGate(*iden*)

reqNoAuthGate(*iden*)

async **reqRole**(*iden*)

async **reqRoleByName**(*name*)

async **reqUser**(*iden*)

async **reqUserByName**(*name*)

async **reqUserByNameOrIden**(*name*)

role(*iden*)

roles()

async **setRoleInfo**(*iden*, *name*, *valu*, *gateiden=None*, *logged=True*, *mesg=None*)

async **setRoleName**(*iden*, *name*)

async **setUserInfo**(*iden*, *name*, *valu*, *gateiden=None*, *logged=True*, *mesg=None*)

async **setUserName**(*iden*, *name*)

async **setUserProfileValu**(*iden*, *name*, *valu*)

async **setUserVarValu**(*iden*, *name*, *valu*)

user(*iden*)

users()

class synapse.lib.auth.**AuthGate**(*info*, *auth*)

Bases: object

The storage object for object specific rules for users/roles.

async **delete**()

genRoleInfo(*iden*)

genUserInfo(*iden*)

pack()

class synapse.lib.auth.**Role**(*info*, *auth*)

Bases: *Ruler*

A role within the authorization subsystem.

A role in Auth exists to bundle rules together so that the same set of rules can be applied to multiple users.

allowed(*perm*, *default=None*, *gateiden=None*)

clearAuthCache()

genGateInfo(*gateiden*)

pack()

async setName(*name*)

class synapse.lib.auth.**Ruler**(*info*, *auth*)

Bases: object

An object that holds a list of rules. This includes Users, Roles, and the AuthGate variants of those

async addRule(*rule*, *indx=None*, *gateiden=None*, *nexs=True*)

async delRule(*rule*, *gateiden=None*)

getRules(*gateiden=None*)

async setRules(*rules*, *gateiden=None*, *nexs=True*, *mesg=None*)

class synapse.lib.auth.**User**(*info*, *auth*)

Bases: *Ruler*

A user (could be human or computer) of the system within Auth.

Cortex-wide rules are stored here. AuthGate-specific rules for this user are stored in an GateUser.

async allow(*perm*)

allowed(*perm: tuple[str, ...]*, *default: str | None = None*, *gateiden: str | None = None*, *deepdeny: bool = False*) → bool | None

Check if a user is allowed a given permission.

Parameters

- **perm** – The permission tuple to check.
- **default** – The default rule value if there is no match.
- **gateiden** – The gate iden to check against.
- **deepdeny** – If True, give precedence for checking deny rules which are more specific than the requested permission.

Notes

The use of the deepdeny argument is intended for checking a less-specific part of a permissions tree, in order to know about possible short circuit options. Using it to check a more specific part may have unintended results.

Returns
The allowed value of the permission.

clearAuthCache()

confirm(*perm*, *default=None*, *gateiden=None*)

genGateInfo(*gateiden*)

getAllowedReason(*perm*, *default=None*, *gateiden=None*)

A routine which will return a tuple of (allowed, info).

getRoles()

async grant(*roleiden*, *indx=None*)

hasRole(*iden*)

isAdmin(*gateiden=None*)

isArchived()

isLocked()

pack(*packroles=False*)

async popProfileValu(*name*, *default=None*)

async popVarValu(*name*, *default=None*)

raisePermDeny(*perm*, *gateiden=None*)

reqAdmin(*gateiden=None*, *mesg=None*)

async revoke(*iden*, *nexs=True*)

async setAdmin(*admin*, *gateiden=None*, *logged=True*)

async setArchived(*archived*)

async setLocked(*locked*, *logged=True*)

async setName(*name*)

async setPasswd(*passwd*, *nexs=True*, *enforce_policy=True*)

async setProfileValu(*name*, *valu*)

async setRoles(*roleidens*)

Replace all the roles for a given user with a new list of roles.

Parameters
roleidens (*list*) – A list of roleidens.

Notes

The roleiden for the "all" role must be present in the new list of roles. This replaces all existing roles that the user has with the new roles.

Returns
None

async setVarValu(*name*, *valu*)

async tryPasswd(*passwd*, *nexs=True*, *enforce_policy=True*)

synapse.lib.auth.**getShadow**(*passwd*)

This API is deprecated.

synapse.lib.auth.**textFromRule**(*rule*)

synapse.lib.autodoc module

class synapse.lib.autodoc.**RstHelp**

Bases: object

addHead(*name*, *lvl=0*, *link=None*, *addprefixline=True*, *addsuffixline=True*)

addLines(**lines*)

getRstText()

synapse.lib.autodoc.**docStormTypes**(*page*, *docinfo*, *linkprefix*, *islib=False*, *lvl=1*, *known_types=None*, *types_prefix=None*, *types_suffix=None*)

Process a list of StormTypes doc information to add them to an RstHelp object.

Notes

This will create internal hyperlink link targets for each header item. The link prefix string must be given with the `linkprefix` argument.

Parameters

- **page** (RstHelp) – The RST page to add .
- **docinfo** (*dict*) – A Stormtypes Doc.
- **linkprefix** (*str*) – The RST link prefix string to use.
- **islib** (*bool*) – Treat the data as a library. This will preface the header and attribute values with $ and use full paths for attributes.
- **lvl** (*int*) – The base header level to use when adding headers to the page.

Returns
None

synapse.lib.autodoc.**genCallsig**(*rtype*)

synapse.lib.autodoc.**genDeprecationWarning**(*name*, *depr*, *runt=False*)

synapse.lib.autodoc.**getArgLines**(*rtype*)

synapse.lib.autodoc.**getLink**(*sname*, *linkprefix*, *ref=False*, *suffix=None*)

synapse.lib.autodoc.**getReturnLines**(*rtype*, *known_types=None*, *types_prefix=None*, *suffix=None*, *isstor=False*)

synapse.lib.autodoc.**getRtypeStr**(*rtype*, *known_types*, *types_prefix*, *suffix*)

synapse.lib.autodoc.**ljuster**(*ilines*)

Helper to lstrip lines of whitespace an appropriate amount.

synapse.lib.autodoc.**prepareRstLines**(*doc*)

Prepare a desc string for RST lines.

synapse.lib.autodoc.**runtimeDocStormTypes**(*page*, *docinfo*, *islib=False*, *lvl=1*, *oneline=False*, *addheader=True*, *preamble=None*)

Process a list of StormTypes doc information to add them to a RstHelp object.

Used for Storm runtime help generation.

Parameters

- **page** (RstHelp) – The RST page to add .
- **docinfo** (*dict*) – A Stormtypes Doc.
- **linkprefix** (*str*) – The RST link prefix string to use.
- **islib** (*bool*) – Treat the data as a library. This will preface the header and attribute values with $ and use full paths for attributes.
- **lvl** (*int*) – The base header level to use when adding headers to the page.
- **oneline** (*bool*) – Only display the first line of description. Omits local headers.
- **preamble** (*list*) – Lines added after the header; and before locls.

Returns

None

synapse.lib.autodoc.**runtimeGetArgLines**(*rtype*)

synapse.lib.autodoc.**runtimeGetReturnLines**(*rtype*, *isstor=False*)

synapse.lib.autodoc.**scrubLines**(*lines*)

Remove any empty lines until we encounter non-empty linee

synapse.lib.base module

class synapse.lib.base.**Base**

Bases: object

Base class for Synapse objects.

Acts as an observable, enables async init and fini.

Example

class Foo(Base):

async def __anit__(self, x, y):

await Base.__anit__(self)

await stuff(x, y)

foo = await Foo.anit(10)

> **Note**
>
> One should not create instances directly via its initializer, i.e. Base(). One shall always use the class method anit.

async addSignalHandlers()

Register SIGTERM/SIGINT signal handlers with the ioloop to fini this object.

async classmethod anit(**args*, ***kwargs*)

async dist(*mesg*)

Distribute an existing event tuple.

Parameters
mesg ((*str*,*dict*)) – An event tuple.

Example

await base.dist(('foo',{'bar':'baz'}))

async enter_context(*item*)

Modeled on Python's contextlib.ExitStack.enter_context. Enters a new context manager and adds its __exit__() and __aexit__ method to its onfini handlers.

Returns
The result of item's own __aenter__ or __enter__() method.

async fini()

Shut down the object and notify any onfini() coroutines.

Returns
Remaining ref count

async fire(*evtname*, ***info*)

Fire the given event name on the Base. Returns a list of the return values of each callback.

Example

for ret in d.fire('woot',foo='asdf'):
print('got: %r' % (ret,))

incref()

Increment the reference count for this base. This API may be optionally used to control fini().

link(*func*)

Add a callback function to receive *all* events.

Example

base1 = Base() base2 = Base()

base1.link(base2.dist)

all events on base1 are also propagated on base2

async main()

Helper function to setup signal handlers for this base as the main object. (use base.waitfini() to block)

> **Note**
>
> This API may only be used when the ioloop is *also* the main thread.

off(*evnt*, *func*)

Remove a previously registered event handler function.

Example

base.off('foo', onFooFunc)

on(*evnt*, *func*, *base=None*)

Add an base function callback for a specific event with optional filtering. If the function returns a coroutine, it will be awaited.

Parameters

- **evnt** (*str*) – An event name
- **func** (*function*) – A callback function to receive event tufo

Examples

Add a callback function and fire it:

async def baz(event):
x = event[1].get('x') y = event[1].get('y') return x + y

d.on('foo', baz)

this fire triggers baz... await d.fire('foo', x=10, y=20)

Return type
None

onWith(*evnt*, *func*)

A context manager which can be used to add a callback and remove it when using a `with` statement.

Parameters

- **evnt** (*str*) – An event name
- **func** (*function*) – A callback function to receive event tufo

onfini(*func*)

Add a function/coroutine/Base to be called on fini().

The rules around how to register function/coroutine/Base to be called:

- Call this method with an instance of Base (this class) if holding a reference to a bound method of the instance (such as a fini() method) would cause the object to be leaked. This is appropriate for ephemeral objects that may be constructed/destroyed multiple times over the lifetime of a process.
- Call this method with an instance method if you want the object to have a lifetime as long as the thing being fini'd.

async postAnit()

Method called after self.__anit__() has completed, but before anit() returns the object to the caller.

schedCallSafe(*func*, **args*, ***kwargs*)

Schedule a function to run as soon as possible on the same event loop that this Base is running on.

This function does *not* pend on the function completion.

Parameters

- **func**
- ***args**
- ****kwargs**

Notes

This method may be called from outside of the event loop on a different thread. This function will break any task scoping done with synapse.lib.scope.

Returns
A Future representing the eventual function execution.

Return type
concurrent.futures.Future

schedCoro(*coro*)

Schedules a free-running coroutine to run on this base's event loop. Kills the coroutine if Base is fini'd. It does not pend on coroutine completion.

Parameters
coro – The coroutine to schedule.

Notes

This function is *not* threadsafe and must be run on the Base's event loop. Tasks created by this function do inherit the synapse.lib.scope Scope from the current task.

Returns
An asyncio.Task object.

Return type
asyncio.Task

schedCoroSafe(*coro*)

Schedules a coroutine to run as soon as possible on the same event loop that this Base is running on.

This function does *not* pend on coroutine completion.

Notes

This method may be run outside the event loop on a different thread. This function will break any task scoping done with synapse.lib.scope.

Returns
A Future representing the eventual coroutine execution.

Return type
concurrent.futures.Future

schedCoroSafePend(*coro*)

Schedules a coroutine to run as soon as possible on the same event loop that this Base is running on

> **Note**
>
> This method may *not* be run inside an event loop

unlink(*func*)

Remove a callback function previously added with link()

Example

base.unlink(callback)

waiter(*count*, **names*, *timeout=None*)

Construct and return a new Waiter for events on this base.

Example

wait up to 3 seconds for 10 foo:bar events…

waiter = base.waiter(10,'foo:bar')

.. fire task that will cause foo:bar events

events = await waiter.wait(timeout=3)

if events == None:
    # handle the timeout case…

for event in events:
    # parse the events if you need…

> **Note**
>
> Use this with caution. It's easy to accidentally construct race conditions with this mechanism ;)

async waitfini(*timeout=None*)

Wait for the base to fini()

Returns
    None if timed out, True if fini happened

Example

base.waitfini(timeout=30)

class synapse.lib.base.**BaseRef**

Bases: *Base*

An object for managing multiple Base instances by name.

async gen(*name*)

Atomically get/gen a Base and incref. (requires ctor during BaseRef init)

Parameters
    name (*str*) – The name/iden of the Base instance.

get(*name*)

Retrieve a Base instance by name.

Parameters
name (*str*) – The name/iden of the Base

Returns
The Base instance (or None)

Return type
(*Base*)

items()

pop(*name*)

Remove and return a Base from the BaseRef.

Parameters
name (*str*) – The name/iden of the Base instance

Returns
The named base (or None)

Return type
(*Base*)

put(*name*, *base*)

Add a Base (or sub-class) to the BaseRef by name.

Parameters

- **name** (*str*) – The name/iden of the Base
- **base** (Base) – The Base instance

Returns
(None)

vals()

class synapse.lib.base.**Waiter**(*base*, *count*, **names*, *timeout=None*)

Bases: object

A helper to wait for a given number of events on a Base.

fini()

async wait(*timeout=None*)

Wait for the required number of events and return them or None on timeout.

Example

evnts = waiter.wait(timeout=30)

if evnts == None:
handleTimedOut() return

for evnt in evnts:
doStuff(evnt)

async synapse.lib.base.**main**(*coro*)

async synapse.lib.base.**schedGenr**(*genr*, *maxsize=100*)

Schedule a generator to run on a separate task and yield results to this task (pipelined generator).

synapse.lib.boss module

class synapse.lib.boss.**Boss**

Bases: *Base*

An object to track "promoted" async tasks.

Promoted tasks are asyncio tasks, wrapped in a synapse task (`s_task.Task`), that are visible to storm users via the task tracking libs/commands such as `ps.list` and `$lib.ps.list()`.

async execute(*coro*, *name*, *user*, *info=None*, *iden=None*)

Create a synapse task from the given coroutine.

get(*iden*)

async promote(*name*, *user*, *info=None*, *taskiden=None*, *background=False*)

Promote the currently running task.

Parameters

- **name** (*str*) – The name of the task.
- **user** – The User who owns the task.
- **taskiden** – An optional GUID for the task.
- **info** – An optional information dictionary containing information about the task.

Returns
The Synapse Task object.

Return type
s_task.Task

async promotetask(*task*, *name*, *user*, *info=None*, *taskiden=None*)

ps()

reqNotShut(*mesg=None*)

async shutdown(*timeout=None*)

synapse.lib.cache module

A few speed optimized (lockless) cache helpers. Use carefully.

class synapse.lib.cache.**EdgeGlobs**

Bases: *TagGlobs*

class synapse.lib.cache.**FixedCache**(*callback*, *size=10000*)

Bases: object

async aget(*key*)

clear()

get(*key*)

pop(*key*)

put(*key*, *val*)

class synapse.lib.cache.**LruDict**(*size=10000*)

Bases: MutableMapping

Maintains the last n accessed keys

get(*key*, *default=None*)

Note: we override default impl from parent to avoid costly KeyError

items() → a set-like object providing a view on D's items

values() → an object providing a view on D's values

class synapse.lib.cache.**TagGlobs**

Bases: object

An object that manages multiple tag globs and values for caching.

add(*name*, *valu*, *base=None*)

get(*name*)

rem(*name*, *valu*)

synapse.lib.cache.**getEdgeGlobRegx**(*name*)

synapse.lib.cache.**getTagGlobRegx**(*name*)

synapse.lib.cache.**memoize**(*size=16384*)

synapse.lib.cache.**memoizemethod**(*size=16384*)

A version of memoize that doesn't cause GC cycles when applied to a method.

synapse.lib.cache.**regexizeEdgeGlob**(*edge*)

synapse.lib.cache.**regexizeTagGlob**(*tag*)

Returns
a regular expression string with ** and * interpreted as tag globs

Precondition:
tag is a valid tagmatch

Notes

A single asterisk will replace exactly one dot-delimited component of a tag A double asterisk will replace one or more of any character.

The returned string does not contain a starting '^' or trailing '$'.

synapse.lib.cell module

class synapse.lib.cell.**Cell**

Bases: *Pusher*, *Aware*

A Cell() implements a synapse micro-service.

A Cell has 5 phases of startup:

1. Universal cell data structures
2. Service specific storage/data (pre-nexs)
3. Nexus subsystem initialization
4. Service specific startup (with nexus)
5. Networking and mirror services

BACKUP_SPAWN_TIMEOUT = 60.0

COMMIT = ''

FREE_SPACE_CHECK_FREQ = 60.0

LOGGED_HTTPAPI_HEADERS = ('User-Agent',)

SYSCTL_CHECK_FREQ = 60.0

SYSCTL_VALS = {'vm.dirty_expire_centisecs': 20, 'vm.dirty_writeback_centisecs': 20}

VERSION = (2, 215, 0)

VERSTRING = '2.215.0'

addActiveCoro(*func*, *iden=None*, *base=None*)

Add a function callback to be run as a coroutine when the Cell is active.

Parameters

- **func** (*coroutine function*) – The function run as a coroutine.
- **iden** (*str*) – The iden to use for the coroutine.
- **base** (*Optional[Base]*) – if present, this active coro will be fini'd when the base is fini'd

Returns
A GUID string that identifies the coroutine for delActiveCoro()

Return type
str

> **Note**
>
> This will re-fire the coroutine if it exits and the Cell is still active.

async addDriveItem(*info*, *path=None*, *reldir='00000000000000000000000000000000'*)

async addDrivePath(*path*, *perm=None*, *reldir='00000000000000000000000000000000'*)

Create the given path using the specified permissions.

The specified permissions are only used when creating new directories.

NOTE: We must do this outside the Drive class to allow us to generate
iden and tick but remain nexus compatible.

addHealthFunc(*func*)

Register a callback function to get a HealthCheck object.

addHttpApi(*path*, *ctor*, *info*)

async addHttpSess(*iden*, *info*)

async addHttpsPort(*port*, *host='0.0.0.0'*, *sslctx=None*)

Add a HTTPS listener to the Cell.

Parameters

- **port** (*int*) – The listening port to bind.
- **host** (*str*) – The listening host.
- **sslctx** (*ssl.SSLContext*) – An externally managed SSL Context.

Note

If the SSL context is not provided, the Cell will assume it manages the SSL context it creates for a given listener and will add a reload handler named https:certs to enabled reloading the SSL certificates from disk.

addReloadableSystem(*name: str*, *func: callable*)

Add a reloadable system. This may be dynamically called at at time.

Parameters

- **name** (*str*) – Name of the system.
- **func** – The callable for reloading a given system.

Note

Reload functions take no arguments when they are executed. Values returned by the reload function must be msgpack friendly.

Returns

None

async addRole(*name*, *iden=None*)

async addRoleRule(*iden*, *rule*, *indx=None*, *gateiden=None*)

async addSignalHandlers()

Register SIGTERM/SIGINT signal handlers with the ioloop to fini this object.

async addUser(*name*, *passwd=None*, *email=None*, *iden=None*)

async addUserApiKey(*useriden*, *name*, *duration=None*)

Add an API key for a user.

Notes

The secret API key is only available once.

Parameters

- **useriden** (*str*) – User iden value.

- **name** (*str*) – Name of the API key.
- **duration** (*int or None*) – Duration of time for the API key to be valid (in milliseconds).

Returns
A tuple of the secret API key value and the API key metadata information.

Return type
tuple

async addUserRole(*useriden*, *roleiden*, *indx=None*)

async addUserRule(*iden*, *rule*, *indx=None*, *gateiden=None*)

async behold()

beholder()

async callPeerApi(*todo*, *timeout=None*)
Yield responses from our peers via the AHA gather call API.

async callPeerGenr(*todo*, *timeout=None*)
Yield responses from invoking a generator via the AHA gather API.

cellapi
alias of *CellApi*

checkFreeSpace()

async checkUserApiKey(*key*)
Check if a user API key is valid.

Notes

If the key is not valid, the dictionary will contain a `mesg` key. If the key is valid, the dictionary will contain the user def in a `udef` key, and the key metadata in a `kdef` key.

Parameters
key (*str*) – The API key to check.

Returns
Tuple of two items, a boolean if the key is valid and a dictionary.

Return type
tuple

```
confbase = {'_log_conf': {'description': 'Opaque structure used for logging by
spawned processes.', 'hideconf': True, 'type': 'object'}, 'aha:admin':
{'description': 'An AHA client certificate CN to register as a local admin user.',
'type': 'string'}, 'aha:leader': {'description': 'The AHA service name to claim
as the active instance of a storm service.', 'type': 'string'}, 'aha:name':
{'description': 'The name of the cell service in the aha service registry.',
'type': 'string'}, 'aha:network': {'description': 'The AHA service network.',
'type': 'string'}, 'aha:promotable': {'default': True, 'description': 'Set to
false to prevent this service from being promoted to leader.', 'type': 'boolean'},
'aha:provision': {'description': 'The telepath URL of the aha provisioning
service.', 'items': {'type': 'string'}, 'type': ['string', 'array']},
'aha:registry': {'description': 'The telepath URL of the aha service registry.',
'items': {'type': 'string'}, 'type': ['string', 'array']}, 'aha:svcinfo':
{'description': 'An AHA svcinfo object. If set, this overrides self discovered Aha
service information.', 'hidecmdl': True, 'hidedocs': True, 'properties':
{'urlinfo': {'properties': {'host': {'type': 'string'}, 'port': {'type':
'integer'}, 'schema': {'type': 'string'}}, 'required': ('host', 'port',
'scheme'), 'type': 'object'}}, 'required': ('urlinfo',), 'type': 'object'},
'aha:user': {'description': 'The username of this service when connecting to
others.', 'type': 'string'}, 'auth:anon': {'description': 'Allow anonymous
telepath access by mapping to the given user name.', 'type': 'string'},
'auth:conf': {'description': 'Extended configuration to be used by an alternate
auth constructor.', 'hideconf': True, 'type': 'object'}, 'auth:ctor':
{'description': 'Allow the construction of the cell auth object to be hooked at
runtime.', 'hideconf': True, 'type': 'string'}, 'auth:passwd': {'description':
'Set to <passwd> (local only) to bootstrap the root user password.', 'type':
'string'}, 'auth:passwd:policy': {'description': 'Specify password
policy/complexity requirements.', 'type': 'object'}, 'backup:dir': {'description':
'A directory outside the service directory where backups will be saved. Defaults to
./backups in the service storage directory.', 'type': 'string'}, 'cell:ctor':
{'description': 'An optional python path to the Cell class. Used by stemcell.',
'hideconf': True, 'type': 'string'}, 'cell:guid': {'description': 'An optional
hard-coded GUID to store as the permanent GUID for the service.', 'hideconf': True,
'type': 'string'}, 'dmon:listen': {'description': 'A config-driven way to specify
the telepath bind URL.', 'type': ['string', 'null']}, 'health:sysctl:checks':
{'default': True, 'description': 'Enable sysctl parameter checks and warn if
values are not optimal.', 'type': 'boolean'}, 'https:headers': {'description':
'Headers to add to all HTTPS server responses.', 'hidecmdl': True, 'type':
'object'}, 'https:parse:proxy:remoteip': {'default': False, 'description':
'Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine
requester IP addresses.', 'type': 'boolean'}, 'https:port': {'description': 'A
config-driven way to specify the HTTPS port.', 'type': ['integer', 'null']},
'inaugural': {'description': 'Data used to drive configuration of the service upon
first startup.', 'hidedocs': True, 'properties': {'roles': {'items':
{'additionalProperties': False, 'properties': {'name': {'pattern':
'^(?!all$).+$', 'type': 'string'}, 'rules': {'items': {'items': [{'type':
'boolean'}, {'items': {'type': 'string'}, 'type': 'array'}], 'maxItems': 2,
'minItems': 2, 'type': 'array'}, 'type': 'array'}}, 'required': ['name'],
'type': 'object'}, 'type': 'array'}, 'users': {'items': {'additionalProperties':
False, 'properties': {'admin': {'default': False, 'type': 'boolean'}, 'email':
{'type': 'string'}, 'name': {'pattern': '^(?!root$).+$', 'type': 'string'},
'roles': {'items': {'type': 'string'}, 'type': 'array'}, 'rules': {'items':
{'items': [{'type': 'boolean'}, {'items': {'type': 'string'}, 'type':
'array'}], 'maxItems': 2, 'minItems': 2, 'type': 'array'}, 'type': 'array'}},
'required': ['name'], 'type': 'object'}, 'type': 'array'}}, 'type': 'object'},
'limit:disk:free': {'default': 5, 'description': 'Minimum disk free space
percentage before setting the cell read-only.', 'maximum': 100, 'minimum': 0,
'type': ['integer', 'null']}, 'max:users': {'default': 0, 'description':
'Maximum number of users allowed on system, not including root or locked/archived
users (0 is no limit).', 'minimum': 0, 'type': 'integer'}, 'mirror':
```

confdefs = {}

async configNexsVers()

async cullNexsLog(*offs*)

async delActiveCoro(*iden*)

Remove an Active coroutine previously added with addActiveCoro().

Parameters
iden (*str*) – The iden returned by addActiveCoro()

async delBackup(*name*)

async delDriveData(*iden*, *vers=None*)

async delDriveInfo(*iden*)

async delDriveItemProp(*iden*, *vers*, *path*)

async delHttpSess(*iden*)

async delRole(*iden*)

async delRoleRule(*iden*, *rule*, *gateiden=None*)

async delUser(*iden*)

async delUserApiKey(*iden*)

Delete an existing API key.

Parameters
iden (*str*) – The iden of the API key to delete.

Returns
True indicating the key was deleted.

Return type
bool

async delUserRole(*useriden*, *roleiden*)

async delUserRule(*iden*, *rule*, *gateiden=None*)

async demote(*peers=None*, *timeout=None*)

async dyncall(*iden*, *todo*, *gatekeys=()*)

async dyniter(*iden*, *todo*, *gatekeys=()*)

async classmethod execmain(*argv*, *outp=None*)

The main entry point for running the Cell as an application.

Parameters

- **argv** (*list*) – A list of command line arguments to launch the Cell with.
- **outp** (*s_ouput.OutPut*) – Optional, an output object. No longer used in the default implementation.

Notes

This coroutine waits until the Cell is fini'd or a SIGINT/SIGTERM signal is sent to the process.

Returns
None.

async feedBeholder(*name*, *info*, *gates=None*, *perms=None*)

Feed a named event onto the `cell:beholder` message bus that will sent to any listeners.

Parameters

- **info** (*dict*) – An information dictionary to be sent to any consumers.
- **gates** (*list*) – List of gate idens, whose details will be added to the outbound message(s).
- **perms** (*list*) – List of permission names, whose details will be added to the outbound message(s).

Returns
None

async fini()

Fini override that ensures locking teardown order.

async freeze(*timeout=30*)

async genHttpSess(*iden*)

async genUserOnepass(*iden*, *duration=600000*)

async getAhaInfo()

async getAhaProxy(*timeout=None*, *feats=None*)

async getApiKeys()

Get all API keys in the cell.

Yields
tuple – kdef values

classmethod getArgParser(*conf=None*)

Get an `argparse.ArgumentParser` for the Cell.

Parameters
conf (*s_config.Config*) – Optional, a Config object which

Notes

Boot time configuration data is placed in the argument group called `config`. This adds default `dirn`, `--telepath`, `--https` and `--name` arguements to the argparser instance. Configuration values which have the `hideconf` or `hidecmdl` value set to True are not added to the argparser instance.

Returns
A ArgumentParser for the Cell.

Return type
argparse.ArgumentParser

async getAuthGate(*iden*)

async getAuthGates()

async getAuthRoles()

async getAuthUsers(*archived=False*)

async getBackupInfo()

Gets information about recent backup activity

async getBackups()

getCachedSslCtx(*opts=None*, *verify=None*)

async getCellApi(*link*, *user*, *path*)

Get an instance of the telepath Client object for a given user, link and path.

Parameters

- **link** (*s_link.Link*) – The link object.
- **user** (*s_auth.User*) – The heavy user object.
- **path** (*str*) – The path requested.

Notes

This defaults to the self.cellapi class. Implementors may override the default class attribute for cellapi to share a different interface.

Returns
The shared object for this cell.

Return type
object

getCellIden()

async getCellInfo()

Return metadata specific for the Cell.

Notes

By default, this function returns information about the base Cell implementation, which reflects the base information in the Synapse Cell.

It is expected that implementers override the following Class attributes in order to provide meaningful version information:

COMMIT - A Git Commit VERSION - A Version tuple. VERSTRING - A Version string.

Returns
A Dictionary of metadata.

Return type
Dict

getCellNexsRoot()

async getCellRunId()

classmethod getCellType()

async getConfOpt(*name*)

async getDmonSessions()

getDmonUser()

Return the user IDEN of a telepath caller who invoked the current task. (defaults to returning current root user)

async getDriveData(*iden*, *vers=None*)

Return the data associated with the drive item by iden. If vers is specified, return that specific version.

async getDriveDataVersions(*iden*)

async getDriveInfo(*iden*, *typename=None*)

async getDriveKids(*iden*)

async getDrivePath(*path*, *reldir='00000000000000000000000000000000'*)

Return a list of drive info elements for each step in path.

This may be used as a sort of "open" which returns all the path info entries. You may then operate directly on drive iden entries and/or check easyperm entries on them before you do...

classmethod getEnvPrefix()

Get a list of envar prefixes for config resolution.

async getHealthCheck()

async getHiveKey(*path*)

Get the value of a key in the cell default hive

async getHiveKeys(*path*)

Return a list of (name, value) tuples for nodes under the path.

async getHttpSessDict(*iden*)

getLocalProxy(*share=None*, *user='root'*)

getLocalUrl(*share=None*, *user='root'*)

async getLogExtra(***kwargs*)

Get an extra dictionary for structured logging which can be used as a extra argument for loggers.

Parameters
****kwargs** – Additional key/value items to add to the log.

Returns
A dictionary

Return type
Dict

async getMirrorUrls()

getMyUrl(*user='root'*)

async getNexsIndx()

async getNexusChanges(*offs*, *tellready=False*, *wait=True*)

getPermDef(*perm*)

getPermDefs()

getReloadableSystems()

async getRoleDef(*iden*)

async getRoleDefByName(*name*)

async getRoleDefs()

getSpooledDict()

getSpooledSet()

async getSystemInfo()

Get info about the system in which the cell is running

Returns

- volsize - Volume where cell is running total space
- volfree - Volume where cell is running free space
- backupvolsize - Backup directory volume total space
- backupvolfree - Backup directory volume free space
- cellstarttime - Cell start time in epoch milliseconds
- celluptime - Cell uptime in milliseconds
- cellrealdisk - Cell's use of disk, equivalent to du
- cellapprdisk - Cell's apparent use of disk, equivalent to ls -l
- osversion - OS version/architecture
- pyversion - Python version
- totalmem - Total memory in the system
- availmem - Available memory in the system
- cpucount - Number of CPUs on system
- tmpdir - The temporary directory interpreted by the Python runtime.

Return type

A dictionary with the following keys. All size values are in bytes

async getTask(*iden*, *peers=True*, *timeout=None*)

async getTasks(*peers=True*, *timeout=None*)

async getTeleApi(*link*, *mesg*, *path*)

Return a shared object for this link. :param link: A network link. :type link: synapse.lib.link.Link :param mesg: The tele:syn handshake message. :type mesg: (str,dict)

async getTeleFeats()

getTempDir()

async getUserApiKey(*iden*)

Get a user API key via iden.

Notes

This contains the raw value. Callers are responsible for removing the `shadow` key.

Parameters
iden (*str*) – The key iden.

Returns
The key dictionary; or none.

Return type
dict

async getUserDef(*iden*, *packroles=True*)

async getUserDefByName(*name*)

async getUserDefs()

getUserName(*iden*, *defv='<unknown>'*)
Translate the user iden to a user name.

async getUserProfInfo(*iden*, *name*, *default=None*)

async getUserProfile(*iden*)

async getUserVarValu(*iden*, *name*, *default=None*)

async handoff(*turl*, *timeout=30*)
Hand off leadership to a mirror in a transactional fashion.

async hasHttpSess(*iden*)

classmethod initCellConf(*conf=None*)
Create a Config object for the Cell.

Parameters
conf (*s_config.Config*) – An optional config structure. This has _opts_data taken from it.

Notes

The Config object has a `envar_prefix` set according to the results of `cls.getEnvPrefix()`.

Returns
A Config helper object.

Return type
s_config.Config

async initCellStorage()

async classmethod initFromArgv(*argv*, *outp=None*)
Cell launcher which does automatic argument parsing, environment variable resolution and Cell creation.

Parameters

- **argv** (*list*) – A list of command line arguments to launch the Cell with.
- **outp** (*s_ouput.OutPut*) – Optional, an output object. No longer used in the default implementation.

Notes

This does the following items:

- Create a Config object from the Cell class.
- Creates an Argument Parser from the Cell class and Config object.
- Parses the provided arguments.
- Loads configuration data from the parsed options and environment variables.
- Sets logging for the process.
- Creates the Cell from the Cell Ctor.
- Adds a Telepath listener, HTTPs port listeners and Telepath share names.
- Returns the Cell.

Returns
This returns an instance of the Cell.

Return type
Cell

async initNexusSubsystem()

async initServiceActive()

async initServiceEarly()

async initServiceNetwork()

async initServicePassive()

async initServiceRuntime()

async initServiceStorage()

initSslCtx(*certpath*, *keypath*)

isActiveCoro(*iden*)

async isCellActive()

async isRoleAllowed(*iden*, *perm*, *gateiden=None*)

async isUserAllowed(*iden*, *perm*, *gateiden=None*, *default=False*)

async iterBackupArchive(*name*, *user*)

async iterNewBackupArchive(*user*, *name=None*, *remove=False*)

async iterSlabData(*name*, *prefix=''*)

async iterUserProfInfo(*iden*)

async iterUserVars(*iden*)

async kill(*user*, *iden*)

async killTask(*iden*, *peers=True*, *timeout=None*)

async listHiveKey(*path=None*)

async listUserApiKeys(*useriden*)

Get all the API keys for a user.

Parameters
useriden (*str*) – The user iden.

Returns
A list of kdef values.

Return type
list

async loadHiveTree(*tree*, *path=()*, *trim=False*)

Note: this is for expert emergency use only.

modCellConf(*conf*)

Modify the Cell's ondisk configuration overrides file and runtime configuration.

Parameters
conf (*dict*) – A dictionary of items to set.

Notes

This does require the data being set to be schema valid.

Returns
None.

async modUserApiKey(*iden*, *key*, *valu*)

Update a value in the user API key metadata.

Parameters

- **iden** (*str*) – Iden of the key to update.
- **key** (*str*) – Name of the valu to update.
- **valu** – The new value.

Returns
An updated key metadata dictionary.

Return type
dict

popCellConf(*name*)

Remove a key from the Cell's ondisk configuration overrides file and runtime configuration.

Parameters
name (*str*) – Name of the value to remove.

Notes

This does **not** modify the cell.yaml file. This does re-validate the configuration after removing the value, so if the value removed had a default populated by schema, that default would be reset.

Returns
None

async popHiveKey(*path*)

Remove and return the value of a key in the cell default hive.

Note: this is for expert emergency use only.

async popUserProfInfo(*iden*, *name*, *default=None*)

async popUserVarValu(*iden*, *name*, *default=None*)

async promote(*graceful=False*)

Transform this cell from a passive follower to an active cell that writes changes locally.

async ps(*user*)

async readyToMirror()

async reload(*subsystem=None*)

async reqAhaProxy(*timeout=None*, *feats=None*)

reqDriveInfo(*iden*, *typename=None*)

async reqGateKeys(*gatekeys*)

async resume()

async rotateNexsLog()

runActiveTask(*coro*)

async runBackup(*name=None*, *wait=True*)

async saveHiveTree(*path=()*)

async setCellActive(*active*)

async setCellVers(*name*, *vers*, *nexs=True*)

async setDriveData(*iden*, *versinfo*, *data*)

async setDriveInfoPath(*iden*, *path*)

async setDriveInfoPerm(*iden*, *perm*)

async setDriveItemProp(*iden*, *vers*, *path*, *valu*)

async setHiveKey(*path*, *valu*)

Set or change the value of a key in the cell default hive

async setHttpSessInfo(*iden*, *name*, *valu*)

async setNexsIndx(*indx*)

async setNexsVers(*vers*)

async setRoleName(*iden*, *name*)

async setRoleRules(*iden*, *rules*, *gateiden=None*)

async setUserAdmin(*iden*, *admin*, *gateiden=None*)

async **setUserArchived**(*iden*, *archived*)

async **setUserEmail**(*useriden*, *email*)

async **setUserLocked**(*iden*, *locked*)

async **setUserName**(*useriden*, *name*)

async **setUserPasswd**(*iden*, *passwd*)

async **setUserProfInfo**(*iden*, *name*, *valu*)

async **setUserRoles**(*useriden*, *roleidens*)

async **setUserRules**(*iden*, *rules*, *gateiden=None*)

async **setUserVarValu**(*iden*, *name*, *valu*)

async **shutdown**(*timeout=None*)

Execute a graceful shutdown by allowing any promoted boss tasks to complete and prevents the boss from accepting additional tasks.

async **sync**()

no-op mutable for testing purposes. If I am follower, when this returns, I have received and applied all the writes that occurred on the leader before this call.

async **trimNexsLog**(*consumers=None*, *timeout=30*)

async **tryUserPasswd**(*name*, *passwd*)

async **updateHttpSessInfo**(*iden*, *vals: dict*)

async **waitNexsOffs**(*offs*, *timeout=None*)

class synapse.lib.cell.**CellApi**

Bases: *Base*

addAuthRole(*name*)

addAuthRule(*name*, *rule*, *indx=None*, *gateiden=None*)

This API is deprecated.

addRole(*name*, *iden=None*)

addRoleRule(*iden*, *rule*, *indx=None*, *gateiden=None*)

addUser(*name*, *passwd=None*, *email=None*, *iden=None*)

async **addUserApiKey**(*name*, *duration=None*, *useriden=None*)

addUserRole(*useriden*, *roleiden*, *indx=None*)

addUserRule(*iden*, *rule*, *indx=None*, *gateiden=None*)

async **allowed**(*perm*, *default=None*)

Check if the user has the requested permission.

Parameters

- **perm** – permission path components to check
- **default** – Value returned if no value stored

Examples

Form a path and check the permission from a remote proxy:

```
perm = ('node', 'add', 'inet:ipv4')
allowed = await prox.allowed(perm)
if allowed:
    dostuff()
```

Returns
True if the user has permission, False if explicitly denied, None if no entry

Return type
Optional[bool]

behold()

Yield Cell system messages

checkUserApiKey(*key*)

cullNexsLog(*offs*)

Remove Nexus log entries up to (and including) the given offset.

Note

If there are consumers of this cell's nexus log they must be caught up to at least the offs argument before culling.

Only rotated logs where the last index is less than the provided offset will be removed from disk.

Parameters
offs (*int*) – The offset to remove entries up to.

Returns
Whether the cull was executed

Return type
bool

delAuthRole(*name*)

delAuthRule(*name*, *rule*, *gateiden=None*)

This API is deprecated.

delAuthUser(*name*)

delBackup(*name*)

Delete a backup by name.

Parameters
name (*str*) – The name of the backup to delete.

delRole(*iden*)

delRoleRule(*iden*, *rule*, *gateiden=None*)

delUser(*iden*)

async delUserApiKey(*iden*)

delUserRole(*useriden*, *roleiden*)

delUserRule(*iden*, *rule*, *gateiden=None*)

demote(*timeout=None*)

dyncall(*iden*, *todo*, *gatekeys=()*)

dyniter(*iden*, *todo*, *gatekeys=()*)

freeze(*timeout=30*)

genUserOnepass(*iden*, *duration=60000*)

getAuthGate(*iden*)

getAuthGates()

getAuthInfo(*name*)

This API is deprecated.

getAuthRoles()

getAuthUsers(*archived=False*)

Parameters

archived (*bool*) – If true, list all users, else list non-archived users

getBackupInfo()

Get information about recent backup activity.

Returns

- currduration - If backup currently running, time in ms since backup started, otherwise None
- laststart - Last time (in epoch milliseconds) a backup started
- lastend - Last time (in epoch milliseconds) a backup ended
- lastduration - How long last backup took in ms
- lastsize - Disk usage of last backup completed
- lastupload - Time a backup was last completed being uploaded via iter(New)BackupArchive
- lastexception - Tuple of exception information if last backup failed, otherwise None

Return type

(dict) It has the following keys

Note: these statistics are not persistent, i.e. they are not preserved between cell restarts.

getBackups()

Retrieve a list of backups.

Returns

A list of backup names.

Return type
list[str]

getCellIden()

async getCellInfo()

async getCellRunId()

getCellType()

getCellUser()

getDiagInfo()

getDmonSessions()

getGcInfo()

For diagnostic purposes only!

NOTE: This API is *not* supported and can be removed at any time!

async getHealthCheck()

getHiveKey(*path*)

getHiveKeys(*path*)

getMirrorUrls()

getNexsIndx()

getNexusChanges(*offs*, *tellready=False*, *wait=True*)

getPermDef(*perm*)

Return a specific permission definition.

getPermDefs()

Return a non-comprehensive list of perm definitions.

getReloadableSystems()

getRoleDef(*iden*)

getRoleDefByName(*name*)

getRoleDefs()

async getRoleInfo(*name*)

getSystemInfo()

Get info about the system in which the cell is running

Returns

- volsize - Volume where cell is running total space
- volfree - Volume where cell is running free space
- backupvolsize - Backup directory volume total space
- backupvolfree - Backup directory volume free space

- celluptime - Cell uptime in milliseconds
- cellrealdisk - Cell's use of disk, equivalent to du
- cellapprdisk - Cell's apparent use of disk, equivalent to ls -l
- osversion - OS version/architecture
- pyversion - Python version
- totalmem - Total memory in the system
- availmem - Available memory in the system

Return type
A dictionary with the following keys. All size values are in bytes

getTask(*iden*, *peers=True*, *timeout=None*)

getTasks(*peers=True*, *timeout=None*)

getUserDef(*iden*, *packroles=True*)

getUserDefByName(*name*)

getUserDefs()

async getUserInfo(*name*)

getUserProfInfo(*iden*, *name*)

getUserProfile(*iden*)

handoff(*turl*, *timeout=30*)

async initCellApi()

async isCellActive()
Returns True if the cell is an active/leader cell.

isRoleAllowed(*iden*, *perm*, *gateiden=None*)

isUserAllowed(*iden*, *perm*, *gateiden=None*, *default=False*)

issue(*nexsiden: str*, *event: str*, *args*, *kwargs*, *meta=None*)

iterBackupArchive(*name*)
Retrieve a backup by name as a compressed stream of bytes.

Note: Compression and streaming will occur from a separate process.

Parameters
name (*str*) – The name of the backup to retrieve.

iterNewBackupArchive(*name=None*, *remove=False*)
Run a new backup and return it as a compressed stream of bytes.

Note: Compression and streaming will occur from a separate process.

Parameters

- **name** (*str*) – The name of the backup to retrieve.
- **remove** (*bool*) – Delete the backup after streaming.

async kill(*iden*)

killTask(*iden*, *peers=True*, *timeout=None*)

listHiveKey(*path=None*)

async listUserApiKeys(*useriden=None*)

popHiveKey(*path*)

popUserProfInfo(*iden*, *name*, *default=None*)

promote(*graceful=False*)

async ps()

readyToMirror()

reload(*subsystem=None*)

resume()

rotateNexsLog()

Rotate the Nexus log at the current offset.

Returns
The starting index of the active Nexus log

Return type
int

runBackup(*name=None*, *wait=True*)

Run a new backup.

Parameters

- **name** (*str*) – The optional name of the backup.
- **wait** (*bool*) – On True, wait for backup to complete before returning.

Returns
The name of the newly created backup.

Return type
str

runGcCollect(*generation=2*)

For diagnostic purposes only!

NOTE: This API is *not* supported and can be removed at any time!

saveHiveTree(*path=()*)

setAuthAdmin(*name*, *isadmin*)

This API is deprecated.

setCellUser(*iden*)

Switch to another user (admin only).

This API allows remote admin/service accounts to impersonate a user. Used mostly by services that manage their own authentication/sessions.

setHiveKey(*path*, *valu*)

setRoleRules(*iden*, *rules*, *gateiden=None*)

setUserAdmin(*iden*, *admin*, *gateiden=None*)

setUserArchived(*useriden*, *archived*)

setUserEmail(*useriden*, *email*)

setUserLocked(*useriden*, *locked*)

async setUserPasswd(*iden*, *passwd*)

setUserProfInfo(*iden*, *name*, *valu*)

setUserRoles(*useriden*, *roleidens*)

setUserRules(*iden*, *rules*, *gateiden=None*)

shutdown(*timeout=None*)

trimNexsLog(*consumers=None*, *timeout=60*)

Rotate and cull the Nexus log (and those of any consumers) at the current offset.

> **Note**
>
> If the consumers argument is provided they will first be checked if online before rotating and raise otherwise. After rotation, all consumers must catch-up to the offset to cull at before executing the cull, and will raise otherwise.

Parameters

- **consumers** (*list or None*) – Optional list of telepath URLs for downstream Nexus log consumers.
- **timeout** (*int*) – Time in seconds to wait for downstream consumers to be caught up.

Returns

The offset that the Nexus log was culled up to and including.

Return type

int

tryUserPasswd(*name*, *passwd*)

waitNexsOffs(*offs*, *timeout=None*)

Wait for the Nexus log to write an offset.

Parameters

- **offs** (*int*) – The offset to wait for.
- **timeout** (*int or None*) – An optional timeout in seconds.

Returns

True if the offset was written, False if it timed out.

Return type

bool

synapse.lib.cell.**SSLCTX_CACHE_SIZE = 64**

Base classes for the synapse "cell" microservice architecture.

synapse.lib.cell.**adminapi**(*log=False*)

Decorator for CellApi (and subclasses) for requiring a method to be called only by an admin user.

Parameters
log (*bool*) – If set to True, log the user, function and arguments.

synapse.lib.cell.**from_leader**(*func*)

Decorator used to indicate that the decorated method must call up to the leader to perform it's work.

This only works on Cell classes and subclasses. The decorated method name MUST be the same as the telepath API name.

synapse.lib.certdir module

class synapse.lib.certdir.**CertDir**(*path: str | None = None*)

Bases: object

Certificate loading/generation/signing utilities.

Features:

- Locates and load certificates, keys, and certificate signing requests (CSRs).
- Generates keypairs for users, hosts, and certificate authorities (CAs), supports both signed and self-signed.
- Generates certificate signing requests (CSRs) for users, hosts, and certificate authorities (CAs).
- Signs certificate signing requests (CSRs).
- Generates PKCS#12 archives for use in browser.

Parameters
path (*str*) – Optional path which can override the default path directory.

Notes

- All certificates will be loaded from and written to ~/.syn/certs by default. Set the environment variable SYN_CERT_DIR to override.
- All certificate generation methods create 4096 bit RSA keypairs.
- All certificate signing methods use sha256 as the signature algorithm.
- CertDir does not currently support signing CA CSRs.

addCertPath(**path: str*)

delCertPath(**path: str*)

delHostCsr(*name: str*, *outp: OutPut | None = None*) → bool

Delete an existing host CSR.

Parameters

- **name** – The name of the host CSR.
- **outp** – The output buffer.

Returns
True if the CSR is deleted, False if it did not exist.

Return type
bool

delUserCsr(*name: str*, *outp:* OutPut | *None* = *None*) → bool

Delete an existing user CSR.

Parameters

- **name** – The name of the user CSR.
- **outp** – The output buffer.

Returns
True if the CSR is deleted, False if it did not exist.

Return type
bool

genCaCert(*name: str*, *signas: str* | *None* = *None*, *outp:* OutPut | *None* = *None*, *save: bool* = *True*) → Tuple[RSAPrivateKey, Certificate]

Generates a CA keypair.

Parameters

- **name** – The name of the CA keypair.
- **signas** – The CA keypair to sign the new CA with.
- **outp** – The output buffer.
- **save** – Save the certificate and key to disk.

Examples

Make a CA named "myca":

```
mycakey, mycacert = cdir.genCaCert('myca')
```

Returns
Tuple containing the private key and certificate objects.

genCaCrl(*name: str*) → *Crl*

Get the CRL for a given CA.

Parameters
name – The CA name.

Returns
The CRL object.

genClientCert(*name: str*, *outp:* OutPut | *None* = *None*) → None

Generates a user PKCS #12 archive.

Please note that the resulting file will contain private key material.

Parameters

- **name** (*str*) – The name of the user keypair.
- **outp** (*synapse.lib.output.Output*) – The output buffer.

Examples

Make the PKC12 object for user "myuser":

```
myuserpkcs12 = cdir.genClientCert('myuser')
```

Returns
None

genCodeCert(*name: str*, *signas: str | None = None*, *outp: OutPut | None = None*, *save: bool = True*) → Tuple[RSAPrivateKey, Certificate]

Generates a code signing keypair.

Parameters

- **name** – The name of the code signing cert.
- **signas** – The CA keypair to sign the new code keypair with.
- **outp** – The output buffer.

Examples

Generate a code signing cert for the name "The Vertex Project":

```
myuserkey, myusercert = cdir.genCodeCert('The Vertex Project')
```

Returns
Tuple containing the key and certificate objects.

genCrlPath(*name: str*) → str

genHostCert(*name: str*, *signas: str | None = None*, *outp: OutPut | None = None*, *csr: DHPublicKey | DSAPublicKey | RSAPublicKey | EllipticCurvePublicKey | Ed25519PublicKey | Ed448PublicKey | X25519PublicKey | X448PublicKey | None = None*, *sans: str | None = None*, *save: bool = True*) → Tuple[RSAPrivateKey | None, Certificate]

Generates a host keypair.

Parameters

- **name** – The name of the host keypair.
- **signas** – The CA keypair to sign the new host keypair with.
- **outp** – The output buffer.
- **csr** – The CSR public key when generating the keypair from a CSR.
- **sans** – String of comma separated alternative names.

Examples

Make a host keypair named "myhost":

```
myhostkey, myhostcert = cdir.genHostCert('myhost')
```

Returns
Tuple containing the private key and certificate objects. Private key may be None when signing a CSR.

genHostCsr(*name: str*, *outp: OutPut | None = None*) → bytes

Generates a host certificate signing request.

Parameters

- **name** – The name of the host CSR.
- **outp** – The output buffer.

Examples

Generate a CSR for the host key named "myhost":

```
cdir.genHostCsr('myhost')
```

Returns

The bytes of the CSR.

genUserCert(*name: str*, *signas: str | None = None*, *outp: OutPut | None = None*, *csr: DHPublicKey | DSAPublicKey | RSAPublicKey | EllipticCurvePublicKey | Ed25519PublicKey | Ed448PublicKey | X25519PublicKey | X448PublicKey | None = None*, *save: bool = True*) → Tuple[RSAPrivateKey | None, Certificate]

Generates a user keypair.

Parameters

- **name** – The name of the user keypair.
- **signas** – The CA keypair to sign the new user keypair with.
- **outp** – The output buffer.
- **csr** – The CSR public key when generating the keypair from a CSR.

Examples

Generate a user cert for the user "myuser":

```
myuserkey, myusercert = cdir.genUserCert('myuser')
```

Returns

Tuple containing the key and certificate objects.

genUserCsr(*name: str*, *outp: OutPut | None = None*) → bytes

Generates a user certificate signing request.

Parameters

- **name** – The name of the user CSR.
- **outp** – The output buffer.

Examples

Generate a CSR for the user "myuser":

```
cdir.genUserCsr('myuser')
```

Returns
The bytes of the CSR.

getCaCert(*name: str*) → Certificate | None

Loads the X509 object for a given CA.

Parameters
name – The name of the CA keypair.

Examples

Get the certificate for the CA "myca":

```
mycacert = cdir.getCaCert('myca')
```

Returns
The certificate, if exists.

getCaCertBytes(*name: str*) → bytes

getCaCertPath(*name: str*) → str | None

Gets the path to a CA certificate.

Parameters
name – The name of the CA keypair.

Examples

Get the path to the CA certificate for the CA "myca":

```
mypath = cdir.getCACertPath('myca')
```

Returns
The path, if exists.

getCaCerts() → List[Certificate]

Return a list of CA certs from the CertDir.

Returns
List of CA certificates.

getCaKey(*name*) → RSAPrivateKey | DSAPrivateKey | None

Loads the PKey object for a given CA keypair.

Parameters
name – The name of the CA keypair.

Examples

Get the private key for the CA "myca":

```
mycakey = cdir.getCaKey('myca')
```

Returns
The private key, if exists.

getCaKeyPath(*name: str*) → str | None

Gets the path to a CA key.

Parameters
name – The name of the CA keypair.

Examples

Get the path to the private key for the CA "myca":

```
mypath = cdir.getCAKeyPath('myca')
```

Returns
The path, if exists.

getClientCert(*name: str*) → PKCS12KeyAndCertificates | None

Loads the PKCS12 archive object for a given user keypair.

Parameters
name – The name of the user keypair.

Examples

Get the PKCS12 object for the user "myuser":

```
mypkcs12 = cdir.getClientCert('myuser')
```

Notes

The PKCS12 archive will contain private key material if it was created with CertDir or the easycert tool

Returns
The PKCS12 archive, if exists.

getClientCertPath(*name: str*) → str | None

Gets the path to a client certificate.

Parameters
name – The name of the client keypair.

Examples

Get the path to the client certificate for "myuser":

```
mypath = cdir.getClientCertPath('myuser')
```

Returns
The path, if exists.

getClientSSLContext(*certname: str | None = None*) → SSLContext

Returns an ssl.SSLContext appropriate for initiating a TLS session

Parameters
certname – If specified, use the user certificate with the matching name to authenticate to the remote service.

Returns
A SSLContext object.

getCodeCert(*name: str*) → Certificate | None

getCodeCertPath(*name: str*) → str | None

getCodeKey(*name: str*) → *PriKey* | None

getCodeKeyPath(*name: str*) → str | None

getCrlPath(*name: str*) → str | None

getHostCaPath(*name: str*) → str | None

Gets the path to the CA certificate that issued a given host keypair.

Parameters
name – The name of the host keypair.

Examples

Get the path to the CA cert which issue the cert for "myhost":

```
mypath = cdir.getHostCaPath('myhost')
```

Returns
The path, if exists.

getHostCert(*name: str*) → Certificate | None

Loads the X509 object for a given host keypair.

Parameters
name – The name of the host keypair.

Examples

Get the certificate object for the host "myhost":

```
myhostcert = cdir.getHostCert('myhost')
```

Returns
The certificate, if exists.

getHostCertHash(*name: str*) → str | None

getHostCertPath(*name: str*) → str | None

Gets the path to a host certificate.

Parameters
name – The name of the host keypair.

Examples

Get the path to the host certificate for the host "myhost":

```
mypath = cdir.getHostCertPath('myhost')
```

Returns
The path, if exists.

getHostCsrPath(*name: str*) → str | None

getHostKey(*name: str*) → RSAPrivateKey | DSAPrivateKey | None

Loads the PKey object for a given host keypair.

Parameters
name – The name of the host keypair.

Examples

Get the private key object for the host "myhost":

```
myhostkey = cdir.getHostKey('myhost')
```

Returns
The private key, if exists.

getHostKeyPath(*name: str*) → str | None

Gets the path to a host key.

Parameters
name – The name of the host keypair.

Examples

Get the path to the host key for the host "myhost":

```
mypath = cdir.getHostKeyPath('myhost')
```

Returns
The path if exists.

Return type
str

getServerSSLContext(*hostname: str | None = None*, *caname: str | None = None*) → SSLContext

Returns an ssl.SSLContext appropriate to listen on a socket

Parameters

- **hostname** – If None, the value from socket.gethostname is used to find the key in the servers directory. This name should match the not-suffixed part of two files ending in .key and .crt in the hosts subdirectory.
- **caname** – If not None, the given name is used to locate a CA certificate used to validate client SSL certs.

Returns
A SSLContext object.

getUserCaPath(*name: str*) → str | None

Gets the path to the CA certificate that issued a given user keypair.

Parameters
name – The name of the user keypair.

Examples

Get the path to the CA cert which issue the cert for "myuser":

```
mypath = cdir.getUserCaPath('myuser')
```

Returns
The path, if exists.

getUserCert(*name: str*) → Certificate | None

Loads the X509 object for a given user keypair.

Parameters
name – The name of the user keypair.

Examples

Get the certificate object for the user "myuser":

```
myusercert = cdir.getUserCert('myuser')
```

Returns
The certificate, if exists.

getUserCertPath(*name: str*) → str | None

Gets the path to a user certificate.

Parameters
name (*str*) – The name of the user keypair.

Examples

Get the path for the user cert for "myuser":

```
mypath = cdir.getUserCertPath('myuser')
```

Returns
The path, if exists.

getUserCsrPath(*name: str*) → str | None

getUserForHost(*user: str*, *host: str*) → str | None

Gets the name of the first existing user cert for a given user and host.

Parameters

- **user** – The name of the user.
- **host** – The name of the host.

Examples

Get the name for the "myuser" user cert at "cool.vertex.link":

```
usercertname = cdir.getUserForHost('myuser', 'cool.vertex.link')
```

Returns
The cert name, if exists.

Return type
str

getUserKey(*name: str*) → RSAPrivateKey | DSAPrivateKey | None

Loads the PKey object for a given user keypair.

Parameters
name – The name of the user keypair.

Examples

Get the key object for the user key for "myuser":

```
myuserkey = cdir.getUserKey('myuser')
```

Returns
The private key, if exists.

getUserKeyPath(*name: str*) → str | None

Gets the path to a user key.

Parameters
name – The name of the user keypair.

Examples

Get the path to the user key for "myuser":

```
mypath = cdir.getUserKeyPath('myuser')
```

Returns
The path, if exists.

importFile(*path: str*, *mode: str*, *outp:* OutPut | *None* = *None*) → None

Imports certs and keys into the Synapse cert directory

Parameters

- **path** – The path of the file to be imported.
- **mode** – The certdir subdirectory to import the file into.

Examples

Import CA certifciate 'mycoolca.crt' to the 'cas' directory:

```
certdir.importFile('mycoolca.crt', 'cas')
```

Notes

importFile does not perform any validation on the files it imports.

Returns
None

isCaCert(*name: str*) → bool

Checks if a CA certificate exists.

Parameters
name – The name of the CA keypair.

Examples

Check if the CA certificate for "myca" exists:

```
exists = cdir.isCaCert('myca')
```

Returns
True if the certificate is present, False otherwise.

isClientCert(*name: str*) → bool

Checks if a user client certificate (PKCS12) exists.

Parameters
name – The name of the user keypair.

Examples

Check if the client certificate "myuser" exists:

```
exists = cdir.isClientCert('myuser')
```

Returns
True if the certificate is present, False otherwise.

isCodeCert(*name: str*) → bool

Checks if a code certificate exists.

Parameters
name – The name of the code keypair.

Examples

Check if the code cert "mypipeline" exists:

```
exists = cdir.isCodeCert('mypipeline')
```

Returns
True if the certificate is present, False otherwise.

isHostCert(*name: str*) → bool

Checks if a host certificate exists.

Parameters
name – The name of the host keypair.

Examples

Check if the host cert "myhost" exists:

```
exists = cdir.isUserCert('myhost')
```

Returns
True if the certificate is present, False otherwise.

isUserCert(*name: str*) → bool

Checks if a user certificate exists.

Parameters
name – The name of the user keypair.

Examples

Check if the user cert "myuser" exists:

```
exists = cdir.isUserCert('myuser')
```

Returns
True if the certificate is present, False otherwise.

loadCertByts(*byts: bytes*) → Certificate

Load a X509 certificate from its PEM encoded bytes.

Parameters
byts – The PEM encoded bytes of the certificate.

Returns
The X509 certificate.

Raises
BadCertBytes – If the certificate bytes are invalid.

saveCaCertByts(*byts: bytes*) → str

saveCertPem(*cert: Certificate*, *path: str*) → None

Save a certificate in PEM format to a file outside the certdir.

saveCodeCertBytes(*byts: bytes*) → str

saveHostCertByts(*byts: bytes*) → str

savePkeyPem(*pkey: DHPrivateKey | Ed25519PrivateKey | Ed448PrivateKey | RSAPrivateKey | DSAPrivateKey | EllipticCurvePrivateKey | X25519PrivateKey | X448PrivateKey*, *path: str*) → None

Save a private key in PEM format to a file outside the certdir.

saveUserCertByts(*byts: bytes*) → str

selfSignCert(*builder: CertificateBuilder*, *pkey: RSAPrivateKey | DSAPrivateKey*) → Certificate

Self-sign a certificate.

Parameters

- **cert** – The certificate to sign.

- **pkey** – The PKey with which to sign the certificate.

Examples

Sign a given certificate with a given private key:

```
cdir.selfSignCert(mycert, myotherprivatekey)
```

Returns
None

signCertAs(*builder: CertificateBuilder*, *signas: str*) → Certificate

Signs a certificate with a CA keypair.

Parameters

- **cert** – The certificate to sign.
- **signas** – The CA keypair name to sign the new keypair with.

Examples

Sign a certificate with the CA "myca":

```
cdir.signCertAs(mycert, 'myca')
```

Returns
None

signHostCsr(*xcsr: CertificateSigningRequest*, *signas: str*, *outp: OutPut | None = None*, *sans: str | None = None*, *save: bool = True*) → Tuple[RSAPrivateKey | None, Certificate]

Signs a host CSR with a CA keypair.

Parameters

- **xcsr** – The certificate signing request.
- **signas** – The CA keypair name to sign the CSR with.
- **outp** – The output buffer.
- **sans** – List of subject alternative names.

Examples

Sign a host key with the CA "myca":

```
cdir.signHostCsr(mycsr, 'myca')
```

Returns
Tuple containing the public key and certificate objects.

signUserCsr(*xcsr: CertificateSigningRequest*, *signas: str*, *outp: OutPut | None = None*, *save: bool = True*) → Tuple[RSAPrivateKey | None, Certificate]

Signs a user CSR with a CA keypair.

Parameters

- **xcsr** – The certificate signing request.
- **signas** – The CA keypair name to sign the CSR with.
- **outp** – The output buffer.

Examples

Sign a user CSR with "myca":

```
cdir.signUserCsr(mycsr, 'myca')
```

Returns
Tuple containing the public key and certificate objects.

Return type
((OpenSSL.crypto.PKey, OpenSSL.crypto.X509))

valCodeCert(*byts: bytes*) → Certificate

Verify a code cert is valid according to certdir's available CAs and CRLs.

Parameters
byts – The certificate bytes.

Raises
s_exc.BadCertVerify if we are unable to verify the certificate. –

Returns
The certificate.

valUserCert(*byts: bytes*, *cacerts: List[Certificate] | None = None*) → Certificate

Validate the PEM encoded x509 user certificate bytes and return it.

Parameters

- **byts** – The bytes for the User Certificate.
- **cacerts** – A tuple of CA Certificates to use for validating the user cert.

Raises
BadCertVerify – If the certificate is not valid.

Returns
The certificate, if it is valid.

class synapse.lib.certdir.**Crl**(*cdir*, *name*)

Bases: object

revoke(*cert: Certificate*) → None

Revoke a certificate with the CRL.

Parameters
cert – The certificate to revoke.

Returns
None

synapse.lib.certdir.**addCertPath**(*path*)

synapse.lib.certdir.**delCertPath**(*path*)

synapse.lib.certdir.**getCertDir**() → *CertDir*

Get the singleton CertDir instance.

Returns
A certdir object.

Return type
CertDir

synapse.lib.certdir.**getCertDirn**() → str

Get the expanded default path used by the singleton CertDir instance.

Returns
The path string.

Return type
str

synapse.lib.certdir.**getServerSSLContext**() → SSLContext

Get a server SSLContext object.

This object has a minimum TLS version of 1.2, a subset of ciphers in use, and disabled client renegotiation.

This object has no certificates loaded in it.

Returns
The context object.

Return type
ssl.SSLContext

synapse.lib.certdir.**iterFqdnUp**(*fqdn*)

synapse.lib.chop module

synapse.lib.chop.**TagMatchRe = regex.Regex('([\\w*]+\\.)*[\\w*]+', flags=regex.V0)**

Shared primitive routines for chopping up strings and values.

synapse.lib.chop.**cvss2_normalize**(*vect*)

Helper function to normalize CVSS2 vectors

synapse.lib.chop.**cvss3x_normalize**(*vect*)

Helper function to normalize CVSS3.X vectors

synapse.lib.chop.**cvss_normalize**(*vdict*, *vers*)

Normalize CVSS vectors

synapse.lib.chop.**cvss_validate**(*vect*, *vers*)

Validate (as best as possible) the CVSS vector string. Look for issues such as:

- No duplicated metrics
- Invalid metrics
- Invalid metric values
- Missing mandatory metrics

Returns a dictionary with the parsed metric:value pairs.

synapse.lib.chop.**digits**(*text*)

synapse.lib.chop.**hexstr**(*text*)

Ensure a string is valid hex.

Parameters
text (*str*) – String to normalize.

Examples

Norm a few strings:

hexstr('0xff00') hexstr('ff00')

Notes

Will accept strings prefixed by '0x' or '0X' and remove them.

Returns
Normalized hex string.

Return type
str

synapse.lib.chop.**intstr**(*text*)

synapse.lib.chop.**onespace**(*text*)

synapse.lib.chop.**printables**(*text*)

synapse.lib.chop.**replaceUnicodeDashes**(*valu*)

Replace unicode dashes in a string with regular dashes.

Parameters
valu (*str*) – A string.

Returns
A new string with replaced dashes.

Return type
str

synapse.lib.chop.**stormstring**(*s*)

Make a string storm safe by escaping backslashes and double quotes.

Parameters
s (*str*) – String to make storm safe.

Notes

This does not encapsulate a string in double quotes.

Returns
A string which can be embedded directly into a storm query.

Return type
str

synapse.lib.chop.**tag**(*text*)

synapse.lib.chop.**tagpath**(*text*)

synapse.lib.chop.**tags**(*norm*)

Divide a normalized tag string into hierarchical layers.

synapse.lib.chop.**uncnorm**(*valu*)

Validate and normalize the UNC path passed in *valu* into a URI.

This function will accept *@SSL* and *@<port>* as part of the host name to indicate SSL (https) or a specific port number. It can also accept IPv6 addresses in the host name even though those are non-standard according to the spec.

synapse.lib.chop.**validateTagMatch**(*tag*)

Raises an exception if tag is not a valid tagmatch (i.e. a tag that might have globs)

synapse.lib.cli module

class synapse.lib.cli.**Cli**

Bases: *Base*

A modular / event-driven CLI base object.

addCmdClass(*ctor*, ***opts*)

Add a Cmd subclass to this cli.

async addSignalHandlers()

Register SIGINT signal handler with the ioloop to cancel the currently running cmdloop task. Removes the handler when the cli is fini'd.

get(*name*, *defval=None*)

getCmdByName(*name*)

Return a Cmd instance by name.

getCmdNames()

Return a list of all the known command names for the CLI.

getCmdPrompt()

Get the command prompt.

Returns
Configured command prompt

Return type
str

histfile = 'cmdr_history'

initCmdClasses()

printf(*mesg*, *addnl=True*, *color=None*)

async prompt(*text=None*)

Prompt for user input from stdin.

async runCmdLine(*line*)

Run a single command line.

Parameters
line (*str*) – Line to execute.

Examples

Execute the 'woot' command with the 'help' switch:

await cli.runCmdLine('woot –help')

Returns
Arbitrary data from the cmd class.

Return type
object

async runCmdLoop()

Run commands from a user in an interactive fashion until fini() or EOFError is raised.

set(*name*, *valu*)

class synapse.lib.cli.**Cmd**(*cli*, ***opts*)

Bases: `object`

Base class for modular commands in the synapse CLI.

getCmdBrief()

Return the single-line description for this command.

getCmdDoc()

Return the help/doc output for this command.

getCmdItem()

Get a reference to the object we are commanding.

getCmdName()

getCmdOpts(*text*)

Use the _cmd_syntax def to split/parse/normalize the cmd line.

Parameters
text (*str*) – Command to process.

Notes

This is implemented independent of argparse (et al) due to the need for syntax aware argument splitting. Also, allows different split per command type

Returns
An opts dictionary.

Return type
dict

printf(*mesg*, *addnl=True*, *color=None*)

async runCmdLine(*line*)

Run a line of command input for this command.

Parameters
line (*str*) – Line to execute

Examples

Run the foo command with some arguments:

await foo.runCmdLine('foo –opt baz woot.com')

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.lib.cli.**CmdHelp**(*cli*, ***opts*)

Bases: *Cmd*

List commands and display help output.

Example

help foocmd

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.lib.cli.**CmdLocals**(*cli*, ***opts*)

Bases: *Cmd*

List the current locals for a given CLI object.

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.lib.cli.**CmdQuit**(*cli*, ***opts*)

Bases: *Cmd*

Quit the current command line interpreter.

Example

quit

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

synapse.lib.cmd module

class synapse.lib.cmd.**Parser**(*prog=None*, *outp=<synapse.lib.output.OutPut object>*, ***kwargs*)

Bases: ArgumentParser

exit(*status=0*, *message=None*)

Argparse expects exit() to be a terminal function and not return. As such, this function must raise an exception instead.

synapse.lib.cmd.**exitmain**(*func*)

async synapse.lib.cmd.**wrapmain**(*func*)

synapse.lib.cmdr module

async synapse.lib.cmdr.**getItemCmdr**(*cell*, *outp=None*, *color=False*, ***opts*)

Construct and return a cmdr for the given remote cell.

Parameters

- **cell** – Cell proxy being commanded.
- **outp** – Output helper object.
- **color** (*bool*) – If true, enable colorized output.
- ****opts** – Additional options pushed into the Cmdr locs.

Examples

Get the cmdr for a proxy:

```
cmdr = await getItemCmdr(foo)
```

Returns
A Cli instance with Cmds loaeded into it.

Return type
s_cli.Cli

async synapse.lib.cmdr.**runItemCmdr**(*item*, *outp=None*, *color=False*, ***opts*)

Create a cmdr for the given item and run the cmd loop.

Parameters

- **item** – Cell proxy being commanded.
- **outp** – Output helper object.
- **color** (*bool*) – If true, enable colorized output.
- ****opts** – Additional options pushed into the Cmdr locs.

Notes

This function does not return while the command loop is run.

Examples

Run the Cmdr for a proxy:

```
await runItemCmdr(foo)
```

Returns
This function returns None.

Return type
None

synapse.lib.config module

class synapse.lib.config.**Config**(*schema*, *conf=None*, *envar_prefixes=None*)

Bases: MutableMapping

Synapse configuration helper based on JSON Schema.

Parameters

- **schema** (*dict*) – The JSON Schema (draft v7) which to validate configuration data against.
- **conf** (*dict*) – Optional, a set of configuration data to preload.
- **envar_prefixes** (*list*) – Optional, a list of prefix strings used when collecting configuration data from environment variables.

Notes

This class implements the collections.abc.MutableMapping class, so it may be used where a dictionary would otherwise be used.

The default values provided in the schema must be able to be recreated from the repr() of their Python value.

Default values are not loaded into the configuration data until the `reqConfValid()` method is called.

asDict()

Get a copy of configuration data.

Returns
A copy of the configuration data.

Return type
dict

getArgParseArgs()

getCmdlineMapping()

classmethod getConfFromCell(*cell*, *conf=None*, *envar_prefixes=None*)

Get a Config object from a Cell directly (either the ctor or the instance thereof).

Returns
A Config object.

Return type
Config

getEnvarMapping(*prefix=None*)

Get a mapping of config values to envars.

Configuration values which have the `hideconf` value set to True are not resolved from environment variables.

req(*key*)

Get a configuration value. If that value is not present in the schema or is not set, then raise an exception.

Parameters
key (*str*) – The key to require.

Returns
The requested value.

reqConfValid()

Validate that the loaded configuration data is valid according to the schema.

Notes

The validation set does set any default values which are not currently set for configuration options.

Returns
This returns nothing.

Return type
None

`reqConfValu`(*key*)

Deprecated. Use `req(key)` API instead.

`reqKeyValid`(*key*, *value*)

Test if a key is valid for the provided schema it is associated with.

Parameters

- **key** (*str*) – Key to check.
- **value** – Value to check.

Raises

- ***BadArg*** – If the key has no associated schema.
- ***BadConfValu*** – If the data is not schema valid.

Returns
None when valid.

`setConfFromEnvs`()

Set configuration options from environment variables.

Notes

Environment variables are resolved from configuration options after doing the following transform:

- Replace `:` characters with `_`.
- Add a config provided prefix, if set.
- Uppercase the string.
- Resolve the environment variable
- If the environment variable is set, set the config value to the results of `yaml.yaml_safeload()` on the value.

Configuration values which have the `hideconf` value set to True are not resolved from environment variables.

Examples

For the configuration value `auth:passwd`, the environment variable is resolved as `AUTH_PASSWD`. With the prefix `cortex`, the the environment variable is resolved as `CORTEX_AUTH_PASSWD`.

Returns
Returns a dictionary of values which were set from enviroment variables.

Return type
dict

setConfFromFile(*path*, *force=False*)

Set the opts for a conf object from YAML file path.

Parameters

- **path** (*str*) – Path to the yaml load. If it exists, it must represent a dictionary.
- **force** (*bool*) – Force the update instead of using setdefault() behavior.

Returns
None

setConfFromOpts(*opts=None*)

Set the opts for a conf object from a namespace object.

Parameters

- **opts** (*argparse.Namespace*) – A Namespace object made from parsing args with an ArgumentParser
- **getArgumentParser.** (*made with*)

Returns
Returns None.

Return type
None

synapse.lib.config.**getJsSchema**(*confbase*, *confdefs*)

Generate a Synapse JSON Schema for a Cell using a pair of confbase and confdef values.

Parameters

- **confbase** (*dict*) – A JSON Schema dictionary of properties for the object. This content has precedence over the confdefs argument.
- **confdefs** (*dict*) – A JSON Schema dictionary of properties for the object.

Notes

This generated a JSON Schema draft 7 schema for a single object, which does not allow for additional properties to be set on it. The data in confdefs is implementer controlled and is welcome to specify

Returns
A complete JSON schema.

Return type
dict

synapse.lib.config.**getJsValidator**(*schema*, *use_default=True*, *handlers={'http': <function localSchemaRefHandler>, 'https': <function localSchemaRefHandler>}*)

Get a fastjsonschema callable.

Parameters

- **schema** (*dict*) – A JSON Schema object.
- **use_default** (*bool*) – Whether to insert “default” key arguments into the validated data structure.

Returns
A callable function that can be used to validate data against the json schema.

Return type
callable

synapse.lib.config.**localSchemaRefHandler**(*uri*)

This function parses the given URI to get the path component and then tries to resolve the referenced schema from the 'jsonschemas' directory of synapse.data.

synapse.lib.config.**make_envar_name**(*key*, *prefix=None*)

Convert a colon delimited string into an uppercase, underscore delimited string.

Parameters

- **key** (*str*) – Config key to convert.
- **prefix** (*str*) – Optional string prefix to prepend the the config key.

Returns
The string to lookup against a envar.

Return type
str

synapse.lib.const module

synapse.lib.coro module

Async/Coroutine related utilities.

class synapse.lib.coro.**Event**

Bases: Event

async timewait(*timeout=None*)

class synapse.lib.coro.**GenrHelp**(*genr*)

Bases: object

async list()

async spin()

async synapse.lib.coro.**agen**(*item*)

Wrap an async_generator *or* generator in an async_generator.

Notes

Do not use this for a synchronous generator which would cause non-blocking IO; otherwise that IO will block the ioloop.

async synapse.lib.coro.**await_bg_tasks**(*timeout=None*)

async synapse.lib.coro.**chunks**(*genr*, *size=100*)

synapse.lib.coro.**create_task**(*coro*)

async synapse.lib.coro.**event_wait**(*event: Event*, *timeout=None*)

Wait on an an asyncio event with an optional timeout

Returns
true if the event got set, False if timed out

synapse.lib.coro.**executor**(*func*, **args*, ***kwargs*)

Execute a non-coroutine function in the ioloop executor pool.

Parameters

- **func** – Function to execute.
- ***args** – Args for the function.
- ****kwargs** – Kwargs for the function.

Examples

Execute a blocking API call in the executor pool:

```
import requests

def block(url, params=None):
    return requests.get(url, params=params).json()

fut = s_coro.executor(block, 'http://some.tld/thign')
resp = await fut
```

Returns
An asyncio future.

Return type
asyncio.Future

async synapse.lib.coro.**forked**(*func*, **args*, ***kwargs*)

Execute a target function in the shared forked process pool and fallback to running in a spawned process if the pool is unavailable.

Parameters

- **func** – The target function.
- ***args** – Function positional arguments.
- ****kwargs** – Function keyword arguments.

Returns
The target function return.

synapse.lib.coro.**genrhelp**(*f*)

synapse.lib.coro.**iscoro**(*item*)

async synapse.lib.coro.**ornot**(*func*, **args*, ***kwargs*)

Calls func and awaits it if a returns a coroutine.

> **Note**
>
> This is useful for implementing a function that might take a telepath proxy object or a local object, and you must call a non-async method on that object.
>
> This is also useful when calling a callback that might either be a coroutine function or a regular function.

Usage:
ok = await s_coro.ornot(maybeproxy.allowed, 'path')

async synapse.lib.coro.**pause**(*genr*, *iterations=10*)

async synapse.lib.coro.**semafork**(*func*, **args*, ***kwargs*)

Execute a target function in the shared forked process pool gated by a semaphore to ensure there are workers reserved for the Storm parser.

Parameters

- **func** – The target function.
- ***args** – Function positional arguments.
- ****kwargs** – Function keyword arguments.

Returns
The target function return.

synapse.lib.coro.**set_pool_logging**(*logger_*, *logconf*)

async synapse.lib.coro.**spawn**(*todo*, *timeout=None*, *ctx=None*, *log_conf=None*)

Run a todo (func, args, kwargs) tuple in a multiprocessing subprocess.

Parameters

- **todo** (*tuple*) – A tuple of function, *args, and **kwargs.
- **timeout** (*int*) – The timeout to wait for the todo function to finish.
- **ctx** (*multiprocess.Context*) – A optional multiprocessing context object.
- **log_conf** (*dict*) – An optional logging configuration for the spawned process.

Notes

The contents of the todo tuple must be able to be pickled for execution. This means that locally bound functions are not eligible targets for spawn.

Returns
The return value of executing the todo function.

async synapse.lib.coro.**waittask**(*task*, *timeout=None*)

Await a task without cancelling it when you time out.

Returns
True if the task completed before the timeout.

Return type
boolean

synapse.lib.datfile module

Utilities for handling data files embedded within python packages.

synapse.lib.datfile.**openDatFile**(*datpath*)

Open a file-like object using a pkg relative path.

Example

fd = openDatFile('foopkg.barpkg/wootwoot.bin')

synapse.lib.drive module

class synapse.lib.drive.**Drive**

Bases: *Base*

Drive is a hierarchical storage abstraction which:

- Provides enveloping which includes meta data for each item: * creator iden / time * updated iden / time / version * number of children * data type for the item * easy perms (enforcement is up to the caller)
- Enforces schemas for data
- Allows storage of historical versions of data
- Provides a "path traversal" based API
- Provides an iden based API that does not require traversal

async addItemInfo(*info*, *path=None*, *reldir='00000000000000000000000000000000'*)

Add a new item at the specified path relative to reldir.

delItemData(*iden*, *vers=None*)

async delItemInfo(*iden*)

Recursively remove the info and all associated data versions.

getItemData(*iden*, *vers=None*)

Return a (versinfo, data) tuple for the given iden. If version is not specified, the current version is returned.

async getItemDataVersions(*iden*)

Yield data version info in reverse created order.

getItemInfo(*iden*, *typename=None*)

async getItemKids(*iden*)

Yield each of the children of the specified item.

async getItemPath(*iden*)

async getItemsByType(*typename*)

async getPathInfo(*path*, *reldir='00000000000000000000000000000000'*)

Return a list of item info for each step in the given path relative to rootdir.

This API is designed to allow the caller to retrieve the path info and potentially check permissions on each level to control access.

getPathNorm(*path*)

getStepInfo(*iden*, *name*)

getTypeSchema(*typename*)

getTypeSchemaVersion(*typename*)

getTypeValidator(*typename*)

hasItemInfo(*iden*)

async hasPathInfo(*path*, *reldir='00000000000000000000000000000000'*)

Check for a path existing relative to reldir.

reqFreeStep(*iden*, *name*)

reqItemInfo(*iden*, *typename=None*)

reqTypeValidator(*typename*)

reqValidData(*typename*, *item*)

async setItemData(*iden*, *versinfo*, *data*)

async setItemPath(*iden*, *path*)

Move an existing item to the given path.

setItemPerm(*iden*, *perm*)

async setTypeSchema(*typename*, *schema*, *callback=None*, *vers=None*)

async walkItemInfo(*iden*)

async walkPathInfo(*path*, *reldir='00000000000000000000000000000000'*)

synapse.lib.drive.**getVersIndx**(*vers*)

synapse.lib.drive.**reqValidName**(*name*)

synapse.lib.dyndeps module

synapse.lib.dyndeps.**getDynLocal**(*name*)

Dynamically import a python module and return a local.

Example

cls = getDynLocal('foopkg.barmod.BlahClass') blah = cls()

synapse.lib.dyndeps.**getDynMeth**(*name*)

Retrieve and return an unbound method by python path.

synapse.lib.dyndeps.**getDynMod**(*name*)

Dynamically import a python module and return a ref (or None).

Example

mod = getDynMod('foo.bar')

synapse.lib.dyndeps.**runDynTask**(*task*)

Run a dynamic task and return the result.

Example

foo = runDynTask(('baz.faz.Foo', (), {}))

synapse.lib.dyndeps.**tryDynFunc**(*name*, **args*, ***kwargs*)

Dynamically import a module and call a function or raise an exception.

synapse.lib.dyndeps.**tryDynLocal**(*name*)

Dynamically import a module and return a module local or raise an exception.

synapse.lib.dyndeps.**tryDynMod**(*name*)

Dynamically import a python module or exception.

synapse.lib.encoding module

synapse.lib.encoding.**addFormat**(*name*, *fn*, *opts*)

Add an additional ingest file format

synapse.lib.encoding.**decode**(*name*, *byts*, ***opts*)

Decode the given byts with the named decoder. If name is a comma separated list of decoders, loop through and do them all.

Example

byts = s_encoding.decode('base64',byts)

Note: Decoder names may also be prefixed with +
to *encode* for that name/layer.

synapse.lib.encoding.**encode**(*name*, *item*, ***opts*)

synapse.lib.encoding.**iterdata**(*fd*, *close_fd=True*, ***opts*)

Iterate through the data provided by a file like object.

Optional parameters may be used to control how the data is deserialized.

Examples

The following example show use of the iterdata function.:

```
with open('foo.csv','rb') as fd:
    for row in iterdata(fd, format='csv', encoding='utf8'):
        dostuff(row)
```

Parameters

- **fd** (*file*) – File like object to iterate over.
- **close_fd** (*bool*) – Default behavior is to close the fd object. If this is not true, the fd will not be closed.
- ****opts** (*dict*) – Ingest open directive. Causes the data in the fd to be parsed according to the 'format' key and any additional arguments.

Yields
An item to process. The type of the item is dependent on the format parameters.

synapse.lib.gis module

synapse.lib.gis.**bbox**(*lat*, *lon*, *dist*)

Calculate a min/max bounding box for the circle defined by lat/lon/dist.

Parameters

- **lat** (*float*) – The latitude in degrees

- **lon** (*float*) – The longitude in degrees
- **dist** (*int*) – A distance in geo:dist base units (mm)

Returns
(latmin, latmax, lonmin, lonmax)

Return type
(float,float,float,float)

synapse.lib.gis.**dms2dec**(*degs*, *mins*, *secs*)

Convert degrees, minutes, seconds lat/long form to degrees float.

Parameters

- **degs** (*int*) – Degrees
- **mins** (*int*) – Minutes
- **secs** (*int*) – Seconds

Returns
Degrees

Return type
(float)

synapse.lib.gis.**haversine**(*px*, *py*, *r=6371008800.0*)

Calculate the haversine distance between two points defined by (lat,lon) tuples.

Parameters

- **px** (*(float,float)*) – lat/long position 1
- **py** (*(float,float)*) – lat/long position 2
- **r** (*float*) – Radius of sphere

Returns
Distance in mm.

Return type
(int)

synapse.lib.gis.**latlong**(*text*)

Chop a latlong string and return (float,float). Does not perform validation on the coordinates.

Parameters
text (*str*) – A longitude,latitude string.

Returns
A longitude, latitude float tuple.

Return type
(float,float)

synapse.lib.gis.**near**(*point*, *dist*, *points*)

Determine if the given point is within dist of any of points.

Parameters

- **point** (*(float,float)*) – A latitude, longitude float tuple.
- **dist** (*int*) – A distance in mm (base units)
- **points** (*list*) – A list of latitude, longitude float tuples to compare against.

synapse.lib.grammar module

synapse.lib.grammar.**chop_float**(*text*, *off*)

synapse.lib.grammar.**isBasePropNoPivprop**(*name*)

synapse.lib.grammar.**isCmdName**(*name*)

synapse.lib.grammar.**isEdgeVerb**(*verb*)

synapse.lib.grammar.**isFormName**(*name*)

synapse.lib.grammar.**isPropName**(*name*)

synapse.lib.grammar.**isUnivName**(*name*)

synapse.lib.grammar.**meh**(*txt*, *off*, *cset*)

synapse.lib.grammar.**nom**(*txt*, *off*, *cset*, *trim=True*)

Consume chars in set from the string and return (subtxt,offset).

Example

text = "foo(bar)" chars = set('abcdefghijklmnopqrstuvwxyz')

name,off = nom(text,0,chars)

Note:

This really shouldn't be used for new code

synapse.lib.grammar.**parse_float**(*text*, *off*)

synapse.lib.hashitem module

synapse.lib.hashitem.**hashitem**(*item*)

Generate a uniq hash for the JSON compatible primitive data structure.

synapse.lib.hashitem.**normdict**(*item*)

synapse.lib.hashitem.**normitem**(*item*)

synapse.lib.hashitem.**normiter**(*item*)

synapse.lib.hashset module

class synapse.lib.hashset.**HashSet**

Bases: object

digests()

Get a list of (name, bytes) tuples for the hashes in the hashset.

eatfd(*fd*)

Consume all the bytes from a file like object.

Example

hset = HashSet() hset.eatfd(fd)

guid()

Use elements from this hash set to create a unique (re)identifier.

update(*byts*)

Update all the hashes in the set with the given bytes.

synapse.lib.health module

class synapse.lib.health.**HealthCheck**(*iden*)

Bases: object

getStatus()

pack()

setStatus(*valu*)

update(*name*, *status*, *mesg=''*, *data=None*)

Append a new component to the Healcheck object.

Parameters

- **name** (*str*) – Name of the reported component.
- **status** (*str*) – nomdinal/degraded/failed status code.
- **mesg** (*str*) – Optional message about the component status.
- **data** (*dict*) – Optional arbitrary dictionary of additional metadata about the component.

Returns
None

synapse.lib.hive module

class synapse.lib.hive.**Hive**

Bases: *Pusher*

An optionally persistent atomically accessed tree which implements primitives for use in making distributed/clustered services.

async add(*full*, *valu*)

Atomically increments a node's value.

async dict(*full*, *nexs=False*)

Open a HiveDict at the given full path.

Parameters
full (*tuple*) – A full path tuple.

Returns
A HiveDict for the full path.

Return type
HiveDict

dir(*full*)

List subnodes of the given Hive path.

Parameters
full (*tuple*) – A full path tuple.

Notes

This returns None if there is not a node at the path.

Returns
A list of tuples. Each tuple contains the name, node value, and the number of children nodes.

Return type
list

async exists(*full*)

Returns whether the Hive path has already been created.

async get(*full*, *defv=None*)

Get the value of a node at a given path.

Parameters
full (*tuple*) – A full path tuple.

Returns
Arbitrary node value.

async loadHiveTree(*tree*, *path=()*, *trim=False*)

async open(*full*)

Open and return a hive Node().

Parameters
full (*tuple*) – A full path tuple.

Returns
A Hive node.

Return type
Node

async pop(*full*, *nexs=False*)

Remove and return the value for the given node.

async rename(*oldpath*, *newpath*)

Moves a node at oldpath and all its descendant nodes to newpath. newpath must not exist

async saveHiveTree(*path=()*)

async set(*full*, *valu*, *nexs=False*)

A set operation at the hive level (full path).

async storNodeDele(*path*)

async storNodeValu(*full*, *valu*)

class synapse.lib.hive.**HiveDict**

Bases: *Base*

get(*name*, *default=None*)

items()

pack()

async pop(*name*, *default=None*)

async set(*name*, *valu*, *nexs=None*)

setdefault(*name*, *valu*)

values()

class synapse.lib.hive.**Node**

Bases: *Base*

A single node within the Hive tree.

async add(*valu*)

Increments existing node valu

async dict(*nexs=False*)

Get a HiveDict for this Node.

Returns
A HiveDict for this Node.

Return type
HiveDict

dir()

get(*name*)

name()

async open(*path*)

Open a child Node of the this Node.

Parameters
path (*tuple*) – A child path of the current node.

Returns
A Node at the child path.

Return type
Node

parent()

async pop(*path=()*)

async set(*valu*)

class synapse.lib.hive.**SlabHive**

Bases: *Hive*

async storNodeDele(*full*)

async storNodeValu(*full*, *valu*)

synapse.lib.hive.**iterpath**(*path*)

async synapse.lib.hive.**opendir**(*dirn*, *conf=None*)

synapse.lib.httpapi module

class synapse.lib.httpapi.**ActiveV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get()

class synapse.lib.httpapi.**AuthAddRoleV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post()

class synapse.lib.httpapi.**AuthAddUserV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post()

class synapse.lib.httpapi.**AuthDelRoleV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post()

class synapse.lib.httpapi.**AuthGrantV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

/api/v1/auth/grant?user=iden&role=iden

async get()

async post()

class synapse.lib.httpapi.**AuthRevokeV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

/api/v1/auth/grant?user=iden&role=iden

async get()

async post()

class synapse.lib.httpapi.**AuthRoleV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get(*iden*)

async post(*iden*)

class synapse.lib.httpapi.**AuthRolesV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get()

class synapse.lib.httpapi.**AuthUserPasswdV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post(*iden*)

class synapse.lib.httpapi.**AuthUserV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get(*iden*)

async post(*iden*)

class synapse.lib.httpapi.**AuthUsersV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get()

class synapse.lib.httpapi.**BeholdSockV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *WebSocket*

async onInitMessage(*byts*)

async on_message(*byts*)

Handle incoming messages on the WebSocket

This method must be overridden.

Changed in version 4.5: `on_message` can be a coroutine.

class synapse.lib.httpapi.**CoreInfoV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

/api/v1/core/info

async get()

class synapse.lib.httpapi.**ExtApiHandler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

/api/ext/.*

compute_etag()

Computes the etag header to be used for this request.

By default uses a hash of the content written so far.

May be overridden to provide custom etag implementations, or may return None to disable tornado's default etag support.

async delete(*path*)

async get(*path*)

async head(*path*)

async options(*path*)

async patch(*path*)

async post(*path*)

async put(*path*)

set_default_headers()

Override this to set HTTP headers at the beginning of the request.

For example, this is the place to set a custom `Server` header. Note that setting such headers in the normal flow of request processing may not do what you want, since headers may be reset during error handling.

storm_prefix = 'init { $request = $lib.cortex.httpapi.response($_http_request_info) }'

class synapse.lib.httpapi.**FeedV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

/api/v1/feed

Examples

Example data:

```
{
    'name': 'syn.nodes',
    'view': null,
    'items': [...],
}
```

async post()

class synapse.lib.httpapi.**Handler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *HandlerBase*, `RequestHandler`

on_connection_close()

Called in async handlers if the client closed the connection.

Override this to clean up resources associated with long-lived connections. Note that this method is called only if the connection was closed during asynchronous processing; if you need to do cleanup after every request override *on_finish* instead.

Proxies may keep a connection open for a time (perhaps indefinitely) after the client has gone away, so this method may not be called promptly after the end user closes their connection.

prepare()

Called at the beginning of a request before *get*/*post*/etc.

Override this method to perform common initialization regardless of the request method. There is no guarantee that `prepare` will be called if an error occurs that is handled by the framework.

Asynchronous support: Use `async def` or decorate this method with *.gen.coroutine* to make it asynchronous. If this method returns an `Awaitable` execution will not proceed until the `Awaitable` is done.

Added in version 3.1: Asynchronous support.

class synapse.lib.httpapi.**HandlerBase**

Bases: object

async allowed(*perm*, *default=False*, *gateiden=None*)

Check if the authenticated user has the given permission.

Parameters

- **perm** (*tuple*) – The permission tuple to check.
- **default** (*boolean*) – The default value for the permission.
- **gateiden** (*str*) – The gateiden to check the permission against.

Notes

This API sets up HTTP response values if it returns False.

Returns
True if the user has the requested permission.

Return type
bool

async authenticated()

Check if the request has an authenticated user or not.

Returns
True if the request has an authenticated user, false otherwise.

Return type
bool

check_origin(*origin*)

getAuthCell()

Return a reference to the cell used for auth operations.

getCustomHeaders()

getJsonBody(*validator=None*)

async getUseridenBody(*validator=None*)

Helper function to confirm that there is an auth user and a valid JSON body in the request.

Parameters
validator – Validator function run on the deserialized JSON body.

Returns
The user definition and body of the request as deserialized JSON, or a tuple of s_common.novalu objects if there was no user or json body.

Return type
(str, object)

async handleApiKeyAuth()

async handleBasicAuth()

Handle basic authentication in the handler.

Notes

Implementors may override this to disable or implement their own basic auth schemes. This is expected to set web_useriden and web_username upon successful authentication.

Returns
The user iden of the logged in user.

Return type
str

`initialize`(*cell*)

`isOrigHost`(*origin*)

`async isUserAdmin`()

Check if the current authenticated user is an admin or not.

Returns
True if the user is an admin, false otherwise.

Return type
bool

`loadJsonMesg`(*byts*, *validator=None*)

`logAuthIssue`(*mesg=None*, *user=None*, *username=None*, *level=30*)

Helper to log issues related to request authentication.

Parameters

- **mesg** (*str*) – Additional message to log.
- **user** (*str*) – User iden, if available.
- **username** (*str*) – Username, if available.
- **level** (*int*) – Logging level to log the message at. Defaults to logging.WARNING.

Returns
None

`options`()

`async reqAuthAdmin`()

Require the current authenticated user to be an admin.

Notes

If this returns False, an error message has already been sent and no additional processing for the request should be done.

Returns
True if the user is an admin, false otherwise.

Return type
bool

`async reqAuthUser`()

`sendAuthRequired`()

sendRestErr(*code: str*, *mesg: str*, ** (Keyword-only parameters separator (PEP 3102))*, *status_code: int | HTTPStatus | None = None*) → None

Send a JSON REST error message with a code and message.

Parameters

- **code** – The error code.
- **mesg** – The error message.
- **status_code** – The HTTP status code. This is optional.

Notes

If the status code is not provided or set prior to calling this API, the response will have an HTTP status code of 200 (OK).

This does write the response stream. No further content should be written in the response after calling this.

sendRestExc(*e: Exception*, ***, *status_code: int | HTTPStatus | None = None*) → None

Send a JSON REST error message based on the exception.

Parameters

- **e** – The exception to send. The exception class name will be used as the error code.
- **status_code** – The HTTP status code. This is optional.

Notes

If the status code is not provided or set prior to calling this API, the response will have an HTTP status code of 200.

This does write the response stream. No further content should be written in the response after calling this.

sendRestRetn(*valu*, ***, *status_code: int | HTTPStatus | None = None*) → None

Send a successful JSON REST response.

Parameters

- **valu** – The JSON compatible value to send.
- **status_code** – The HTTP status code. This is optional.

Notes

If the status code is not provided or set prior to calling this API, the response will have an HTTP status code of 200.

This does write the response stream. No further content should be written in the response after calling this.

async sess(*gen=True*)

Get the heavy Session object for the request.

Parameters

gen (*bool*) – If set to True, generate a new session if there is no sess cookie.

Notes

This stores the identifier in the `sess` cookie for with a 14 day expiration, stored in the Cell. Valid requests with that `sess` cookie will resolve to the same Session object.

Returns
A heavy session object. If the sess cookie is invalid or gen is false, this returns None.

Return type
Sess

`set_default_headers()`

`async useriden()`
Get the user iden of the current session user.

> **Note**
> This function will pull the iden from the current session, or attempt to resolve the useriden with basic authentication.

Returns
The iden of the current session user.

Return type
str

`class synapse.lib.httpapi.HealthCheckV1(application: Application, request: HTTPServerRequest, **kwargs: Any)`

Bases: *Handler*

`async get()`

`class synapse.lib.httpapi.LoginV1(application: Application, request: HTTPServerRequest, **kwargs: Any)`

Bases: *Handler*

`async post()`

`class synapse.lib.httpapi.LogoutV1(application: Application, request: HTTPServerRequest, **kwargs: Any)`

Bases: *Handler*

`async get()`

`class synapse.lib.httpapi.ModelNormV1(application: Application, request: HTTPServerRequest, **kwargs: Any)`

Bases: *Handler*

`async get()`

`async post()`

`class synapse.lib.httpapi.ModelV1(application: Application, request: HTTPServerRequest, **kwargs: Any)`

Bases: *Handler*

`async get()`

class synapse.lib.httpapi.**OnePassIssueV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

/api/v1/auth/onepass/issue

async post()

class synapse.lib.httpapi.**ReqValidStormV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

async get()

async post()

class synapse.lib.httpapi.**RobotHandler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *HandlerBase*, RequestHandler

async get()

class synapse.lib.httpapi.**Sess**

Bases: *Base*

addWebSock(*sock*)

delWebSock(*sock*)

async login(*user*)

async logout()

async set(*name*, *valu*)

async update(*vals: dict*)

class synapse.lib.httpapi.**StormCallV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

async get()

async post()

class synapse.lib.httpapi.**StormExportV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

async get()

async post()

class synapse.lib.httpapi.**StormHandler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

getCore()

class synapse.lib.httpapi.**StormNodesV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

async get()

async post()

class synapse.lib.httpapi.**StormV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *StormHandler*

async get()

async post()

class synapse.lib.httpapi.**StormVarsGetV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async get()

class synapse.lib.httpapi.**StormVarsPopV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post()

class synapse.lib.httpapi.**StormVarsSetV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

async post()

class synapse.lib.httpapi.**StreamHandler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

Subclass for Tornado streaming uploads.

Notes

- Async method prepare() is called after headers are read but before body processing.
- Sync method on_finish() can be used to cleanup after a request.
- Sync method on_connection_close() can be used to cleanup after a client disconnect.
- Async methods post(), put(), etc are called after the streaming has completed.

async data_received(*chunk*)

Implement this method to handle streamed request data.

Requires the *.stream_request_body* decorator.

May be a coroutine for flow control.

class synapse.lib.httpapi.**WebSocket**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *HandlerBase*, WebSocketHandler

async **xmit**(*name*, ***info*)

synapse.lib.ingest module

synapse.lib.interval module

A few utilities for dealing with intervals.

synapse.lib.interval.**fold**(**vals*)

Initialize a new (min,max) tuple interval from values.

Parameters
***vals** (*[int,...]*) – A list of values (or Nones)

Returns
A (min,max) interval tuple or None

Return type
((int,int))

synapse.lib.interval.**overlap**(*ival0*, *ival1*)

Determine if two interval tuples have overlap.

Parameters

- **ival0** (*(int,int)*) – An interval tuple
- **ival1** (*(int,int)*)

Returns
True if the intervals overlap, otherwise False

Return type
(bool)

synapse.lib.interval.**parsetime**(*text*)

Parse an interval time string and return a (min,max) tuple.

Parameters
text (*str*) – A time interval string

Returns
A epoch millis epoch time string

Return type
((int,int))

synapse.lib.json module

synapse.lib.json.**dump**(*obj: Any*, *fp: BinaryIO*, *sort_keys: bool = False*, *indent: bool = False*, *default: Callable | None = None*, *newline: bool = False*) → None

Serialize a python object to a file-like object opened in binary mode.

Similar to the standard library json.dump().

Parameters

- **obj** (*object*) – The python object to serialize.

- **fp** (*file*) – The python file pointer to write the serialized data to.
- **sort_keys** (*bool*) – Sort dictionary keys. Default: False.
- **indent** (*bool*) – Include 2 spaces of indentation. Default: False.
- **default** (*Optional[Callable]*) – Callback for serializing unknown object types. Default: None.
- **newline** (*bool*) – Append a newline to the end of the serialized data. Default: False.

Returns: None

Raises
synapse.exc.MustBeJsonSafe – This exception is raised when a python object cannot be serialized.

synapse.lib.json.**dumps**(*obj: Any*, *sort_keys: bool = False*, *indent: bool = False*, *default: Callable | None = None*, *newline: bool = False*) → bytes

Serialize a python object to byte string.

Similar to the standard library json.dumps().

Parameters

- **obj** (*object*) – The python object to serialize.
- **sort_keys** (*bool*) – Sort dictionary keys. Default: False.
- **indent** (*bool*) – Include 2 spaces of indentation. Default: False.
- **default** (*Optional[Callable]*) – Callback for serializing unknown object types. Default: None.
- **newline** (*bool*) – Append a newline to the end of the serialized data. Default: False.

Returns
The JSON serialized python object.

Return type
(bytes)

Raises
synapse.exc.MustBeJsonSafe – This exception is raised when a python object cannot be serialized.

synapse.lib.json.**jslines**(**paths: list[str]*) → Iterator[Any]

Deserialize the JSON lines data at *paths.

Parameters
***paths** – The file path parts to load the data from.

Yields
(object) – The deserialized JSON data from each line.

Raises
synapse.exc.BadJsonText – This exception is raised when there is an error deserializing the provided data.

synapse.lib.json.**jsload**(**paths: str*) → Any

Deserialize the JSON data at *paths.

Parameters
***paths** – The file path parts to load the data from.

Returns
The deserialized JSON data.

Return type
(object)

Raises
synapse.exc.BadJsonText – This exception is raised when there is an error deserializing the provided data.

synapse.lib.json.**jssave**(*js: Any*, **paths: list[str]*) → None

Serialize the python object to a file.

Parameters

- **js** – The python object to serialize.
- ***paths** – The file path parts to save the data to.

Returns: None

Raises

- *synapse.exc.MustBeJsonSafe* – This exception is raised when a python
- **object cannot be serialized.** –

synapse.lib.json.**load**(*fp: BinaryIO*) → Any

Deserialize JSON data from a file.

Similar to the standard library json.load().

Parameters
fp (*file*) – The python file pointer to read the data from.

Returns
The deserialized JSON data.

Return type
(object)

Raises
synapse.exc.BadJsonText – This exception is raised when there is an error deserializing the provided data.

synapse.lib.json.**loads**(*s: str | bytes*) → Any

Deserialize a JSON string.

Similar to the standard library json.loads().

Parameters
s (*str | bytes*) – The JSON data to be deserialized.

Returns
The deserialized JSON data.

Return type
(object)

Raises
synapse.exc.BadJsonText – This exception is raised when there is an error deserializing the provided data.

synapse.lib.json.**reqjsonsafe**(*item: Any*, *strict: bool = False*) → None

Check if a python object is safe to be serialized to JSON.

Uses default type coercion from synapse.lib.json.dumps.

Parameters

- **item** (*any*) – The python object to check.
- **strict** (*bool*) – If specified, do not fallback to python json library which is more permissive of unicode strings. Default: False

Returns: None if item is json serializable, otherwise raises an exception.

Raises

- ***synapse.exc.MustBeJsonSafe*** – This exception is raised when the item
- **cannot be serialized.** –

synapse.lib.jsonstor module

class synapse.lib.jsonstor.**JsonStor**

Bases: *Base*

A filesystem like storage mechanism that allows hirarchical lookup of reference counted "objects" that have individually editable properties.

#TODO json validation by path glob matches? (persists?) #TODO GUID ACCESS with index generation by type #TODO registered types jsonschema with optional write-back validation

async cmpDelPathObjProp(*path*, *prop*, *valu*)

async copyPathObj(*oldp*, *newp*)

async copyPathObjs(*paths*)

async delPathObj(*path*)

Remove a path and decref the object it references.

async delPathObjProp(*path*, *prop*)

async getPathList(*path*)

async getPathObj(*path*)

async getPathObjProp(*path*, *prop*)

async getPathObjs(*path*)

async hasPathObj(*path*)

async popPathObjProp(*path*, *prop*, *defv=None*)

async setPathLink(*srcpath*, *dstpath*)

Add a link from the given srcpath to the dstpath. NOTE: This causes the item at dstpath to be incref'd

async setPathObj(*path*, *item*)

Set (and/or reinitialize) the object at the given path.

NOTE: This will break any links by creating a new object.

async **setPathObjProp**(*path*, *prop*, *valu*)

class synapse.lib.jsonstor.**JsonStorApi**

Bases: *CellApi*

async **addQueue**(*name*, *info*)

addUserNotif(*useriden*, *mesgtype*, *mesgdata=None*)

async **cmpDelPathObjProp**(*path*, *name*, *valu*)

async **copyPathObj**(*oldp*, *newp*)

async **copyPathObjs**(*paths*)

async **cullQueue**(*name*, *offs*)

async **delPathObj**(*path*)

async **delPathObjProp**(*path*, *name*)

async **delQueue**(*name*)

delUserNotif(*indx*)

async **getPathList**(*path*)

async **getPathObj**(*path*)

async **getPathObjProp**(*path*, *prop*)

async **getPathObjs**(*path*)

getUserNotif(*indx*)

async **getsQueue**(*name*, *offs*, *size=None*, *cull=True*, *wait=True*)

async **hasPathObj**(*path*)

iterUserNotifs(*useriden*, *size=None*)

async **popPathObjProp**(*path*, *prop*)

async **putsQueue**(*name*, *items*)

async **setPathLink**(*srcpath*, *dstpath*)

async **setPathObj**(*path*, *item*)

async **setPathObjProp**(*path*, *prop*, *valu*)

watchAllUserNotifs(*offs=None*)

class synapse.lib.jsonstor.**JsonStorCell**

Bases: *Cell*

async **addQueue**(*name*, *info*)

async **addUserNotif**(*useriden*, *mesgtype*, *mesgdata=None*)

cellapi
alias of *JsonStorApi*

async cmpDelPathObjProp(*path*, *name*, *valu*)

async copyPathObj(*oldp*, *newp*)

async copyPathObjs(*paths*)

async cullQueue(*name*, *offs*)

async delPathObj(*path*)

async delPathObjProp(*path*, *name*)

async delQueue(*name*)

async delUserNotif(*indx*)

classmethod getEnvPrefix()
Get a list of envar prefixes for config resolution.

async getPathList(*path*)

async getPathObj(*path*)

async getPathObjProp(*path*, *prop*)

async getPathObjs(*path*)

async getUserNotif(*indx*)

async getsQueue(*name*, *offs*, *size=None*, *cull=True*, *wait=True*)

async hasPathObj(*path*)

async initServiceStorage()

async iterUserNotifs(*useriden*, *size=None*)

async popPathObjProp(*path*, *prop*)

async putsQueue(*name*, *items*)

async setPathLink(*srcpath*, *dstpath*)

async setPathObj(*path*, *item*)

async setPathObjProp(*path*, *prop*, *valu*)

async watchAllUserNotifs(*offs=None*)

synapse.lib.layer module

The Layer 2.0 archtecture introduces several optimized node/message serialization formats used by the layers to optimize returning primitives and facilitate efficient node construction:

Note

This interface is subject to change between minor revisions.

Storage Types (<stortype>)

In Layers 2.0, each node property from the model has an associated "storage type". Each storage type determines how the data is indexed and represented within the Layer. This formalizes the separation of "data model" from "storage model". Each data model type has a "stortype" property which coresponds to one of the STOR_TYPE_XXX values. The knowledge of the mapping of data model types to storage types is the responsibility of the data model, making the Layer implementation fully decoupled from the data model.

Node Edits / Edits

A node edit consists of a (<buid>, <form>, [edits]) tuple. An edit is Tuple of (<type>, <info>, List[NodeEdits]) where the first element is an int that matches to an EDIT_* constant below, the info is a tuple that varies depending on the first element, and the third element is a list of dependent NodeEdits that will only be applied if the edit actually makes a change.

Storage Node (<sode>)

A storage node is a layer/storage optimized node representation which is similar to a "packed node". A storage node *may* be partial (as it is produced by a given layer) and are joined by the view/snap into "full" storage nodes which are used to construct Node() instances.

Sode format:

```
(<buid>, {

    'ndef': (<formname>, <formvalu>),

    'props': {
        <propname>: <propvalu>,
    }

    'tags': {
        <tagname>: <tagvalu>,
    }

    'tagprops: {
        <tagname>: {
            <propname>: <propvalu>,
        },
    }

    # changes that were *just* made.
    'edits': [
        <edit>
    ]

}),
```

class synapse.lib.layer.**IndxBy**(*layr*, *abrv*, *db*)

Bases: `object`

IndxBy sub-classes encapsulate access methods and encoding details for various types of properties within the layer to be lifted/compared by storage types.

buidsByDups(*indx*)

buidsByPref(*indx=b''*)

buidsByRange(*minindx*, *maxindx*)

buidsByRangeBack(*minindx*, *maxindx*)

getNodeValu(*buid*)

hasIndxBuid(*indx*, *buid*)

keyBuidsByDups(*indx*)

keyBuidsByDupsBack(*indx*)

keyBuidsByPref(*indx=b''*)

keyBuidsByPrefBack(*indx=b''*)

keyBuidsByRange(*minindx*, *maxindx*)

keyBuidsByRangeBack(*minindx*, *maxindx*)

Yields backwards from maxindx to minindx

scanByDups(*indx*)

scanByPref(*indx=b''*)

scanByPrefBack(*indx=b''*)

scanByRange(*minindx*, *maxindx*)

scanByRangeBack(*minindx*, *maxindx*)

class synapse.lib.layer.**IndxByForm**(*layr*, *form*)

Bases: *IndxBy*

getNodeValu(*buid*)

class synapse.lib.layer.**IndxByProp**(*layr*, *form*, *prop*)

Bases: *IndxBy*

getNodeValu(*buid*)

class synapse.lib.layer.**IndxByPropArray**(*layr*, *form*, *prop*)

Bases: *IndxBy*

getNodeValu(*buid*)

class synapse.lib.layer.**IndxByTag**(*layr*, *form*, *tag*)

Bases: *IndxBy*

getNodeValuForm(*buid*)

class synapse.lib.layer.**IndxByTagProp**(*layr*, *form*, *tag*, *prop*)

Bases: *IndxBy*

getNodeValu(*buid*)

class synapse.lib.layer.**Layer**

Bases: *Pusher*

The base class for a cortex layer.

async clone(*newdirn*)

Copy the contents of this layer to a new layer

async confirmLayerEditPerms(*user*, *gateiden*, *delete=False*)

async delete()

Delete the underlying storage

getAbrvProp(*abrv*)

async getEdgeVerbs()

async getEdges(*verb=None*)

async getEditIndx()

Returns what will be the *next* (i.e. 1 past the last) nodeedit log index.

async getEditOffs()

Return the offset of the last *recorded* log entry. Returns -1 if nodeedit log is disabled or empty.

async getEditSize()

async getFormCounts()

getFormProps()

getIdenFutu(*iden=None*)

async getLayerSize()

Get the total storage size for the layer.

async getMirrorStatus()

async getModelVers()

async getNdefRefs(*buid*)

async getNodeData(*buid*, *name*)

Return a single element of a buid's node data

getNodeEditWindow()

async getNodeForm(*buid*)

async getNodeTag(*buid*, *tag*)

async getNodeValu(*buid*, *prop=None*)

Retrieve either the form valu or a prop valu for the given node by buid.

getPropAbrv(*form*, *prop*)

async getPropArrayCount(*formname*, *propname=None*)

Return the number of invidiual value rows in the layer for the given array form/prop.

getPropArrayValuCount(*formname*, *propname*, *stortype*, *valu*)

async getPropCount(*formname*, *propname=None*, *maxsize=None*)

Return the number of property rows in the layer for the given form/prop.

getPropValuCount(*formname*, *propname*, *stortype*, *valu*)

getStorIndx(*stortype*, *valu*)

async getStorNode(*buid*)

getStorNodeCount()

async getStorNodes()

Yield (buid, sode) tuples for all the nodes with props/tags/tagprops stored in this layer.

async getStorNodesByForm(*form*)

Yield (buid, sode) tuples for nodes of a given form with props/tags/tagprops/edges/nodedata in this layer.

async getTagCount(*tagname*, *formname=None*)

Return the number of tag rows in the layer for the given tag/form.

getTagPropAbrv(**args*)

async getTagPropCount(*form*, *tag*, *prop*)

Return the number of property rows in the layer for the given form/tag/prop.

getTagPropValuCount(*form*, *tag*, *prop*, *stortype*, *valu*)

getTagProps()

async getUnivPropCount(*propname*, *maxsize=None*)

Return the number of universal property rows in the layer for the given prop.

async hasNodeData(*buid*, *name*)

async hasNodeEdge(*buid1*, *verb*, *buid2*)

async hasTagProp(*name*)

async initLayerActive()

async initLayerPassive()

async initUpstreamSync(*url*)

async iterEdgeVerbs(*n1buid*, *n2buid*)

async iterFormRows(*form*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes of a single form, optionally (re)starting at startvalu.

Parameters

- **form** (*str*) – A form name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns

AsyncIterator[Tuple(buid, valu)]

async iterLayerNodeEdits()

Scan the full layer and yield artificial sets of nodeedits.

async iterNodeData(*buid*)

Return a generator of all a buid's node data

async iterNodeDataKeys(*buid*)

Return a generator of all a buid's node data keys

async iterNodeEdgeVerbsN1(*buid*)

async iterNodeEdgesN1(*buid*, *verb=None*)

async iterNodeEdgesN2(*buid*, *verb=None*)

async iterNodeEditLog(*offs=0*)

Iterate the node edit log and yield (offs, edits, meta) tuples.

async iterNodeEditLogBack(*offs=0*)

Iterate the node edit log and yield (offs, edits, meta) tuples in reverse.

async iterPropIndxBuids(*formname*, *propname*, *indx*)

async iterPropRows(*form*, *prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular secondary property, optionally (re)starting at startvalu.

Parameters

- **form** (*str*) – A form name.
- **prop** (*str*) – A universal property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns

AsyncIterator[Tuple(buid, valu)]

async iterPropValues(*formname*, *propname*, *stortype*)

async iterTagPropRows(*tag*, *prop*, *form=None*, *stortype=None*, *startvalu=None*)

Yields (buid, valu) that match a tag:prop, optionally (re)starting at startvalu.

Parameters

- **tag** (*str*) – tag name
- **prop** (*str*) – prop name
- **form** (*Optional[str]*) – optional form name
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns

AsyncIterator[Tuple(buid, valu)]

async iterTagRows(*tag*, *form=None*, *starttupl=None*)

Yields (buid, (valu, form)) values that match a tag and optional form, optionally (re)starting at starttupl.

Parameters

- **tag** (*str*) – the tag to match
- **form** (*Optional[str]*) – if present, only yields buids of nodes that match the form.
- **starttupl** (*Optional[Tuple[buid, form]]*) – if present, (re)starts the stream of values there.

Returns

AsyncIterator[Tuple(buid, (valu, form))]

Note

This yields (buid, (tagvalu, form)) instead of just buid, valu in order to allow resuming an interrupted call by feeding the last value retrieved into starttupl

async iterUnivRows(*prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular universal property, optionally (re)starting at startvalu.

Parameters

- **prop** (*str*) – A universal property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns

AsyncIterator[Tuple(buid, valu)]

async iterWipeNodeEdits()

async liftByDataName(*name*)

async liftByFormValu(*form*, *cmprvals*, *reverse=False*)

async liftByProp(*form*, *prop*, *reverse=False*)

async liftByPropArray(*form*, *prop*, *cmprvals*, *reverse=False*)

async liftByPropValu(*form*, *prop*, *cmprvals*, *reverse=False*)

async liftByTag(*tag*, *form=None*, *reverse=False*)

async liftByTagProp(*form*, *tag*, *prop*, *reverse=False*)

async liftByTagPropValu(*form*, *tag*, *prop*, *cmprvals*, *reverse=False*)

Note: form may be None

async liftByTagValu(*tag*, *cmpr*, *valu*, *form=None*, *reverse=False*)

async liftByTags(*tags*)

async liftTagProp(*name*)

mayDelBuid(*buid*, *sode*)

nodeeditctor

alias of *SlabSeqn*

async pack()

async saveNodeEdits(*edits*, *meta*)

Save node edits to the layer and return a tuple of (nexsoffs, changes).

Note: nexsoffs will be None if there are no changes.

async setLayerInfo(*name*, *valu*)

async setModelVers(*vers*)

setPropAbrv(*form*, *prop*)

setSodeDirty(*buid*, *sode*, *form*)

setTagPropAbrv(**args*)

async stat()

async storNodeEdits(*nodeedits*, *meta*)

async storNodeEditsNoLift(*nodeedits*, *meta*)

Execute a series of node edit operations.

Does not return the updated nodes.

async syncIndexEvents(*offs*, *matchdef*, *wait=True*)

Yield (offs, (buid, form, ETYPE, VALS, META)) tuples from the nodeedit log starting from the given offset. Only edits that match the filter in matchdef will be yielded.

Notes

ETYPE is an constant EDIT_* above. VALS is a tuple whose format depends on ETYPE, outlined in the comment next to the constant. META is a dict that may contain keys 'user' and 'time' to represent the iden of the user that initiated the change, and the time that it took place, respectively.

Additionally, every 1000 entries, an entry (offs, (None, None, EDIT_PROGRESS, (), ())) message is emitted.

The matchdef dict may contain the following keys: forms, props, tags, tagprops. The value must be a sequence of strings. Each key/val combination is treated as an "or", so each key and value yields more events. forms: EDIT_NODE_ADD and EDIT_NODE_DEL events. Matches events for nodes with forms in the value list. props: EDIT_PROP_SET and EDIT_PROP_DEL events. Values must be in form:prop or .universal form tags: EDIT_TAG_SET and EDIT_TAG_DEL events. Values must be the raw tag with no #. tagprops: EDIT_TAGPROP_SET and EDIT_TAGPROP_DEL events. Values must be just the prop or tag:prop.

Will not yield any values if this layer was not created with logedits enabled

Parameters

- **offs** (*int*) – starting nexus/editlog offset
- **matchdef** (*Dict[str, Sequence[str]]*) – a dict describing which events are yielded
- **wait** (*bool*) – whether to pend and stream value until this layer is fini'd

async syncNodeEdits(*offs*, *wait=True*, *reverse=False*)

Identical to syncNodeEdits2, but doesn't yield meta

async syncNodeEdits2(*offs*, *wait=True*, *reverse=False*)

Once caught up with storage, yield them in realtime.

Returns

Tuple of offset(int), nodeedits, meta(dict)

async verify(*config=None*)

async verifyAllBuids(*scanconf=None*)

async verifyAllProps(*scanconf=None*)

async verifyAllTagProps(*scanconf=None*)

async verifyAllTags(*scanconf=None*)

async verifyBuidTag(*buid*, *formname*, *tagname*, *tagvalu*)

async verifyByBuid(*buid*, *sode*)

async verifyByProp(*form*, *prop*, *autofix=None*)

async verifyByPropArray(*form*, *prop*, *autofix=None*)

async verifyByTag(*tag*, *autofix=None*)

async verifyByTagProp(*form*, *tag*, *prop*, *autofix=None*)

async waitEditOffs(*offs*, *timeout=None*)

Wait for the node edit log to write an entry at/past the given offset.

async waitForHot()

Wait for the layer's slab to be prefaulted and locked into memory if lockmemory is true, otherwise return.

async waitUpstreamOffs(*iden*, *offs*)

class synapse.lib.layer.**LayerApi**

Bases: *CellApi*

async getEditIndx()

Returns what will be the *next* nodeedit log index.

async getEditSize()

Return the total number of (edits, meta) pairs in the layer changelog.

async getIden()

async iterLayerNodeEdits()

Scan the full layer and yield artificial nodeedit sets.

saveNodeEdits(*edits*, *meta*)

Save node edits to the layer and return a tuple of (nexsoffs, changes).

Note: nexsoffs will be None if there are no changes.

async storNodeEdits(*nodeedits*, *meta=None*)

async **storNodeEditsNoLift**(*nodeedits*, *meta=None*)

async **syncNodeEdits**(*offs*, *wait=True*, *reverse=False*)

Yield (offs, nodeedits) tuples from the nodeedit log starting from the given offset.

Once caught up with storage, yield them in realtime.

async **syncNodeEdits2**(*offs*, *wait=True*)

class synapse.lib.layer.**StorType**(*layr*, *stortype*)

Bases: object

decodeIndx(*valu*)

indx(*valu*)

async **indxBy**(*liftby*, *cmpr*, *valu*, *reverse=False*)

async **indxByForm**(*form*, *cmpr*, *valu*, *reverse=False*)

async **indxByProp**(*form*, *prop*, *cmpr*, *valu*, *reverse=False*)

async **indxByPropArray**(*form*, *prop*, *cmpr*, *valu*, *reverse=False*)

async **indxByTagProp**(*form*, *tag*, *prop*, *cmpr*, *valu*, *reverse=False*)

async **verifyBuidProp**(*buid*, *form*, *prop*, *valu*)

class synapse.lib.layer.**StorTypeFloat**(*layr*, *stortype*, *size=8*)

Bases: *StorType*

FloatPackNegMax = b'\x80\x00\x00\x00\x00\x00\x00\x00'

FloatPackNegMin = b'\xff\xf0\x00\x00\x00\x00\x00\x00'

FloatPackPosMax = b'\x7f\xf0\x00\x00\x00\x00\x00\x00'

FloatPackPosMin = b'\x00\x00\x00\x00\x00\x00\x00\x00'

FloatPacker = <_struct.Struct object>

decodeIndx(*bytz*)

fpack()

S.pack(v1, v2, ...) -> bytes

Return a bytes object containing values v1, v2, ... packed according to the format string S.format. See help(struct) for more on format strings.

indx(*valu*)

class synapse.lib.layer.**StorTypeFqdn**(*layr*)

Bases: *StorTypeUtf8*

decodeIndx(*bytz*)

indx(*norm*)

class synapse.lib.layer.**StorTypeGuid**(*layr*)

Bases: *StorType*

decodeIndx(*bytz*)

indx(*valu*)

class synapse.lib.layer.**StorTypeHier**(*layr*, *stortype*, *sepr='.'*)

Bases: *StorType*

decodeIndx(*bytz*)

getHierIndx(*valu*)

indx(*valu*)

class synapse.lib.layer.**StorTypeHugeNum**(*layr*, *stortype*)

Bases: *StorType*

decodeIndx(*bytz*)

getHugeIndx(*norm*)

indx(*norm*)

class synapse.lib.layer.**StorTypeInt**(*layr*, *stortype*, *size*, *signed*)

Bases: *StorType*

decodeIndx(*bytz*)

getIntIndx(*valu*)

indx(*valu*)

class synapse.lib.layer.**StorTypeIpv6**(*layr*)

Bases: *StorType*

decodeIndx(*bytz*)

getIPv6Indx(*valu*)

indx(*valu*)

class synapse.lib.layer.**StorTypeIval**(*layr*)

Bases: *StorType*

decodeIndx(*bytz*)

indx(*valu*)

class synapse.lib.layer.**StorTypeLatLon**(*layr*)

Bases: *StorType*

decodeIndx(*bytz*)

indx(*valu*)

class synapse.lib.layer.**StorTypeLoc**(*layr*)

Bases: *StorTypeHier*

class synapse.lib.layer.**StorTypeMsgp**(*layr*)

Bases: *StorType*

indx(*valu*)

class synapse.lib.layer.**StorTypeNdef**(*layr*)

Bases: *StorType*

indx(*valu*)

class synapse.lib.layer.**StorTypeTag**(*layr*)

Bases: *StorTypeHier*

static getTagFilt(*cmpr*, *valu*)

class synapse.lib.layer.**StorTypeTime**(*layr*)

Bases: *StorTypeInt*

class synapse.lib.layer.**StorTypeUtf8**(*layr*)

Bases: *StorType*

decodeIndx(*bytz*)

indx(*valu*)

synapse.lib.layer.**getFlatEdits**(*nodeedits*)

synapse.lib.link module

class synapse.lib.link.**Link**

Bases: *Base*

A Link() is created to wrap a socket reader/writer.

feed(*byts*)

Used by Plex() to unpack bytes.

get(*name*, *defval=None*)

Get a property from the Link info.

getAddrInfo()

Get a summary of address information related to the link.

async getSpawnInfo()

getTlsPeerCn()

async recv(*size*)

async recvsize(*size*)

async rx()

async send(*byts*)

set(*name*, *valu*)

Set a property in the Link info.

async tx(*mesg*)

Async transmit routine which will wait for writer drain().

txfini()

async synapse.lib.link.**connect**(*host*, *port*, *ssl=None*, *hostname=None*, *linkinfo=None*)

Async connect and return a Link().

async synapse.lib.link.**fromspawn**(*spawninfo*)

async synapse.lib.link.**linkfile**(*mode='wb'*)

Connect a socketpair to a file-object and return (link, file).

async synapse.lib.link.**linksock**(*forceclose=False*)

Connect a Link, socket pair.

async synapse.lib.link.**listen**(*host*, *port*, *onlink*, *ssl=None*)

Listen on the given host/port and fire onlink(Link).

Returns a server object that contains the listening sockets

async synapse.lib.link.**unixconnect**(*path*)

Connect to a PF_UNIX server listening on the given path.

async synapse.lib.link.**unixlisten**(*path*, *onlink*)

Start an PF_UNIX server listening on the given path.

synapse.lib.lmdbslab module

class synapse.lib.lmdbslab.**GuidStor**(*slab*, *name*)

Bases: object

async del_(*iden*)

async dict(*iden*)

gen(*iden*)

has(*iden*)

set(*iden*, *name*, *valu*)

class synapse.lib.lmdbslab.**Hist**(*slab*, *name*)

Bases: object

A class for storing items in a slab by time.

Each added item is inserted into the specified db within the slab using the current epoch-millis time stamp as the key.

add(*item*, *tick=None*)

carve(*tick*, *tock=None*)

class synapse.lib.lmdbslab.**HotCount**

Bases: *HotKeyVal*

Like HotKeyVal, but optimized for integer/count vals

static DecFunc(*b*)

Decode a signed 64-bit int from 8 byte big-endian

static EncFunc(*i*)

Encode a signed 64-bit int into 8 byte big-endian bytes

get(*name: str*, *defv=0*)

inc(*name: str*, *valu=1*)

set(*name: str*, *valu*)

class synapse.lib.lmdbslab.**HotKeyVal**

Bases: *Base*

A hot-loop capable keyval that only syncs on commit.

static DecFunc(*byts*, *use_list=False*)

Use msgpack to de-serialize a python object.

Parameters
byts (*bytes*) – The bytes to de-serialize

Notes

String objects are decoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow decoding bad input strings.

Returns
The de-serialized object

Return type
obj

static EncFunc(*item*)

Use msgpack to serialize a compatible python object.

Parameters
item (*obj*) – The object to serialize

Notes

String objects are encoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow encoding bad input strings.

Returns
The serialized bytes in msgpack format.

Return type
bytes

delete(*name: str*)

get(*name: str*, *defv=None*)

pack()

set(*name: str*, *valu*)

sync()

class synapse.lib.lmdbslab.**LmdbBackup**

Bases: *Base*

async saveto(*dstdir*)

class synapse.lib.lmdbslab.**MultiQueue**

Bases: *Base*

Allows creation/consumption of multiple durable queues in a slab.

async add(*name*, *info*)

async cull(*name*, *offs*)

Remove up-to (and including) the queue entry at offs.

async dele(*name*, *minoffs*, *maxoffs*)

Remove queue entries from minoffs, up-to (and including) the queue entry at maxoffs.

exists(*name*)

async get(*name*, *offs*, *wait=False*, *cull=True*)

Return (nextoffs, item) tuple or (-1, None) for the given offset.

async gets(*name*, *offs*, *size=None*, *cull=False*, *wait=False*)

Yield (offs, item) tuples from the message queue.

list()

offset(*name*)

async pop(*name*, *offs*)

Pop a single entry from the named queue by offset.

async put(*name*, *item*, *reqid=None*)

async puts(*name*, *items*, *reqid=None*)

async rem(*name*)

async sets(*name*, *offs*, *items*)

Overwrite queue entries with the values in items, starting at offs.

size(*name*)

status(*name*)

class synapse.lib.lmdbslab.**SafeKeyVal**(*slab*, *name*, *prefix=''*)

Bases: `object`

Key/value storage that does not store items in memory and ensures keys are < 512 characters in length.

Note:
The key size limitation includes the length of any prefixes added by using getSubKeyVal().

delete(*name*)

Delete a key.

get(*name*, *defv=None*)

Get the value for a key.

> **Note**
>
> This may only be used for keys < 512 characters in length.

getSubKeyVal(*prefix*)

items(*pref=''*)

keys(*pref=''*)

pop(*name*, *defv=None*)

reqValidName(*name*)

set(*name*, *valu*)

async truncate(*pref=''*)

Delete all keys.

values(*pref=''*)

class synapse.lib.lmdbslab.**Scan**(*slab*, *db*)

Bases: `object`

A state-object used by Slab. Not to be instantiated directly.

Parameters

- **slab** (Slab) – which slab the scan is over
- **db** (*str*) – name of open database on the slab

bump()

first()

isatitem()

Returns if the cursor is at the value in atitem

iterfunc()

iternext()

resume()

set_key(*lkey*)

set_range(*lkey*, *valu=None*)

class synapse.lib.lmdbslab.**ScanBack**(*slab*, *db*)

Bases: *Scan*

A state-object used by Slab. Not to be instantiated directly.

Scans backwards.

first()

iterfunc()

next_key()

resume()

set_key(*lkey*)

set_range(*lkey*)

class synapse.lib.lmdbslab.**ScanKeys**(*slab*, *db*, *nodup=False*)

Bases: *Scan*

An iterator over the keys of the database. If the database is dupsort, a key with multiple values with be yielded once for each value.

isatitem()

Returns if the cursor is at the value in atitem

iterfunc()

iternext()

resume()

class synapse.lib.lmdbslab.**Slab**

Bases: *Base*

A "monolithic" LMDB instance for use in a asyncio loop thread.

COMMIT_PERIOD = 0.2

DEFAULT_GROWSIZE = None

DEFAULT_MAPSIZE = 1073741824

WARN_COMMIT_TIME_MS = 1000

addResizeCallback(*callback*)

allslabs = {}

async copydb(*sourcedbname*, *destslab*, *destdbname=None*, *progresscb=None*)

Copy an entire database in this slab to a new database in potentially another slab.

Parameters

- **sourcedbname** (*str*) – name of the db in the source environment
- **destslab** (*LmdbSlab*) – which slab to copy rows to
- **destdbname** (*str*) – the name of the database to copy rows to in destslab
- **progresscb** (*Callable[int]*) – if not None, this function will be periodically called with the number of rows completed

Returns
the number of rows copied

Return type
(int)

Note

If any rows already exist in the target database, this method returns an error. This means that one cannot use destdbname=None unless there are no explicit databases in the destination slab.

async copyslab(*dstpath*, *compact=True*)

count(*lkey*, *db=None*)

async countByPref(*byts*, *db=None*, *maxsize=None*)

Return the number of rows in the given db with the matching prefix bytes.

dbexists(*name*)

The DB exists already if there's a key in the default DB with the name of the database

delete(*lkey*, *val=None*, *db=None*)

dropdb(*name*)

Deletes an **entire database** (i.e. a table), losing all data.

async fini()

Shut down the object and notify any onfini() coroutines.

Returns

Remaining ref count

firstkey(*db=None*)

Return the first key or None from the given db.

forcecommit()

Note

This method may raise a MapFullError

get(*lkey*, *db=None*)

async getHotCount(*name*)

async getMultiQueue(*name*, *nexsroot=None*)

getNameAbrv(*name*)

getSafeKeyVal(*name*, *prefix=''*, *create=True*)

getSeqn(*name*)

async classmethod getSlabStats()

classmethod getSlabsInDir(*dirn*)

Returns all open slabs under a directory

has(*lkey*, *db=None*)

hasdup(*lkey*, *lval*, *db=None*)

async classmethod initSyncLoop(*inst*)

initdb(*name*, *dupsort=False*, *integerkey=False*, *dupfixed=False*)

last(*db=None*)

Return the last key/value pair from the given db.

lastkey(*db=None*)

Return the last key or None from the given db.

pop(*lkey*, *db=None*)

prefexists(*byts*, *db=None*)

Returns True if a prefix exists in the db.

put(*lkey*, *lval*, *dupdata=False*, *overwrite=True*, *append=False*, *db=None*)

async putmulti(*kvpairs*, *dupdata=False*, *append=False*, *db=None*)

rangeexists(*lmin*, *lmax=None*, *db=None*)

Returns True if at least one key exists in the range.

replace(*lkey*, *lval*, *db=None*)

Like put, but returns the previous value if existed

scanByDups(*lkey*, *db=None*)

scanByDupsBack(*lkey*, *db=None*)

scanByFull(*db=None*)

scanByFullBack(*db=None*)

scanByPref(*byts*, *startkey=None*, *startvalu=None*, *db=None*)

Parameters

- **byts** (*bytes*) – prefix to match on
- **startkey** (*Optional[bytes]*) – if present, will start scanning at key=byts+startkey
- **startvalu** (*Optional[bytes]*) – if present, will start scanning at (key+startkey, startvalu)

Notes

startvalu only makes sense if byts+startkey matches an entire key. startvalu is only value for dupsort=True dbs

scanByPrefBack(*byts*, *db=None*)

scanByRange(*lmin*, *lmax=None*, *db=None*)

scanByRangeBack(*lmax*, *lmin=None*, *db=None*)

scanKeys(*db=None*, *nodup=False*)

scanKeysByPref(*byts*, *db=None*, *nodup=False*)

stat(*db=None*)

statinfo()

async sync()

async classmethod syncLoopOnce()

async classmethod syncLoopTask()

syncevnt = None

synctask = None

async trash()

Deletes underlying storage

class synapse.lib.lmdbslab.**SlabAbrv**(*slab*, *name*)

Bases: object

A utility for translating arbitrary bytes into fixed with id bytes

abrvToByts(*abrv*)

abrvToName(*byts*)

bytsToAbrv(*byts*)

keys()

nameToAbrv(*name*)

names()

setBytsToAbrv(*byts*)

class synapse.lib.lmdbslab.**SlabDict**(*slab*, *db=None*, *pref=b''*)

Bases: object

A dictionary-like object which stores its props in a slab via a prefix.

It is assumed that only one SlabDict with a given prefix exists at any given time, but it is up to the caller to cache them.

get(*name*, *defval=None*)

Get a name from the SlabDict.

Parameters

- **name** (*str*) – The key name.
- **defval** (*obj*) – The default value to return.

Returns
The return value, or None.

Return type
(obj)

inc(*name*, *valu=1*)

items()

Return a tuple of (prop, valu) tuples from the SlabDict.

Returns
Tuple of (name, valu) tuples.

Return type
(((str, object), ...))

keys()

pop(*name*, *defval=None*)

Pop a name from the SlabDict.

Parameters

- **name** (*str*) – The name to remove.
- **defval** (*obj*) – The default value to return if the name is not present.

Returns
The object stored in the SlabDict, or defval if the object was not present.

Return type
object

set(*name*, *valu*)

Set a name in the SlabDict.

Parameters

- **name** (*str*) – The key name.
- **valu** (*obj*) – A msgpack compatible value.

Returns
None

synapse.lib.modelrev module

class synapse.lib.modelrev.**ModelMigration_0_2_31**

Bases: object

async classmethod anit(*core*, *layers*)

async delNode(*buid*)

async editEdgeAdd(*layriden*, *buid*, *formname*, *verb*, *iden*)

async editEdgeDel(*layriden*, *buid*, *formname*, *verb*, *iden*)

async editNodeAdd(*layriden*, *buid*, *formname*, *formvalu*, *stortype*)

async editNodeDel(*layriden*, *buid*, *formname*, *formvalu*)

async editNodedataDel(*layriden*, *buid*, *formname*, *name*, *valu*)

async editNodedataSet(*layriden*, *buid*, *formname*, *name*, *newvalu*, *oldvalu*)

async editPropDel(*layriden*, *buid*, *formname*, *propname*, *propvalu*, *stortype*)

async editPropSet(*layriden*, *buid*, *formname*, *propname*, *newvalu*, *oldvalu*, *stortype*)

async editTagDel(*layriden*, *buid*, *formname*, *tagname*, *tagvalu*)

async editTagSet(*layriden*, *buid*, *formname*, *tagname*, *newvalu*, *oldvalu*)

async editTagpropDel(*layriden*, *buid*, *formname*, *tagname*, *propname*, *propvalu*, *stortype*)

async editTagpropSet(*layriden*, *buid*, *formname*, *tagname*, *propname*, *newvalu*, *oldvalu*, *stortype*)

getNode(*buid*)

getRefInfo(*formname*)

getRoProps(*formname*)

async getSodeByPropValuNoNorm(*layer*, *formname*, *propname*, *valu*, *cmpr='='*)

async moveNode(*buid*, *newvalu*)

async removeNode(*buid*)

async revModel_0_2_31()

async storeNode(*buid*)

class synapse.lib.modelrev.ModelRev(*core*)

Bases: object

async revCoreLayers()

async revModel20210126(*layers*)

async revModel20210312(*layers*)

async revModel20210528(*layers*)

async revModel20210801(*layers*)

async revModel20211112(*layers*)

async revModel20220307(*layers*)

async revModel20220315(*layers*)

async revModel20220509(*layers*)

async revModel20220706(*layers*)

async revModel20220803(*layers*)

async revModel20220901(*layers*)

async revModel20221025(*layers*)

async revModel20221123(*layers*)

async revModel20221212(*layers*)

async revModel20221220(*layers*)

async revModel20230209(*layers*)

async revModel_0_2_18(*layers*)

async revModel_0_2_19(*layers*)

async revModel_0_2_20(*layers*)

async revModel_0_2_21(*layers*)

async revModel_0_2_22(*layers*)

async **revModel_0_2_23**(*layers*)

async **revModel_0_2_24**(*layers*)

async **revModel_0_2_25**(*layers*)

async **revModel_0_2_26**(*layers*)

async **revModel_0_2_27**(*layers*)

async **revModel_0_2_29**(*layers*)

async **revModel_0_2_30**(*layers*)

async **revModel_0_2_31**(*layers*)

async **revModel_0_2_32**(*layers*)

async **revModel_0_2_33**(*layers*)

async **runStorm**(*text*, *opts=None*)

Run storm code in a schedcoro and log the output messages.

Parameters

- **text** (*str*) – Storm query to execute.
- **opts** – Storm opts.

Returns
None

synapse.lib.module module

class synapse.lib.module.**CoreModule**(*core*, *conf=None*)

Bases: object

confdefs = ()

getConfPath()

Get the path to the module specific config file (conf.yaml).

Notes

This creates the parent directory for the conf.yaml file if it does not exist. This API exists to allow a implementor to get the conf path during initCoreModule and drop a example config if needed. One use case of that is for missing configuration values, an example config can be written to the file and a exception raised.

Returns
Path to where the conf file is located at.

Return type
str

getModDir()

Get the path to the module specific directory.

Notes

This creates the directory if it did not previously exist.

Returns
The filepath to the module specific directory.

Return type
str

`getModName()`

Return the lowercased name of this module.

Notes

This pulls the `mod_name` attribute on the class. This allows an implementer to set a arbitrary name for the module. If this attribute is not set, it defaults to `self.__class__.__name__.lower()` and sets `mod_name` to that value.

Returns
The module name.

Return type
(str)

`getModPath(*paths)`

Construct a path relative to this module's working directory.

Parameters
`*paths` – A list of path strings

Notes

This creates the module specific directory if it does not exist.

Returns
The full path (or None if no cortex dir is configured).

Return type
(str)

`getModelDefs()`

`getStormCmds()`

Module implementers may override this to provide a list of Storm commands which will be loaded into the Cortex.

Returns
A list of Storm Command classes (not instances).

Return type
list

`async initCoreModule()`

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

mod_name = None

async preCoreModule()

Module implementers may override this method to execute code immediately after a module has been loaded.

Notes

The `initCoreModule` function is preferred for overriding instead of `preCoreModule()`.

No Cortex layer/storage operations will function in preCoreModule.

Any exception raised within this method will halt additional loading of the module.

Returns
None

synapse.lib.modules module

Module which implements the synapse module API/convention.

synapse.lib.msgpack module

class synapse.lib.msgpack.**Unpk**

Bases: `object`

An extension of the msgpack streaming Unpacker which reports sizes.

Notes

String objects are decoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow decoding bad input strings.

feed(*byts*)

Feed bytes to the unpacker and return completed objects.

Parameters
byts (*bytes*) – Bytes to unpack.

Notes

It is intended that this function is called multiple times with bytes from some sort of a stream, as it will unpack and return objects as they are available.

Returns
List of tuples containing the item size and the unpacked item.

Return type
list

synapse.lib.msgpack.**deepcopy**(*item*, *use_list=False*)

Copy a msgpack serializable by packing then unpacking it. For complex primitives, this runs in about 1/3 the time of copy.deepcopy()

synapse.lib.msgpack.**dumpfile**(*item*, *path*)

Dump an object to a file by path.

Parameters

- **item** (*object*) – The object to serialize.
- **path** (*str*) – The file path to save.

Returns
None

synapse.lib.msgpack.**en**(*item*)

Use msgpack to serialize a compatible python object.

Parameters
item (*obj*) – The object to serialize

Notes

String objects are encoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow encoding bad input strings.

Returns
The serialized bytes in msgpack format.

Return type
bytes

synapse.lib.msgpack.**getvars**(*varz*)

synapse.lib.msgpack.**isok**(*item*)

Returns True if the item can be msgpacked (by testing packing).

synapse.lib.msgpack.**iterfd**(*fd*)

Generator which unpacks a file object of msgpacked content.

Parameters
fd – File object to consume data from.

Notes

String objects are decoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow decoding bad input strings.

Yields
Objects from a msgpack stream.

synapse.lib.msgpack.**iterfile**(*path*, *since=-1*)

Generator which yields msgpack objects from a file path.

Parameters
path – File path to open and consume data from.

Notes

String objects are decoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow decoding bad input strings.

Yields
Objects from a msgpack stream.

`synapse.lib.msgpack.`**`loadfile`**(*path*)

Load and upack the msgpack bytes from a file by path.

Parameters
path (*str*) – The file path to a message pack file.

Raises
msgpack.exceptions.ExtraData – If the file contains multiple objects.

Returns
The decoded python object.

Return type
(obj)

`synapse.lib.msgpack.`**`un`**(*byts*, *use_list=False*)

Use msgpack to de-serialize a python object.

Parameters
byts (*bytes*) – The bytes to de-serialize

Notes

String objects are decoded using utf8 encoding. In order to handle potentially malformed input, `unicode_errors='surrogatepass'` is set to allow decoding bad input strings.

Returns
The de-serialized object

Return type
obj

synapse.lib.multislabseqn module

class synapse.lib.multislabseqn.**MultiSlabSeqn**

Bases: *Base*

An append-optimized sequence of byte blobs stored across multiple slabs for fast rotating/culling

async add(*item: Any*, *indx=None*) → int

Add a single item to the sequence.

async cull(*offs: int*) → bool

Remove entries up to (and including) the given offset.

async get(*offs: int*) → Any

Retrieve a single row by offset

getOffsetEvent(*offs: int*) → Event

Returns an asyncio Event that will be set when the particular offset is written. The event will be set if the offset has already been reached.

async gets(*offs*, *wait=True*) → AsyncIterator[Tuple[int, Any]]

Just like iter, but optionally waits for new entries once the end is reached.

index() → int

Return the current index to be used

async iter(*offs: int*) → AsyncIterator[Tuple[int, Any]]

Iterate over items in a sequence from a given offset.

Parameters
offs (*int*) – The offset to begin iterating from.

Yields
(indx, valu) – The index and valu of the item.

async last() → Tuple[int, Any] | None

async rotate() → int

Rotate the Nexus log at the current index.

> **Note**
>
> After this executes the tailseqn will be empty. Waiting for this indx to be written will indicate when it is possible to cull 1 minus the return value such that the rotated seqn is deleted.

Returns
The starting index of the new seqn

Return type
int

setIndex(*indx: int*) → None

static slabFilename(*dirn: str*, *indx: int*)

async waitForOffset(*offs: int*, *timeout=None*) → bool

Returns
true if the event got set, False if timed out

synapse.lib.nexus module

class synapse.lib.nexus.**ChangeDist**

Bases: *Base*

A utility class to distribute new change entries to mirrors/followers

update() → bool

class synapse.lib.nexus.**NexsRoot**

Bases: *Base*

async addWriteHold(*reason*)

async cull(*offs*)

async delWriteHold(*reason*)

async eat(*nexsiden*, *event*, *args*, *kwargs*, *meta*)

Actually mutate for the given nexsiden instance.

async enNexsLog()

getChangeDist(*offs: int*) → AsyncIterator[*ChangeDist*]

getNexsKids()

async index()

async isNexsReady()

async issue(*nexsiden*, *event*, *args*, *kwargs*, *meta=None*)

If I'm not a follower, mutate, otherwise, ask the leader to make the change and wait for the follower loop to hand me the result through a future.

async iter(*offs: int*, *tellready=False*, *wait=True*) → AsyncIterator[Any]

Returns an iterator of change entries in the log

async promote()

async recover() → None

Replays the last entry in the nexus log in case we crashed between writing the log and applying it.

Notes

This must be called at cell startup after subsystems are initialized but before any write transactions might happen.

The log can only have recorded 1 entry ahead of what is applied. All log actions are idempotent, so replaying the last action that (might have) already happened is harmless.

reqNotReadOnly()

async rotate()

async runMirrorLoop(*proxy*)

async setNexsReady(*status*)

async setindex(*indx*)

async startup()

async waitOffs(*offs*, *timeout=None*)

class synapse.lib.nexus.**Pusher**

Bases: *Base*

A mixin-class to manage distributing changes where one might plug in mirroring or consensus protocols

async modNexsRoot(*ctor*)

classmethod onPush(*event: str*, *passitem=False*) → Callable

Decorator that registers a method to be a handler for a named event

Parameters

- **event** – string that distinguishes one handler from another. Must be unique per Pusher subclass

- **passitem** – whether to pass the (offs, mesg) tuple to the handler as "nexsitem"

classmethod onPushAuto(*event: str*, *passitem=False*) → Callable

Decorator that does the same as onPush, except automatically creates the top half method

Parameters

- **event** – string that distinguishes one handler from another. Must be unique per Pusher subclass
- **passitem** – whether to pass the (offs, mesg) tuple to the handler as "nexsitem"

async saveToNexs(*name*, **args*, ***kwargs*)

setNexsRoot(*nexsroot*)

class synapse.lib.nexus.**RegMethType**(*name: str*, *bases: List[type]*, *attrs: Dict[str, Any]*)

Bases: `type`

Metaclass that collects all methods in class with _regme prop into a class member called _regclstupls

synapse.lib.node module

class synapse.lib.node.**Node**(*snap*, *sode*, *bylayer=None*)

Bases: `object`

A Cortex hypergraph node.

NOTE: This object is for local Cortex use during a single Xact.

async addEdge(*verb*, *n2iden*, *extra=None*)

async addTag(*tag*, *valu=(None, None)*)

Add a tag to a node.

Parameters

- **tag** (*str*) – The tag to add to the node.
- **valu** – The optional tag value. If specified, this must be a value that norms as a valid time interval as an ival.

Returns
This returns None.

Return type
None

async delEdge(*verb*, *n2iden*, *extra=None*)

async delTag(*tag*, *init=False*)

Delete a tag from the node.

async delTagProp(*tag*, *name*)

async delete(*force=False*)

Delete a node from the cortex.

The following tear-down operations occur in order:

- validate that you have permissions to delete the node
- validate that you have permissions to delete all tags

- validate that there are no remaining references to the node.
- **delete all the tags (bottom up)**
  - fire onDelTag() handlers
  - delete tag properties from storage
- **delete all secondary properties**
  - fire onDelProp handler
  - delete secondary property from storage
- **delete the primary property**
  - fire onDel handlers for the node
  - delete primary property from storage

async filter(*runt*, *text*, *opts=None*, *path=None*)

get(*name*)

Return a secondary property value from the Node.

Parameters
name (*str*) – The name of a secondary property.

Returns
The secondary property value or None.

Return type
(obj)

getByLayer()

Return a dictionary that translates the node's bylayer dict to a primitive.

async getData(*name*, *defv=None*)

async getEmbeds(*embeds*)

Return a dictionary of property embeddings.

getNodeRefs()

Return a list of (prop, (form, valu)) refs out for the node.

async getStorNodes()

Return a list of the raw storage nodes for each layer.

getTag(*name*, *defval=None*)

getTagProp(*tag*, *prop*, *defval=None*)

Return the value (or defval) of the given tag property.

getTagProps(*tag*)

getTags(*leaf=False*)

has(*name*)

async hasData(*name*)

hasTag(*name*)

hasTagProp(*tag*, *prop*)

Check if a #foo.bar:baz tag property exists on the node.

iden()

async iterData()

async iterDataKeys()

async iterEdgeVerbs(*n2buid*)

async iterEdgesN1(*verb=None*)

async iterEdgesN2(*verb=None*)

pack(*dorepr=False*)

Return the serializable/packed version of the node.

Parameters
dorepr (*bool*) – Include repr information for human readable versions of properties.

Returns
An (ndef, info) node tuple.

Return type
(tuple)

async pop(*name*, *init=False*)

Remove a property from a node and return the value

async popData(*name*)

repr(*name=None*, *defv=None*)

reprs()

Return a dictionary of repr values for props whose repr is different than the system mode value.

async set(*name*, *valu*, *init=False*)

Set a property on the node.

Parameters

- **name** (*str*) – The name of the property.
- **valu** (*obj*) – The value of the property.
- **init** (*bool*) – Set to True to disable read-only enforcement

Returns
True if the property was changed.

Return type
(bool)

async setData(*name*, *valu*)

async setTagProp(*tag*, *name*, *valu*)

Set the value of the given tag property.

async storm(*runt*, *text*, *opts=None*, *path=None*)

Parameters
path (Path) – If set, then vars from path are copied into the new runtime, and vars are copied back out into path at the end

> **Note**
> If opts is not None and opts['vars'] is set and path is not None, then values of path vars take precedent

tagpropreprs()

Return a dictionary of repr values for tagprops whose repr is different than the system mode value.

class synapse.lib.node.**Path**(*vars*, *nodes*, *links=None*)

Bases: object

A path context tracked through the storm runtime.

clone()

finiframe()

Pop a scope frame from the path, restoring runt if at the top :param runt: A storm runtime to restore if we're at the top :type runt: Runtime :param merge: Set to true to merge vars back up into the next frame :type merge: bool

fork(*node*, *link*)

getVar(*name*, *defv=<synapse.common.NoValu object>*)

initframe(*initvars=None*)

meta(*name*, *valu*)

Add node specific metadata to be returned with the node.

async pack(*path=False*)

async popVar(*name*)

async setVar(*name*, *valu*)

synapse.lib.node.**iden**(*pode*)

Return the iden (buid) of the packed node.

Parameters
pode (*tuple*) – A packed node.

Returns
The node iden.

Return type
str

synapse.lib.node.**ndef**(*pode*)

Return a node definition (<form>,<valu>) tuple from the node.

Parameters
pode (*tuple*) – A packed node.

Returns
The (<form>,<valu>) tuple for the node

Return type
((str,obj))

synapse.lib.node.**prop**(*pode*, *prop*)

Return the valu of a given property on the node.

Parameters

- **pode** (*tuple*) – A packed node.
- **prop** (*str*) – Property to retrieve.

Notes

The prop argument may be the full property name (foo:bar:baz), relative property name (:baz) , or the unadorned property name (baz).

Returns:

synapse.lib.node.**props**(*pode*)

Get the props from the node.

Parameters
pode (*tuple*) – A packed node.

Notes

This will include any universal props present on the node.

Returns
A dictionary of properties.

Return type
dict

synapse.lib.node.**reprNdef**(*pode*)

Get the ndef of the pode with a human readable value.

Parameters
pode (*tuple*) – A packed node.

Notes

The human readable value is only available if the node came from a storm query execution where the `repr` key was passed into the `opts` argument with a True value.

Returns
A tuple of form and the human readable value.

Return type
(str, str)

synapse.lib.node.**reprProp**(*pode*, *prop*)

Get the human readable value for a secondary property from the pode.

Parameters

- **pode** (*tuple*) – A packed node.
- **prop**

Notes

The human readable value is only available if the node came from a storm query execution where the `repr` key was passed into the `opts` argument with a True value.

The prop argument may be the full property name (foo:bar:baz), relative property name (:baz) , or the unadorned property name (baz).

Returns
The human readable property value. If the property is not present, returns None.

Return type
str

synapse.lib.node.**reprTag**(*pode*, *tag*)

Get the human readable value for the tag timestamp from the pode.

Parameters

- **pode** (*tuple*) – A packed node.
- **tag** (*str*) – The tag to get the value for.

Notes

The human readable value is only available if the node came from a storm query execution where the `repr` key was passed into the `opts` argument with a True value.

If the tag does not have a timestamp, this returns a empty string.

Returns
The human readable value for the tag. If the tag is not present, returns None.

Return type
str

synapse.lib.node.**reprTagProps**(*pode*, *tag*)

Get the human readable values for any tagprops on a tag for a given node.

Parameters

- **pode** (*tuple*) – A packed node.
- **tag** (*str*) – The tag to get the tagprops reprs for.

Notes

The human readable value is only available if the node came from a storm query execution where the `repr` key was passed into the `opts` argument with a True value.

If the tag does not have any tagprops associated with it, this returns an empty list.

Returns
A list of tuples, containing the name of the tagprop and the repr value.

Return type
list

synapse.lib.node.**tagged**(*pode*, *tag*)

Check if a packed node has a given tag.

Parameters

- **pode** (*tuple*) – A packed node.

- **tag** (*str*) – The tag to check.

Examples

Check if a node is tagged with "woot" and dostuff if it is.

```
if s_node.tagged(node,'woot'):
    dostuff()
```

Notes

If the tag starts with #, this is removed prior to checking.

Returns
True if the tag is present. False otherwise.

Return type
bool

synapse.lib.node.**tags**(*pode*, *leaf=False*)

Get all the tags for a given node.

Parameters

- **pode** (*tuple*) – A packed node.
- **leaf** (*bool*) – If True, only return leaf tags

Returns
A list of tag strings.

Return type
list

synapse.lib.node.**tagsnice**(*pode*)

Get all the leaf tags and the tags that have values or tagprops.

Parameters
pode (*tuple*) – A packed node.

Returns
A list of tag strings.

Return type
list

synapse.lib.oauth module

class synapse.lib.oauth.**OAuthMixin**

Bases: *Pusher*

Mixin for Cells to organize and execute OAuth token refreshes.

async addOAuthProvider(*conf*)

async clearOAuthAccessToken(*provideriden*, *useriden*)

Remove a client access token by clearing the configuration. This will prevent further refreshes (if scheduled), and a new auth code will be required the next time an access token is requested.

async delOAuthProvider(*iden*)

async getOAuthAccessToken(*provideriden*, *useriden*)

async getOAuthClient(*provideriden*, *useriden*)

async getOAuthProvider(*iden*)

listOAuthClients()

Returns
List of (provideriden, useriden, conf) for each client.

Return type
list

async listOAuthProviders()

async setOAuthAuthCode(*provideriden*, *useriden*, *authcode*, *code_verifier=None*)

Typically set as the end result of a successful OAuth flow. An initial access token and refresh token will be immediately requested, and the client will be loaded into the schedule to be background refreshed.

synapse.lib.oauth.**normOAuthTokenData**(*issued_at*, *data*)

Normalize timestamps to be in epoch millis and set expires_at/refresh_at.

synapse.lib.output module

Tools for easily hookable output from cli-like tools.

class synapse.lib.output.**OutPut**

Bases: object

printf(*mesg*, *addnl=True*)

class synapse.lib.output.**OutPutBytes**

Bases: *OutPutFd*

class synapse.lib.output.**OutPutFd**(*fd*, *enc='utf8'*)

Bases: *OutPut*

class synapse.lib.output.**OutPutStr**

Bases: *OutPut*

synapse.lib.parser module

class synapse.lib.parser.**AstConverter**(*text*)

Bases: Transformer

Convert AST from parser into synapse AST, depth first.

If a method with a name that matches the current rule exists, that will be called, otherwise __default__ will be used

caseentry(*meta*, *kids*)

cmdrargs(*meta*, *kids*)

embedquery(*meta*, *kids*)

evalvalu(*meta*, *kids*)

exprdict(*meta*, *kids*)

exprlist(*meta*, *kids*)

funcargs(*meta*, *kids*)

A list of function parameters (as part of a function definition)

funccall(*meta*, *kids*)

liftreverse(*meta*, *kids*)

metaToAstInfo(*meta*, *isterm=False*)

operrelprop_join(*meta*, *kids*)

operrelprop_pivot(*meta*, *kids*, *isjoin=False*)

raiseBadSyntax(*mesg*, *astinfo*)

stormcmdargs(*meta*, *kids*)

subquery(*meta*, *kids*)

switchcase(*meta*, *kids*)

varderef(*meta*, *kids*)

varlist(*meta*, *kids*)

yieldvalu(*meta*, *kids*)

class synapse.lib.parser.**AstInfo**(*text*, *soff*, *eoff*, *sline*, *eline*, *scol*, *ecol*, *isterm*)

Bases: `tuple`

ecol

Alias for field number 6

eline

Alias for field number 4

eoff

Alias for field number 2

isterm

Alias for field number 7

scol

Alias for field number 5

sline

Alias for field number 3

soff

Alias for field number 1

text

Alias for field number 0

class synapse.lib.parser.**CmdStringer**(*visit_tokens: bool = True*)

Bases: `Transformer`

alist(*meta*, *kids*)

cmdstring(*meta*, *kids*)

valu(*meta*, *kids*)

class synapse.lib.parser.**Parser**(*text*, *offs=0*)

Bases: object

Storm query parser

cmdrargs()

Parse command args that might have storm queries as arguments

eval()

lookup()

query()

Parse the storm query

Returns (s_ast.Query): instance of parsed query

search()

synapse.lib.parser.**format_unescape**(*valu*)

synapse.lib.parser.**massage_vartokn**(*astinfo*, *x*)

synapse.lib.parser.**parseEval**(*text*)

synapse.lib.parser.**parseQuery**(*text*, *mode='storm'*)

Parse a storm query and return the Lark AST. Cached here to speed up unit tests

synapse.lib.parser.**parse_cmd_string**(*text*, *off*)

Parse a command line string which may be quoted.

synapse.lib.parser.**unescape**(*valu*)

Parse a string for backslash-escaped characters and omit them. The full list of escaped characters can be found at https://docs.python.org/3/reference/lexical_analysis.html#string-and-bytes-literals

synapse.lib.queue module

class synapse.lib.queue.**AQueue**

Bases: *Base*

An async queue with chunk optimized sync compatible consumer.

put(*item*)

Add an item to the queue.

async slice()

class synapse.lib.queue.**Queue**(*maxsize=None*)

Bases: object

An asyncio Queue with batch methods and graceful close.

async close()

async put(*item*)

async puts(*items*)

async size()

async slice(*size=1000*)

async slices(*size=1000*)

class synapse.lib.queue.**Window**

Bases: *Base*

A Queue like object which yields added items. If the queue ever reaches its maxsize, it will be fini()d. On fini(), the Window will continue to yield results until empty and then return.

async put(*item*)

Add a single item to the Window.

async puts(*items*)

Add multiple items to the window.

synapse.lib.ratelimit module

class synapse.lib.ratelimit.**RateLimit**(*rate*, *per*)

Bases: object

A RateLimit class may be used to detect/enforce rate limits.

Example

allow 20 uses per 10 sec (2/sec) rlimit = RateLimit(20,10)

Notes

It is best (even in a "calls per day" type config) to specify a smaller "per" to force rate "smoothing".

allows()

Returns True if the rate limit has not been reached.

Example

if not rlimit.allows():
    rasie RateExceeded()

ok to go...

synapse.lib.reflect module

synapse.lib.reflect.**getClsNames**(*item*)

Return a list of "fully qualified" class names for an instance.

Example

for name in getClsNames(foo):
    print(name)

synapse.lib.reflect.**getItemLocals**(*item*)

Iterate the locals of an item and yield (name,valu) pairs.

Example

for name,valu in getItemLocals(item):
dostuff()

synapse.lib.reflect.**getMethName**(*meth*)

Return a fully qualified string for the <mod>.<class>.<func> name of a given method.

synapse.lib.reflect.**getShareInfo**(*item*)

Get a dictionary of special annotations for a Telepath Proxy.

Parameters
item – Item to inspect.

Notes

This will set the `_syn_telemeth` attribute on the item and the items class, so this data is only computed once.

Returns
A dictionary of methods requiring special handling by the proxy.

Return type
dict

synapse.lib.rstorm module

class synapse.lib.rstorm.**OutPutRst**

Bases: *OutPutStr*

Rst specific helper for output intended to be indented in RST text as a literal block.

prefix = ' '

printf(*mesg*, *addnl=True*)

class synapse.lib.rstorm.**StormCliOutput**

Bases: *StormCli*

async handleErr(*mesg*)

printf(*mesg*, *addnl=True*, *color=None*)

async runRstCmdLine(*text*, *ctx*, *stormopts=None*)

class synapse.lib.rstorm.**StormOutput**(*core*, *ctx*, *stormopts=None*, *opts=None*)

Bases: *StormCmd*

Produce standard output from a stream of storm runtime messages. Must be instantiated for a single query with a rstorm context.

printf(*mesg*, *addnl=True*, *color=None*)

async runCmdLine(*line*)

Run a line of command input for this command.

Parameters
line (*str*) – Line to execute

Examples

Run the foo command with some arguments:

await foo.runCmdLine('foo –opt baz woot.com')

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.lib.rstorm.**StormRst**

Bases: *Base*

async run()

Parses the specified RST file with Storm directive handling.

Returns
List of line strings for the RST output

Return type
list

synapse.lib.rstorm.**getCell**(*ctor*, *conf*)

synapse.lib.schemas module

synapse.lib.scope module

class synapse.lib.scope.**Scope**(**frames*, ***vals*)

Bases: object

The Scope object assists in creating nested varible scopes.

Example

with Scope() as scope:

scope.set('foo',10)

with scope:
scope.set('foo',20) dostuff(scope) # 'foo' is 20…

dostuff(scope) # 'foo' is 10 again…

add(*name*, **vals*)

Add values as iter() compatible items in the current scope frame.

copy()

Create a shallow copy of the current Scope.

Returns
A new scope which is a copy of the current scope.

Return type
Scope

enter(*vals=None*)

Add an additional scope frame.

get(*name*, *defval=None*)

Retrieve a value from the closest scope frame.

iter(*name*)

Iterate through values added with add() from each scope frame.

leave()

Pop the current scope frame.

pop(*name*, *defval=None*)

Pop and return a value (from the last frame) of the scope.

Parameters
name (*str*) – The name of the scope variable.

Returns
The scope variable value or None

Return type
obj

set(*name*, *valu*)

Set a value in the current scope frame.

update(*vals*)

Set multiple values in the current scope frame.

synapse.lib.scope.**clone**(*task: Task*) → None

Clone the current task Scope onto the provided task.

Parameters
task (*asyncio.Task*) – The task object to attach the scope too.

Notes

This must be run from an asyncio IO loop.

If the current task does not have a scope, we clone the default global Scope.

This will `enter()` the scope, and add a task callback to `leave()` the scope.

Returns
None

synapse.lib.scope.**ctor**(*name*, *func*, **args*, ***kwargs*)

Add a ctor callback to the global scope.

synapse.lib.scope.**enter**(*vals=None*)

Return the task's local scope for use in a with block

synapse.lib.scope.**get**(*name*, *defval=None*)

Access this task's scope with default values from glob.

synapse.lib.scope.**pop**(*name*)

Pop and return a task scope variable. :param name: The task scope variable name. :type name: str

Returns
The scope value or None

Return type
obj

synapse.lib.scope.**set**(*name*, *valu*)

Set a value in the current frame of the local task scope.

synapse.lib.scope.**update**(*vals*)

synapse.lib.scrape module

synapse.lib.scrape.**contextScrape**(*text*, *form=None*, *refang=True*, *first=False*)

Scrape types from a blob of text and yield info dictionaries.

Parameters

- **text** (*str*) – Text to scrape.
- **form** (*str*) – Optional form to scrape. If present, only scrape items which match the provided form.
- **refang** (*bool*) – Whether to remove de-fanging schemes from text before scraping.
- **first** (*bool*) – If true, only yield the first item scraped.

Notes

The dictionaries yielded by this function contains the following keys:

match
The raw matching text found in the input text.

offset
The offset into the text where the match was found.

valu
The resulting value.

form
The corresponding form for the valu.

Returns
Yield info dicts of results.

Return type
(dict)

async synapse.lib.scrape.**contextScrapeAsync**(*text*, *form=None*, *refang=True*, *first=False*)

Scrape types from a blob of text and yield info dictionaries, using the shared forked process pool.

Parameters

- **text** (*str*) – Text to scrape.
- **form** (*str*) – Optional form to scrape. If present, only scrape items which match the provided form.
- **refang** (*bool*) – Whether to remove de-fanging schemes from text before scraping.
- **first** (*bool*) – If true, only yield the first item scraped.

Notes

The dictionaries yielded by this function contains the following keys:

match
The raw matching text found in the input text.

offset
The offset into the text where the match was found.

valu
The resulting value.

form
The corresponding form for the valu.

Returns
Yield info dicts of results.

Return type
(dict)

synapse.lib.scrape.**cve_check**(*match: Match*)

synapse.lib.scrape.**fqdn_check**(*match: Match*)

synapse.lib.scrape.**genFangRegex**(*fangs*, *flags=regex.I*)

synapse.lib.scrape.**genMatches**(*text: str*, *regx: compile*, *opts: dict*)
Generate regular expression matches for a blob of text.

Parameters

- **text** (*str*) – The text to generate matches for.
- **regx** (*regex.Regex*) – A compiled regex object. The regex must contained a named match group for `valu`.
- **opts** (*dict*) – An options dictionary.

Notes

The dictionaries yielded by this function contains the following keys:

raw_valu
The raw matching text found in the input text.

offset
The offset into the text where the match was found.

valu
The resulting value - this may be altered by callbacks.

The options dictionary can contain a `callback` key. This function is expected to take a single argument, a regex.Match object, and return a tuple of the new valu and info dictionary. The new valu is used as the `valu` key in the returned dictionary, and any other information in the info dictionary is pushed into the return dictionary as well.

Yields
dict – A dictionary of match results.

async synapse.lib.scrape.**genMatchesAsync**(*text: str*, *regx: compile*, *opts: dict*)

Generate regular expression matches for a blob of text, using the shared forked process pool.

Parameters

- **text** (*str*) – The text to generate matches for.
- **regx** (*regex.Regex*) – A compiled regex object. The regex must contained a named match group for `valu`.
- **opts** (*dict*) – An options dictionary.

Notes

The dictionaries yielded by this function contains the following keys:

raw_valu
The raw matching text found in the input text.

offset
The offset into the text where the match was found.

valu
The resulting value - this may be altered by callbacks.

The options dictionary can contain a `callback` key. This function is expected to take a single argument, a regex.Match object, and return a tuple of the new valu and info dictionary. The new valu is used as the `valu` key in the returned dictionary, and any other information in the info dictionary is pushed into the return dictionary as well.

Yields
dict – A dictionary of match results.

synapse.lib.scrape.**getForms**()

Get a list of forms recognized by the scrape APIs.

Returns
A list of form values.

Return type
list

synapse.lib.scrape.**inet_server_check**(*match: Match*)

synapse.lib.scrape.**ipv6_check**(*match: Match*)

synapse.lib.scrape.**linux_path_check**(*match: Match*)

synapse.lib.scrape.**refang_text**(*txt*)

Remove address de-fanging in text blobs, .e.g. example[.]com to example.com

Matches to keys in FANGS is case-insensitive, but replacement will always be with the lowercase version of the re-fanged value. For example, HXXP://FOO.COM will be returned as http://FOO.COM

Returns
Re-fanged text blob

Return type
(str)

synapse.lib.scrape.**refang_text2**(*txt: str*, *re: compile = regex.Regex('fxp:\|fxps:\|hxxp:\|hxxps:\|fxp\\[s\\]:\|hxxp\\[s\\]:\|ftp\\[:\\]\|fxp\\[:\\]\|ftps\\[:\\]\|fxps\\[flags=regex.I | regex.V0)*, *fangs: dict = {'(.)': '.', '()': '', '()': '', '()': '', '.]': '.', '[.': '.', '[.]': '.', '[:]': ':', '[@]': '@', '[at]': '@', '[dot]': '.', '[]': '', '[]': '', '[]': '', \\.': '.', 'ftp(:)': 'ftp:', 'ftp[:': 'ftp:', 'ftp[://]': 'ftp://', 'ftp[:]': 'ftp:', 'ftps(:)': 'ftps:', 'ftps[:': 'ftps:', 'ftps[://]': 'ftps://', 'ftps[:]': 'ftps:', 'fxp(:)': 'ftp:', 'fxp:': 'ftp:', 'fxp[:': 'ftp:', 'fxp[://]': 'ftp://', 'fxp[:]': 'ftp:', 'fxp[s]:': 'ftps:', 'fxps(:)': 'ftps:', 'fxps:': 'ftps:', 'fxps[:': 'ftps:', 'fxps[://]': 'ftps://', 'fxps[:]': 'ftps:', 'http(:)': 'http:', 'http[:': 'http:', 'http[://]': 'http://', 'http[:]': 'http:', 'https(:)': 'https:', 'https[:': 'https:', 'https[://]': 'https://', 'https[:]': 'https:', 'hxxp(:)': 'http:', 'hxxp:': 'http:', 'hxxp[:': 'http:', 'hxxp[://]': 'http://', 'hxxp[:]': 'http:', 'hxxp[s]:': 'https:', 'hxxps(:)': 'https:', 'hxxps:': 'https:', 'hxxps[:': 'https:', 'hxxps[://]': 'https://', 'hxxps[:]': 'https:'}*)

Remove address de-fanging in text blobs, .e.g. example[.]com to example.com

Notes

Matches to keys in FANGS is case-insensitive, but replacement will always be with the lowercase version of the re-fanged value. For example, `HXXP://FOO.COM` will be returned as `http://FOO.COM`

Parameters
txt (*str*) – The text to re-fang.

Returns
A tuple containing the new text, and a dictionary containing offset information where the new text was altered with respect to the original text.

Return type
tuple(str, dict)

synapse.lib.scrape.**scrape**(*text*, *ptype=None*, *refang=True*, *first=False*)

Scrape types from a blob of text and return node tuples.

Parameters

- **text** (*str*) – Text to scrape.
- **ptype** (*str*) – Optional ptype to scrape. If present, only scrape items which match the provided type.
- **refang** (*bool*) – Whether to remove de-fanging schemes from text before scraping.
- **first** (*bool*) – If true, only yield the first item scraped.

Returns
Yield tuples of node ndef values.

Return type
(str, object)

async synapse.lib.scrape.**scrapeAsync**(*text*, *ptype=None*, *refang=True*, *first=False*)

Scrape types from a blob of text and return node tuples, using the shared forked process pool.

Parameters

- **text** (*str*) – Text to scrape.
- **ptype** (*str*) – Optional ptype to scrape. If present, only scrape items which match the provided type.
- **refang** (*bool*) – Whether to remove de-fanging schemes from text before scraping.

- **first** (*bool*) – If true, only yield the first item scraped.

Returns
Yield tuples of node ndef values.

Return type
(str, object)

synapse.lib.scrape.**unc_path_check**(*match: Match*)

synapse.lib.scrape.**url_scheme_check**(*match: Match*)

synapse.lib.scrape.**windows_path_check**(*match: Match*)

synapse.lib.share module

class synapse.lib.share.**Share**

Bases: *Base*

Class to wrap a dynamically shared object.

synapse.lib.slaboffs module

class synapse.lib.slaboffs.**SlabOffs**(*slab:* Slab, *db: str*)

Bases: object

A helper for storing offset integers by iden.

As with all slab objects, this is meant for single-thread async loop use.

delete(*iden*)

get(*iden*)

set(*iden*, *offs*)

synapse.lib.slabseqn module

class synapse.lib.slabseqn.**SlabSeqn**(*slab*, *name: str*)

Bases: object

An append optimized sequence of byte blobs.

Parameters

- **lenv** (*lmdb.Environment*) – The LMDB Environment.
- **name** (*str*) – The name of the sequence.

add(*item*, *indx=None*)

Add a single item to the sequence.

async aiter(*offs*, *wait=False*, *timeout=None*)

Iterate over items in a sequence from a given offset.

Parameters

- **offs** (*int*) – The offset to begin iterating from.
- **wait** (*boolean*) – Once caught up, yield new results in realtime.
- **timeout** (*int*) – Max time to wait for a new item.

Yields
(indx, valu) – The index and valu of the item.

`async cull(offs)`

Remove entries up to (and including) the given offset.

`first()`

`get(offs)`

Retrieve a single row by offset

`getByIndxByts(indxbyts)`

`getOffsetEvent(offs)`

Returns an asyncio Event that will be set when the particular offset is written. The event will be set if the offset has already been reached.

`getraw(byts)`

`async gets(offs, wait=True)`

Returns an async generator of indx/valu tuples, optionally waiting and continuing to yield them as new entries are added

Parameters

- **offs** (*int*) – The offset to begin iterating from.
- **wait** (*bool*) – Whether to continue yielding tupls when it hits the end of the sequence.

Yields
(indx, valu) – The index and valu of the item.

`index()`

Return the current index to be used

`iter(offs, reverse=False)`

Iterate over items in a sequence from a given offset.

Parameters
offs (*int*) – The offset to begin iterating from.

Yields
(indx, valu) – The index and valu of the item.

`iterBack(offs)`

Iterate backwards over items in a sequence from a given offset.

Parameters
offs (*int*) – The offset to begin iterating from.

Yields
(indx, valu) – The index and valu of the item.

`last()`

`nextindx()`

Determine the next insert offset according to storage.

Returns
The next insert offset.

Return type
int

pop(*offs*)

Pop a single entry at the given offset.

rows(*offs*)

Iterate over raw indx, bytes tuples from a given offset.

async save(*items*)

Save a series of items to a sequence.

Parameters
items (*tuple*) – The series of items to save into the sequence.

Returns
The index of the first item

slice(*offs*, *size*)

sliceBack(*offs*, *size*)

stat()

trim(*offs*)

Delete entries starting at offset and moving forward.

async waitForOffset(*offs*, *timeout=None*)

Returns
true if the event got set, False if timed out

synapse.lib.snap module

class synapse.lib.snap.**ProtoNode**(*ctx*, *buid*, *form*, *valu*, *node*)

Bases: object

A prototype node used for staging node adds using a SnapEditor.

TODO: This could eventually fully mirror the synapse.lib.node.Node API and be used
to slipstream into sections of the pipeline to facilitate a bulk edit / transaction

async addEdge(*verb*, *n2iden*)

async addTag(*tag*, *valu=(None, None)*, *tagnode=None*)

async delEdge(*verb*, *n2iden*)

async flushEdits()

get(*name*)

async getData(*name*)

getNodeEdit()

async getSetSubOps(*name*, *valu*, *norminfo=None*)

getTag(*tag*)

getTagProp(*tag*, *name*)

async hasData(*name*)

hasTagProp(*tag*, *name*)

iden()

async set(*name*, *valu*, *norminfo=None*, *ignore_ro=False*)

async setData(*name*, *valu*)

async setTagProp(*tag*, *name*, *valu*)

class synapse.lib.snap.**Scrubber**(*rules*)

Bases: `object`

scrub(*pode*)

class synapse.lib.snap.**Snap**

Bases: *Base*

A "snapshot" is a transaction across multiple Cortex layers.

The Snap object contains the bulk of the Cortex API to facilitate performance through careful use of transaction boundaries.

Transactions produce the following EventBus events:

('print', {}),

async addFeedData(*name*, *items*)

async addFeedNodes(*name*, *items*)

Call a feed function and return what it returns (typically yields Node()s).

Parameters

- **name** (*str*) – The name of the feed record type.
- **items** (*list*) – A list of records of the given feed type.

Returns

The return value from the feed function. Typically Node() generator.

Return type

(object)

async addNode(*name*, *valu*, *props=None*, *norminfo=None*)

Add a node by form name and value with optional props.

Parameters

- **name** (*str*) – The form of node to add.
- **valu** (*obj*) – The value for the node.
- **props** (*dict*) – Optional secondary properties for the node.

Notes

If a props dictionary is provided, it may be mutated during node construction.

Returns
A Node object. It may return None if the snap is unable to add or lift the node.

Return type
s_node.Node

async addNodes(*nodedefs*)

Add/merge nodes in bulk.

The addNodes API is designed for bulk adds which will also set properties, add tags, add edges, and set nodedata to existing nodes. Nodes are specified as a list of the following tuples:

((form, valu), {'props':{}, 'tags':{}})

Parameters
nodedefs (*list*) – A list of nodedef tuples.

Returns
A list of xact messages.

Return type
(list)

async addStormRuntime(*query*, *opts=None*, *user=None*)

async applyNodeEdit(*edit*, *nodecache=None*)

async applyNodeEdits(*edits*, *nodecache=None*, *meta=None*)

Sends edits to the write layer and evaluates the consequences (triggers, node object updates)

buidcachesize = 100000

async clearCache()

clearCachedNode(*buid*)

async eval(*text*, *opts=None*, *user=None*)

Run a storm query and yield Node() objects.

getEditor()

async getNdefRefs(*buid*, *props=False*)

async getNodeByBuid(*buid*)

Retrieve a node tuple by binary id.

Parameters
buid (*bytes*) – The binary ID for the node.

Returns
The node object or None.

Return type
Optional[s_node.Node]

async getNodeByNdef(*ndef*)

Return a single Node by (form,valu) tuple.

Parameters

- **ndef** ((*str,obj*)) – A (form,valu) ndef tuple. valu must be
- **normalized.**

Returns
The Node or None.

Return type
(*synapse.lib.node.Node*)

async getNodeData(*buid*, *name*, *defv=None*)

Get nodedata from closest to write layer, no merging involved

getNodeEditor(*node*)

async getRuntNodes(*full*, *valu=None*, *cmpr=None*)

async getSnapMeta()

Retrieve snap metadata to store along side nodeEdits.

getStormRuntime(*query*, *opts=None*, *user=None*)

async getTagNode(*name*)

Retrieve a cached tag node. Requires name is normed. Does not add.

async getTagNorm(*tagname*)

async hasNodeData(*buid*, *name*)

Return True if the buid has nodedata set on it under the given name False otherwise

async hasNodeEdge(*buid1*, *verb*, *buid2*)

async iterEdgeVerbs(*n1buid*, *n2buid*)

async iterNodeData(*buid*)

Returns: Iterable[Tuple[str, Any]]

async iterNodeDataKeys(*buid*)

Yield each data key from the given node by buid.

async iterNodeEdgesN1(*buid*, *verb=None*)

async iterNodeEdgesN2(*buid*, *verb=None*)

async iterStormPodes(*text*, *opts*, *user=None*)

Yield packed node tuples for the given storm query text.

async keepalive(*period*)

async nodes(*text*, *opts=None*, *user=None*)

async nodesByDataName(*name*)

async nodesByProp(*full*, *reverse=False*)

async nodesByPropArray(*full*, *cmpr*, *valu*, *reverse=False*, *norm=True*)

async **nodesByPropTypeValu**(*name*, *valu*, *reverse=False*)

async **nodesByPropValu**(*full*, *cmpr*, *valu*, *reverse=False*, *norm=True*)

async **nodesByTag**(*tag*, *form=None*, *reverse=False*)

async **nodesByTagProp**(*form*, *tag*, *name*, *reverse=False*)

async **nodesByTagPropValu**(*form*, *tag*, *name*, *cmpr*, *valu*, *reverse=False*)

async **nodesByTagValu**(*tag*, *cmpr*, *valu*, *form=None*, *reverse=False*)

async **printf**(*mesg*)

async **saveNodeEdits**(*edits*, *meta*)

async **storm**(*text*, *opts=None*, *user=None*)

Execute a storm query and yield (Node(), Path()) tuples.

tagcachesize = 1000

async **warn**(*mesg*, *log=True*, ***info*)

async **warnonce**(*mesg*, *log=True*, ***info*)

class synapse.lib.snap.**SnapEditor**(*snap*, *meta=None*)

Bases: object

A SnapEditor allows tracking node edits with subs/deps as a transaction.

async **addNode**(*formname*, *valu*, *props=None*, *norminfo=None*)

async **flushEdits**()

async **getAddNodeOps**(*formname*, *valu*, *props=None*, *norminfo=None*)

async **getNodeByBuid**(*buid*)

getNodeEdits()

loadNode(*node*)

synapse.lib.spooled module

class synapse.lib.spooled.**Dict**

Bases: *Spooled*

get(*key*, *defv=None*)

has(*key*)

items()

keys()

pop(*key*, *defv=None*)

async **set**(*key*, *val*)

class synapse.lib.spooled.**Set**

Bases: *Spooled*

A minimal set-like implementation that will spool to a slab on large growth.

async add(*valu*)

async clear()

async copy()

discard(*valu*)

has(*key*)

class synapse.lib.spooled.**Spooled**

Bases: *Base*

A Base class that can be used to implement objects which fallback to lmdb.

These objects are intended to fallback from Python to lmbd slabs, which aligns them together. Under memory pressure, these objects have a better shot of getting paged out.

synapse.lib.storm module

class synapse.lib.storm.**BackgroundCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute a query pipeline as a background task. NOTE: Variables are passed through but nodes are not

async execStormCmd(*runt*, *genr*)

Abstract base method

async execStormTask(*query*, *opts*)

getArgParser()

name = 'background'

class synapse.lib.storm.**BatchCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Run a query with batched sets of nodes.

The batched query will have the set of inbound nodes available in the variable $nodes.

This command also takes a conditional as an argument. If the conditional evaluates to true, the nodes returned by the batched query will be yielded, if it evaluates to false, the inbound nodes will be yielded after executing the batched query.

NOTE: This command is intended to facilitate use cases such as queries to external
APIs with aggregate node values to reduce quota consumption. As this command interrupts the node stream, it should be used carefully to avoid unintended slowdowns in the pipeline.

Example

// Execute a query with batches of 5 nodes, then yield the inbound nodes batch $lib.false –size 5 { $lib.print($nodes) }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'batch'

class synapse.lib.storm.**Cmd**(*runt*, *runtsafe*)

Bases: object

A one line description of the command.

Command usage details and long form description.

Example

cmd –help

Notes

Python Cmd implementers may override the forms attribute with a dictionary to provide information about Synapse forms which are possible input and output nodes that a Cmd may recognize. A list of (key, form) tuples may also be added to provide information about forms which may have additional nodedata added to them by the Cmd.

Example:

```
{
    'input': (
        'inet:ipv4',
        'tel:mob:telem',
    ),
    'output': (
        'geo:place',
    ),
    'nodedata': (
        ('foodata', 'inet:http:request'),
        ('bardata', 'inet:ipv4'),
    ),
}
```

asroot = False

async execStormCmd(*runt*, *genr*)

Abstract base method

forms = {}

getArgParser()

classmethod getCmdBrief()

getDescr()

getName()

classmethod getStorNode(*form*)

isReadOnly()

name = 'cmd'

pkgname = ''

readonly = False

async setArgv(*argv*)

svciden = ''

class synapse.lib.storm.**CopyToCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Copy nodes from the current view into another view.

Examples

// Copy all nodes tagged with #cno.mal.redtree to the target view.

#cno.mal.redtree | copyto 33c971ac77943da91392dadd0eec0571

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'copyto'

class synapse.lib.storm.**CountCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Iterate through query results, and print the resulting number of nodes which were lifted. This does not yield the nodes counted, unless the –yield switch is provided.

Example

Count the number of IPV4 nodes with a given ASN. inet:ipv4:asn=20 | count

Count the number of IPV4 nodes with a given ASN and yield them. inet:ipv4:asn=20 | count –yield

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'count'

readonly = True

class synapse.lib.storm.**DelNodeCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Delete nodes produced by the previous query logic.

(no nodes are returned)

Example

inet:fqdn=vertex.link | delnode

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'delnode'

class synapse.lib.storm.**DiffCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Generate a list of nodes with changes in the top layer of the current view.

Examples

// Lift all nodes with any changes

diff

// Lift ou:org nodes that were added in the top layer.

diff –prop ou:org

// Lift inet:ipv4 nodes with the :asn property modified in the top layer.

diff –prop inet:ipv4:asn

// Lift the nodes with the tag #cno.mal.redtree added in the top layer.

diff –tag cno.mal.redtree

// Lift nodes by multiple tags (results are uniqued)

diff –tag cno.mal.redtree rep.vt

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'diff'

readonly = True

class synapse.lib.storm.**DivertCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Either consume a generator or yield it's results based on a conditional.

NOTE: This command is purpose built to facilitate the –yield convention common to storm commands.

NOTE: The genr argument must not be a function that returns, else it will be invoked for each inbound node.

Example

divert $cmdopts.yield $fooBarBaz()

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'divert'

class synapse.lib.storm.**DmonManager**

Bases: *Base*

Manager for StormDmon objects.

async addDmon(*iden*, *ddef*)

getDmon(*iden*)

getDmonDef(*iden*)

getDmonDefs()

getDmonRunlog(*iden*)

async popDmon(*iden*)

Remove the dmon and fini it if its exists.

async start()

Start all the dmons.

async stop()

Stop all the dmons.

class synapse.lib.storm.**EdgesDelCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Bulk delete light edges from input nodes.

Examples

Delete all "foo" light edges from an inet:ipv4 inet:ipv4=1.2.3.4 | edges.del foo

Delete light edges with any verb from a node inet:ipv4=1.2.3.4 | edges.del *

Delete all "foo" light edges to an inet:ipv4 inet:ipv4=1.2.3.4 | edges.del foo –n2

async delEdges(*node*, *verb*, *n2=False*)

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'edges.del'

class synapse.lib.storm.**GraphCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Generate a subgraph from the given input nodes and command line options.

Example

Using the graph command:

```
inet:fqdn | graph
            --degrees 2
            --filter { -#nope }
            --pivot { <(seen)- meta:source }
            --form-pivot inet:fqdn {<- * | limit 20}
            --form-pivot inet:fqdn {-> * | limit 20}
            --form-filter inet:fqdn {-inet:fqdn:issuffix=1}
            --form-pivot syn:tag {-> *}
            --form-pivot * {-> #}
```

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'graph'

class synapse.lib.storm.HelpCmd(*runt*, *runtsafe*)

Bases: *Cmd*

List available information about Storm and brief descriptions of different items.

Notes

If an item is provided, this can be a string or a function.

Examples

// Get all available commands, libraries, types, and their brief descriptions.

help

// Only get commands which have "model" in the name.

help model

// Get help about the base Storm library

help $lib

// Get detailed help about a specific library or library function

help –verbose $lib.print

// Get detailed help about a named Storm type

help –verbose str

// Get help about a method from a $node object

<inbound $node> help $node.tags

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'help'

class synapse.lib.storm.IdenCmd(*runt*, *runtsafe*)

Bases: *Cmd*

Lift nodes by iden.

Example

iden b25bc9eec7e159dce879f9ec85fb791f83b505ac55b346fcb64c3c51e98d1175 | count

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'iden'

readonly = True

class synapse.lib.storm.**IntersectCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Yield an intersection of the results of running inbound nodes through a pivot.

> **Note**
>
> This command must consume the entire inbound stream to produce the intersection. This type of stream consuming before yielding results can cause the query to appear laggy in comparison with normal incremental stream operations.

Examples

// Show the it:mitre:attack:technique nodes common to several groups

it:mitre:attack:group*in=(G0006, G0007) | intersect { -> it:mitre:attack:technique }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'intersect'

class synapse.lib.storm.**LiftByVerb**(*runt*, *runtsafe*)

Bases: *Cmd*

Lift nodes from the current view by an light edge verb.

Examples

Lift all the n1 nodes for the light edge “foo” lift.byverb “foo”

Lift all the n2 nodes for the light edge “foo” lift.byverb –n2 “foo”

Notes

Only a single instance of a node will be yielded from this command when that node is lifted via the light edge membership.

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

async iterEdgeNodes(*verb*, *idenset*, *n2=False*)

name = 'lift.byverb'

class synapse.lib.storm.**LimitCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Limit the number of nodes generated by the query in the given position.

Example

inet:ipv4 | limit 10

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'limit'

readonly = True

class synapse.lib.storm.**MaxCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Consume nodes and yield only the one node with the highest value for an expression.

Examples

// Yield the file:bytes node with the highest :size property file:bytes#foo.bar | max :size

// Yield the file:bytes node with the highest value for $tick file:bytes#foo.bar +.seen ($tick, $tock) = .seen | max $tick

// Yield the it:dev:str node with the longest length it:dev:str | max $lib.len($node.value())

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'max'

readonly = True

class synapse.lib.storm.**MergeCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Merge edits from the incoming nodes down to the next layer.

NOTE: This command requires the current view to be a fork.

NOTE: The arguments for including/excluding tags can accept tag glob
expressions for specifying tags. For more information on tag glob expressions, check the Synapse documentation for $node.globtags().

NOTE: If –wipe is specified, and there are nodes that cannot be merged,
they will be skipped (with a warning printed) and removed when the top layer is replaced. This should occur infrequently, for example, when a form is locked due to deprecation, a form no longer exists, or the data at rest fails normalization.

Examples

// Having tagged a new #cno.mal.redtree subgraph in a forked view...

#cno.mal.redtree | merge –apply

// Print out what the merge command *would* do but dont.

#cno.mal.redtree | merge

// Merge any org nodes with changes in the top layer.

diff | +ou:org | merge –apply

// Merge all tags other than cno.* from ou:org nodes with edits in the // top layer.

diff | +ou:org | merge –only-tags –exclude-tags cno.** –apply

// Merge only tags rep.vt.* and rep.whoxy.* from ou:org nodes with edits // in the top layer.

diff | +ou:org | merge –include-tags rep.vt.* rep.whoxy.* –apply

// Lift only inet:ipv4 nodes with a changed :asn property in top layer // and merge all changes.

diff –prop inet:ipv4:asn | merge –apply

// Lift only nodes with an added #cno.mal.redtree tag in the top layer and merge them.

diff –tag cno.mal.redtree | merge –apply

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'merge'

class synapse.lib.storm.**MinCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Consume nodes and yield only the one node with the lowest value for an expression.

Examples

// Yield the file:bytes node with the lowest :size property file:bytes#foo.bar | min :size

// Yield the file:bytes node with the lowest value for $tick file:bytes#foo.bar +.seen ($tick, $tock) = .seen | min $tick

// Yield the it:dev:str node with the shortest length it:dev:str | min $lib.len($node.value())

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'min'

readonly = True

class synapse.lib.storm.**MoveNodesCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Move storage nodes between layers.

Storage nodes will be removed from the source layers and the resulting storage node in the destination layer will contain the merged values (merged in bottom up layer order by default).

Examples

// Move storage nodes for ou:org nodes to the top layer

ou:org | movenodes –apply

// Print out what the movenodes command *would* do but dont.

ou:org | movenodes

// In a view with many layers, only move storage nodes from the bottom layer // to the top layer.

$layers = $lib.view.get().layers $top = $layers.0.iden $bot = $layers."-1".iden

ou:org | movenodes –srclayers $bot –destlayer $top

// In a view with many layers, move storage nodes to the top layer and // prioritize values from the bottom layer over the other layers.

$layers = $lib.view.get().layers $top = $layers.0.iden $mid = $layers.1.iden $bot = $layers.2.iden

ou:org | movenodes –precedence $bot $top $mid

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'movenodes'

class synapse.lib.storm.**MoveTagCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Rename an entire tag tree and preserve time intervals.

Example

movetag foo.bar baz.faz.bar

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'movetag'

class synapse.lib.storm.**OnceCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

The once command is used to filter out nodes which have already been processed via the use of a named key. It includes an optional parameter to allow the node to pass the filter again after a given amount of time.

For example, to run an enrichment command on a set of nodes just once:

file:bytes#my.files | once enrich:foo | enrich.foo

The once command filters out any nodes which have previously been through any other use of the "once" command using the same <name> (in this case "enrich:foo").

You may also specify the –asof option to allow nodes to pass the filter after a given amount of time. For example, the following command will allow any given node through every 2 days:

file:bytes#my.files | once enrich:foo –asof "-2 days" | enrich.foo

Use of "–asof now" or any future date or positive relative time offset will always allow the node to pass the filter.

State tracking data for the once command is stored as nodedata which is stored in your view's write layer, making it view-specific. So if you have two views, A and B, and they do not share any layers between them, and you execute this query in view A:

inet:ipv4=8.8.8.8 | once enrich:address | enrich.baz

And then you run it in view B, the node will still pass through the once command to the enrich.baz portion of the query because the tracking data for the once command does not yet exist in view B.

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'once'

class synapse.lib.storm.ParallelCmd(*runt*, *runtsafe*)

Bases: *Cmd*

Execute part of a query pipeline in parallel. This can be useful to minimize round-trip delay during enrichments.

Examples

inet:ipv4#foo | parallel { $place = $lib.import(foobar).lookup(:latlong) [:place=$place] }

NOTE: Storm variables set within the parallel query pipelines do not interact.

NOTE: If there are inbound nodes to the parallel command, parallel pipelines will be created as each node is processed, up to the number specified by –size. If the number of nodes in the pipeline is less than the value specified by –size, additional pipelines with no inbound node will not be created. If there are no inbound nodes to the parallel command, the number of pipelines specified by –size will always be created.

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'parallel'

async nextitem(*inq*)

async pipeline(*runt*, *query*, *inq*, *outq*, *runtvars*)

readonly = True

class synapse.lib.storm.Parser(*prog=None*, *descr=None*, *root=None*, *model=None*, *cdef=None*)

Bases: object

add_argument(**names*, ***opts*)

help(*mesg=None*)

parse_args(*argv*)

set_inputs(*idefs*)

class synapse.lib.storm.PureCmd(*cdef*, *runt*, *runtsafe*)

Bases: *Cmd*

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

getDescr()

getName()

readonly = True

class synapse.lib.storm.**ReIndexCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Use admin privileges to re index/normalize node properties.

NOTE: Currently does nothing but is reserved for future use.

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'reindex'

class synapse.lib.storm.**RunAsCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute a storm query as a specified user.

NOTE: This command requires admin privileges.

NOTE: Heavy objects (for example a View or Layer) are bound to the context which they
are instantiated in and methods on them will be run using the user in that context. This means that executing a method on a variable containing a heavy object which was instantiated outside of the runas command and then used within the runas command will check the permissions of the outer user, not the one specified by the runas command.

Examples

// Create a node as another user. runas someuser { [inet:fqdn=foo.com] }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'runas'

class synapse.lib.storm.**Runtime**

Bases: *Base*

A Runtime represents the instance of a running query.

The runtime should maintain a firm API boundary using the snap. Parallel query execution requires that the snap be treated as an opaque object which is called through, but not dereferenced.

addInput(*node*)

Add a Node() object as input to the query runtime.

allowed(*perms*, *gateiden=None*, *default=None*)

allowedEasyPerm(*item*, *perm*)

allowedReason(*perms*, *gateiden=None*, *default=None*)

cancel()

confirm(*perms*, *gateiden=None*, *default=None*)

Raise AuthDeny if the user doesn't have the permission.

Notes

An elevated runtime with asroot=True will always return True.

Parameters

- **perms** (*tuple*) – The permission tuple.
- **gateiden** (*str*) – The gateiden.
- **default** (*bool*) – The default value.

Returns
If the permission is allowed.

Return type
True

Raises
AuthDeny – If the user does not have the permission.

confirmEasyPerm(*item*, *perm*, *mesg=None*)

confirmPropDel(*prop*, *layriden=None*)

confirmPropSet(*prop*, *layriden=None*)

async coreDynCall(*todo*, *perm=None*)

async dyncall(*iden*, *todo*, *gatekeys=()*)

async dyniter(*iden*, *todo*, *gatekeys=()*)

async emit(*item*)

async emitter()

async execute(*genr=None*)

getCmdRuntime(*query*, *opts=None*)
Yield a runtime with proper scoping for use in executing a pure storm command.

getGraph()

async getInput()

async getModRuntime(*query*, *opts=None*)
Construct a non-context managed runtime for use in module imports.

async getOneNode(*propname*, *valu*, *filt=None*, *cmpr='='*)
Return exactly 1 node by <prop> <cmpr> <valu>

getOpt(*name*, *defval=None*)

getScopeVars()
Return a dict of all the vars within this and all parent scopes.

async getStormQuery(*text*)

getSubRuntime(*query*, *opts=None*)
Yield a runtime with shared scope that will populate changes upward.

async **getTeleProxy**(*url*, ***opts*)

getVar(*name*, *defv=None*)

initPath(*node*)

async **initSubRuntime**(*query*, *opts=None*)

Construct and return sub-runtime with a shared scope. (caller must fini)

isAdmin(*gateiden=None*)

isRuntVar(*name*)

layerConfirm(*perms*)

async **popVar**(*name*)

async **printf**(*mesg*)

reqAdmin(*gateiden=None*, *mesg=None*)

async **reqGateKeys**(*gatekeys*)

async **reqUserCanReadLayer**(*layriden*)

setGraph(*gdef*)

setOpt(*name*, *valu*)

async **setVar**(*name*, *valu*)

async **storm**(*text*, *opts=None*, *genr=None*)

Execute a storm runtime which inherits from this storm runtime.

async **warn**(*mesg*, ***info*)

async **warnonce**(*mesg*, ***info*)

class synapse.lib.storm.**ScrapeCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Use textual properties of existing nodes to find other easily recognizable nodes.

Examples

Scrape properties from inbound nodes and create standalone nodes. inet:search:query | scrape

Scrape properties from inbound nodes and make refs light edges to the scraped nodes. inet:search:query | scrape –refs

Scrape only the :engine and :text props from the inbound nodes. inet:search:query | scrape :text :engine

Scrape the primary property from the inbound nodes. it:dev:str | scrape $node.repr()

Scrape properties inbound nodes and yield newly scraped nodes. inet:search:query | scrape –yield

Skip re-fanging text before scraping. inet:search:query | scrape –skiprefang

Limit scrape to specific forms. inet:search:query | scrape –forms (inet:fqdn, inet:ipv4)

async **execStormCmd**(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'scrape'

class synapse.lib.storm.**SleepCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Introduce a delay between returning each result for the storm query.

NOTE: This is mostly used for testing / debugging.

Example

#foo.bar | sleep 0.5

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'sleep'

readonly = True

class synapse.lib.storm.**SpinCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Iterate through all query results, but do not yield any. This can be used to operate on many nodes without returning any.

Example

foo:bar:size=20 [+#hehe] | spin

async execStormCmd(*runt*, *genr*)

Abstract base method

name = 'spin'

readonly = True

class synapse.lib.storm.**StormDmon**

Bases: *Base*

A background storm runtime which is restarted by the cortex.

async bump()

async dmonloop()

pack()

async run()

async stop()

class synapse.lib.storm.**TagPruneCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Prune a tag (or tags) from nodes.

This command will delete the tags specified as parameters from incoming nodes, as well as all of their parent tags that don't have other tags as children.

For example, given a node with the tags:

#parent #parent.child #parent.child.grandchild

Pruning the parent.child.grandchild tag would remove all tags. If the node had the tags:

#parent #parent.child #parent.child.step #parent.child.grandchild

Pruning the parent.child.grandchild tag will only remove the parent.child.grandchild tag as the parent tags still have other children.

Examples

Prune the parent.child.grandchild tag inet:ipv4=1.2.3.4 | tag.prune parent.child.grandchild

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

hasChildTags(*node*, *tag*)

name = 'tag.prune'

class synapse.lib.storm.**TeeCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute multiple Storm queries on each node in the input stream, joining output streams together.

Commands are executed in order they are given; unless the `--parallel` switch is provided.

Examples

Perform a pivot out and pivot in on a inet:ivp4 node inet:ipv4=1.2.3.4 | tee { -> * } { <- * }

Also emit the inbound node inet:ipv4=1.2.3.4 | tee –join { -> * } { <- * }

Execute multiple enrichment queries in parallel. inet:ipv4=1.2.3.4 | tee -p { enrich.foo } { enrich.bar } { enrich.baz }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'tee'

async pipeline(*runt*, *outq*, *genr=None*)

readonly = True

class synapse.lib.storm.**TreeCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Walk elements of a tree using a recursive pivot.

Examples

pivot upward yielding each FQDN inet:fqdn=www.vertex.link | tree { :domain -> inet:fqdn }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'tree'

readonly = True

class synapse.lib.storm.**UniqCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Filter nodes by their uniq iden values. When this is used a Storm pipeline, only the first instance of a given node is allowed through the pipeline.

A relative property or variable may also be specified, which will cause this command to only allow through the first node with a given value for that property or value rather than checking the node iden.

Examples

Filter duplicate nodes after pivoting from inet:ipv4 nodes tagged with #badstuff #badstuff +inet:ipv4 ->* | uniq

Unique inet:ipv4 nodes by their :asn property #badstuff +inet:ipv4 | uniq :asn

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'uniq'

readonly = True

class synapse.lib.storm.**ViewExecCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

Execute a storm query in a different view.

NOTE: Variables are passed through but nodes are not. The behavior of this command may be non-intuitive in relation to the way storm normally operates. For further information on behavior and limitations when using *view.exec*, reference the *view.exec* section of the Synapse User Guide: https://v.vtx.lk/view-exec.

Examples

// Move some tagged nodes to another view inet:fqdn#foo.bar $fqdn=$node.value() | view.exec 95d5f31f0fb414d2b00069d3b1ee64c6 { [inet:fqdn=$fqdn] }

async execStormCmd(*runt*, *genr*)

Abstract base method

getArgParser()

name = 'view.exec'

readonly = True

synapse.lib.storm.**queryhash**(*text*)

synapse.lib.storm_format module

class synapse.lib.storm_format.**StormLexer**(*parser*)

Bases: Lexer

get_tokens_unprocessed(*text*)

This method should process the text and return an iterable of `(index, tokentype, value)` tuples where `index` is the starting position of the token within the input text.

It must be overridden by subclasses. It is recommended to implement it as a generator to maximize effectiveness.

synapse.lib.storm_format.**highlight_storm**(*parser*, *text*)

Prints a storm query with syntax highlighting

synapse.lib.stormctrl module

exception synapse.lib.stormctrl.**StormBreak**(**args*, ***info*)

Bases: *StormLoopCtrl*, *StormCtrlFlow*

statement = 'break'

exception synapse.lib.stormctrl.**StormContinue**(**args*, ***info*)

Bases: *StormLoopCtrl*, *StormCtrlFlow*

statement = 'continue'

exception synapse.lib.stormctrl.**StormCtrlFlow**

Bases: Exception

Base class all StormCtrlFlow exceptions derive from.

exception synapse.lib.stormctrl.**StormExit**(**args*, ***info*)

Bases: _SynErrMixin, *StormCtrlFlow*

exception synapse.lib.stormctrl.**StormGenrCtrl**(**args*, ***info*)

Bases: _SynErrMixin

statement = ''

exception synapse.lib.stormctrl.**StormLoopCtrl**(**args*, ***info*)

Bases: _SynErrMixin

statement = ''

exception synapse.lib.stormctrl.**StormReturn**(*item=None*)

Bases: *StormCtrlFlow*

exception synapse.lib.stormctrl.**StormStop**(**args*, ***info*)

Bases: *StormGenrCtrl*, *StormCtrlFlow*

statement = 'stop'

synapse.lib.stormhttp module

class synapse.lib.stormhttp.**HttpResp**(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a HTTP response.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormhttp.**LibHttp**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library exposing an HTTP client API.

For APIs that accept an ssl_opts argument, the dictionary may contain the following values:

```
({
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl_
↪verify argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can be␣
↪included in client_cert.
    'ca_cert': <str> - A PEM encoded full chain CA certificate for use when␣
↪verifying the request.
})
```

For APIs that accept a proxy argument, the following values are supported:

```
(null): Deprecated - Use the proxy defined by the http:proxy configuration option␣
↪if set.
(true): Use the proxy defined by the http:proxy configuration option if set.
(false): Do not use the proxy defined by the http:proxy configuration option if set.
<str>: A proxy URL string.
```

async codereason(*code*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async inetHttpConnect(*url*, *headers=None*, *ssl_verify=True*, *timeout=300*, *params=None*, *proxy=True*, *ssl_opts=None*)

async urldecode(*text*)

async urlencode(*text*)

class synapse.lib.stormhttp.**WebSocket**

Bases: *Base*, *StormType*

Implements the Storm API for a Websocket.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async rx(*timeout=None*)

async tx(*mesg*)

synapse.lib.stormsvc module

class synapse.lib.stormsvc.**StormSvc**

Bases: `object`

The StormSvc mixin class used to make a remote storm service with commands.

async getStormSvcInfo()

async getStormSvcPkgs()

class synapse.lib.stormsvc.**StormSvcClient**

Bases: *Base*

A StormService is a wrapper for a telepath proxy to a service accessible from the storm runtime.

synapse.lib.stormtypes module

class synapse.lib.stormtypes.**Bool**(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a boolean instance.

async bool()

class synapse.lib.stormtypes.**Bytes**(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Bytes object.

async bool()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**CmdOpts**(*valu*, *path=None*)

Bases: *Dict*

A dictionary like object that holds a reference to a command options namespace. (This allows late-evaluation of command arguments rather than forcing capture)

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

async stormrepr()

async value(*use_list=False*)

class synapse.lib.stormtypes.CronJob(*runt*, *cdef*, *path=None*)

Bases: *Prim*

Implements the Storm api for a cronjob instance.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.Dict(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Dictionary object.

async bool()

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

async stormrepr()

async value(*use_list=False*)

class synapse.lib.stormtypes.Layer(*runt*, *ldef*, *path=None*)

Bases: *Prim*

Implements the Storm api for a layer instance.

async getEdges()

async getEdgesByN1(*nodeid*)

async getEdgesByN2(*nodeid*)

async getMirrorStatus()

async getNodeData(*nodeid*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async getStorNode(*nodeid*)

async getStorNodes()

async getStorNodesByForm(*form*)

async liftByNodeData(*name*)

async liftByProp(*propname*, *propvalu=None*, *propcmpr='='*)

async liftByTag(*tagname*, *formname=None*)

async verify(*config=None*)

class synapse.lib.stormtypes.**Lib**(*runt*, *name=()*)

Bases: *StormType*

A collection of storm methods under a name

addLibFuncs()

async deref(*name*)

async dyncall(*iden*, *todo*, *gatekeys=()*)

async dyniter(*iden*, *todo*, *gatekeys=()*)

async initLibAsync()

async stormrepr()

class synapse.lib.stormtypes.**LibAxon**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for interacting with the Cortex's Axon.

For APIs that accept an ssl_opts argument, the dictionary may contain the following values:

```
({
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl␣
↪argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can be␣
↪included in client_cert.
})
```

For APIs that accept a proxy argument, the following values are supported:

```
``(null)``: Deprecated - Use the proxy defined by the http:proxy configuration␣
↪option if set.
``(true)``: Use the proxy defined by the http:proxy configuration option if set.
``(false)``: Do not use the proxy defined by the http:proxy configuration option if␣
↪set.
<str>: A proxy URL string.
```

async csvrows(*sha256*, *dialect='excel'*, *errors='ignore'*, ***fmtparams*)

async **del_**(*sha256*)

async **dels**(*sha256s*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **has**(*sha256*)

async **hashset**(*sha256*)

async **jsonlines**(*sha256*, *errors='ignore'*)

async **list**(*offs=0*, *wait=False*, *timeout=None*)

async **metrics**()

async **put**(*byts*)

async **read**(*sha256*, *offs=0*, *size=1048576*)

Read bytes from a file in the Axon.

async **readlines**(*sha256*, *errors='ignore'*)

async **size**(*sha256*)

async **unpack**(*sha256*, *fmt*, *offs=0*)

Unpack bytes from a file in the Axon using struct.

async **upload**(*genr*)

async **urlfile**(**args*, ***kwargs*)

async **wget**(*url*, *headers=None*, *params=None*, *method='GET'*, *json=None*, *body=None*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

async **wput**(*sha256*, *url*, *headers=None*, *params=None*, *method='PUT'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

class synapse.lib.stormtypes.**LibBase**(*runt*, *name=()*)

Bases: *Lib*

The Base Storm Library. This mainly contains utility functionality.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **trycast**(*name*, *valu*)

class synapse.lib.stormtypes.**LibBase64**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for encoding and decoding base64 data.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibBytes**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with bytes storage. This Library is deprecated; use `$lib.axon.*` instead.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibCron**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Cron Jobs in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibCsv**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with csvtool.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibDict**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with dictionaries.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibDmon**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with StormDmons.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibExport**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for exporting data.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

async toaxon(*query*, *opts=None*)

class synapse.lib.stormtypes.**LibFeed**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Cortex feed functions.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibGlobals**(*runt*, *name*)

Bases: *Lib*

A Storm Library for interacting with global variables which are persistent across the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibJsonStor**(*runt*, *name=()*)

Bases: *Lib*

Implements cortex JSON storage.

addLibFuncs()

async cachedel(*path*, *key*)

async cacheget(*path*, *key*, *asof='now'*, *envl=False*)

async cacheset(*path*, *key*, *valu*)

async get(*path*, *prop=None*)

async has(*path*)

async iter(*path=None*)

async set(*path*, *valu*, *prop=None*)

class synapse.lib.stormtypes.**LibLayer**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Layers in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibLift**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with lift helpers.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibPipe**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for interacting with non-persistent queues.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibPkg**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Storm Packages.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibPs**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with running tasks on the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibQueue**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with persistent Queues in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibRegx**(*runt*, *name=()*)

Bases: *Lib*

A Storm library for searching/matching with regular expressions.

async escape(*text*)

async findall(*pattern*, *text*, *flags=0*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **matches**(*pattern*, *text*, *flags=0*)

async **replace**(*pattern*, *replace*, *text*, *flags=0*)

async **search**(*pattern*, *text*, *flags=0*)

class synapse.lib.stormtypes.**LibService**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Storm Services.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibStr**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with strings.

async **concat**(**args*)

async **format**(*text*, ***kwargs*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **join**(*sepr*, *items*)

class synapse.lib.stormtypes.**LibTags**(*runt*, *name=()*)

Bases: *Lib*

Storm utility functions for tags.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async **prefix**(*names*, *prefix*, *ispart=False*)

class synapse.lib.stormtypes.**LibTelepath**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for making Telepath connections to remote services.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibTime**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with timestamps.

async day(*tick*)

async dayofmonth(*tick*)

async dayofweek(*tick*)

async dayofyear(*tick*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async hour(*tick*)

async minute(*tick*)

async month(*tick*)

async monthofyear(*tick*)

async second(*tick*)

async toUTC(*tick*, *timezone*)

async year(*tick*)

class synapse.lib.stormtypes.**LibTrigger**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Triggers in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibVars**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with runtime variables.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**LibView**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for interacting with Views in the Cortex.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**List**(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a List instance.

async bool()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async setitem(*name*, *valu*)

async stormrepr()

async value(*use_list=False*)

class synapse.lib.stormtypes.**Node**(*node*, *path=None*)

Bases: *Prim*

Implements the Storm api for a node instance.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**NodeData**(*node*, *path=None*)

Bases: *Prim*

A Storm Primitive representing the NodeData stored for a Node.

async cacheget(*name*, *asof='now'*)

async cacheset(*name*, *valu*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**NodeProps**(*node*, *path=None*)

Bases: *Prim*

A Storm Primitive representing the properties on a Node.

async get(*name*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async list()

async set(*prop*, *valu*)

async setitem(*name*, *valu*)

Set a property on a Node.

Parameters

- **name** (*str*) – The name of the property to set.
- **valu** – The value being set.

Raises

- **s_exc** – NoSuchProp: If the property being set is not valid for the node.
- **s_exc.BadTypeValu** – If the value of the property fails to normalize.

value()

class synapse.lib.stormtypes.**Number**(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Number instance.

Storm Numbers are high precision fixed point decimals corresponding to the the hugenum storage type.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

class synapse.lib.stormtypes.**Path**(*node*, *path=None*)

Bases: *Prim*

Implements the Storm API for the Path object.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**PathMeta**(*path*)

Bases: *Prim*

Put the storm deref/setitem/iter convention on top of path meta information.

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

class synapse.lib.stormtypes.**PathVars**(*path*)

Bases: *Prim*

Put the storm deref/setitem/iter convention on top of path variables.

async deref(*name*)

async iter()

async setitem(*name*, *valu*)

class synapse.lib.stormtypes.**Pipe**(*runt*, *size*)

Bases: *StormType*

A Storm Pipe provides fast ephemeral queues.

async close()

Close the pipe for writing. This will cause the slice()/slices() API to return once drained.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**Prim**(*valu*, *path=None*)

Bases: *StormType*

The base type for all Storm primitive values.

async bool()

async iter()

async nodes()

async stormrepr()

value()

class synapse.lib.stormtypes.**Proxy**(*runt*, *proxy*, *path=None*)

Bases: *StormType*

Implements the Storm API for a Telepath proxy.

These can be created via `$lib.telepath.open()`. Storm Service objects are also Telepath proxy objects.

Methods called off of these objects are executed like regular Telepath RMI calls.

An example of calling a method which returns data:

```
$prox = $lib.telepath.open($url)
$result = $prox.doWork($data)
return ( $result )
```

An example of calling a method which is a generator:

```
$prox = $lib.telepath.open($url)
for $item in $prox.genrStuff($data) {
    $doStuff($item)
}
```

async deref(*name*)

async stormrepr()

class synapse.lib.stormtypes.**ProxyGenrMethod**(*meth*, *path=None*)

Bases: *StormType*

Implements the generator methods for the telepath:proxy.

An example of calling a method which is a generator:

```
$prox = $lib.telepath.open($url)
for $item in $prox.genrStuff($data) {
    $doStuff($item)
}
```

async stormrepr()

class synapse.lib.stormtypes.ProxyMethod(*runt*, *meth*, *path=None*)

Bases: *StormType*

Implements the call methods for the telepath:proxy.

An example of calling a method which returns data:

```
$prox = $lib.telepath.open($url)
$result = $prox.doWork($data)
$doStuff($result)
```

async stormrepr()

class synapse.lib.stormtypes.Query(*text*, *varz*, *runt*, *path=None*)

Bases: *Prim*

A storm primitive representing an embedded query.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async nodes()

async stormrepr()

class synapse.lib.stormtypes.Queue(*runt*, *name*, *info*)

Bases: *StormType*

A StormLib API instance of a named channel in the Cortex multiqueue.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async stormrepr()

class synapse.lib.stormtypes.Service(*runt*, *ssvc*)

Bases: *Proxy*

async deref(*name*)

class synapse.lib.stormtypes.Set(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a Set object.

async bool()

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

async stormrepr()

class synapse.lib.stormtypes.StormHiveDict(*runt*, *info*)

Bases: *Prim*

A Storm Primitive representing a HiveDict.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

async iter()

value()

class synapse.lib.stormtypes.StormType(*path=None*)

Bases: object

The base type for storm runtime value objects.

async deref(*name*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

ismutable()

async setitem(*name*, *valu*)

class synapse.lib.stormtypes.StormTypesRegistry

Bases: object

addStormLib(*path*, *ctor*)

addStormType(*path*, *ctor*)

base_undefined_types = ('any', 'int', 'lib', 'null', 'time', 'prim', 'undef', 'float', 'generator')

delStormLib(*path*)

delStormType(*path*)

getLibDocs(*lib=None*)

getTypeDocs(*styp: str = None*)

iterLibs()

iterTypes()

known_types = {'aha:pool', 'auth:gate', 'auth:role', 'auth:user', 'auth:user:json', 'auth:user:profile', 'auth:user:vars', 'boolean', 'bytes', 'cache:fixed', 'cmdopts', 'cronjob', 'dict', 'hive:dict', 'http:api', 'http:api:methods', 'http:api:perms', 'http:api:request', 'http:api:request:headers', 'http:api:vars', 'inet:http:oauth:v1:client', 'inet:http:resp', 'inet:http:socket', 'inet:imap:server', 'inet:smtp:message', 'json:schema', 'layer', 'list', 'model:form', 'model:property', 'model:tagprop', 'model:type', 'node', 'node:data', 'node:path', 'node:path:meta', 'node:path:vars', 'node:props', 'number', 'pipe', 'proj:comment', 'proj:comments', 'proj:epic', 'proj:epics', 'proj:project', 'proj:sprint', 'proj:sprints', 'proj:ticket', 'proj:tickets', 'queue', 'random', 'set', 'spooled:set', 'stat:tally', 'stix:bundle', 'storm:query', 'str', 'tabular:printer', 'telepath:proxy', 'telepath:proxy:genrmethod', 'telepath:proxy:method', 'text', 'trigger', 'user:profile:dict', 'user:vars:dict', 'vault', 'vault:data', 'view', 'xml:element'}

registerLib(*ctor*)

Decorator to register a StormLib

registerType(*ctor*)

Decorator to register a StormPrim

rtypes = {}

undefined_types = {'any', 'float', 'generator', 'int', 'lib', 'null', 'prim', 'time', 'undef'}

class synapse.lib.stormtypes.Str(*valu*, *path=None*)

Bases: *Prim*

Implements the Storm API for a String object.

async bool()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns

A key/value pairs.

Return type

dict

class synapse.lib.stormtypes.**Text**(*valu*, *path=None*)

Bases: *Prim*

A mutable text type for simple text construction.

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

class synapse.lib.stormtypes.**Trigger**(*runt*, *tdef*)

Bases: *Prim*

Implements the Storm API for a Trigger.

async deref(*name*)

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async move(*viewiden*)

async pack()

async set(*name*, *valu*)

class synapse.lib.stormtypes.**Undef**

Bases: `object`

async stormrepr()

class synapse.lib.stormtypes.**View**(*runt*, *vdef*, *path=None*)

Bases: *Prim*

Implements the Storm api for a View instance.

async addNode(*form*, *valu*, *props=None*)

async delMergeRequest()

async delMergeVote(*useriden=None*)

async detach()

async getMergeRequest()

async getMergeRequestSummary()

async getMerges()

async getMergingViews()

getObjLocals()

Get the default list of key-value pairs which may be added to the object `.locls` dictionary.

Returns
A key/value pairs.

Return type
dict

async setMergeComment(*comment*)

async setMergeRequest(*comment=None*)

async setMergeVote(*approved=True*, *comment=None*)

async setMergeVoteComment(*comment*)

async viewDynCall(*todo*, *perm*)

async viewDynIter(*todo*, *perm*)

synapse.lib.stormtypes.**allowed**(*perm*, *gateiden=None*)

synapse.lib.stormtypes.**allowedEasyPerm**(*item*, *perm*)

synapse.lib.stormtypes.**confirm**(*perm*, *gateiden=None*)

synapse.lib.stormtypes.**confirmEasyPerm**(*item*, *perm*, *mesg=None*)

synapse.lib.stormtypes.**fromprim**(*valu*, *path=None*, *basetypes=True*)

synapse.lib.stormtypes.**getCallSig**(*func*) → Signature

Get the callsig of a function, stripping self if present.

synapse.lib.stormtypes.**getDoc**(*obj*, *errstr*)

Helper to get __doc__

synapse.lib.stormtypes.**intify**(*x*)

synapse.lib.stormtypes.**ismutable**(*valu*)

async synapse.lib.stormtypes.**kwarg_format**(*_text*, ***kwargs*)

Replaces instances curly-braced argument names in text with their values

async synapse.lib.stormtypes.**resolveAxonProxyArg**(*valu*)

Resolve a proxy value to the kwarg to set for an Axon HTTP call.

Parameters
valu (*str|null|bool*) – The proxy value.

Returns
A retn tuple where the proxy kwarg should not be set if ok=False, otherwise a proxy URL or None.

Return type
tuple

async synapse.lib.stormtypes.**resolveCoreProxyUrl**(*valu*)

Resolve a proxy value to a proxy URL.

Parameters
valu (*str|None|bool*) – The proxy value.

Returns
A proxy URL string or None.

Return type
(str|None)

synapse.lib.stormtypes.**stormfunc**(*readonly=False*)

synapse.lib.stormtypes.**strifyHttpArg**(*item*, *multi=False*)

async synapse.lib.stormtypes.**tobool**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**tobuidhex**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**tocmprvalu**(*valu*)

async synapse.lib.stormtypes.**toint**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**toiter**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**tonumber**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**toprim**(*valu*, *path=None*, *use_list=False*)

async synapse.lib.stormtypes.**torepr**(*valu*, *usestr=False*)

async synapse.lib.stormtypes.**tostor**(*valu*, *isndef=False*)

async synapse.lib.stormtypes.**tostr**(*valu*, *noneok=False*)

async synapse.lib.stormtypes.**totype**(*valu*, *basetypes=False*) → str

Convert a value to its Storm type string.

Parameters

- **valu** – The object to check.
- **basetypes** (*bool*) – If True, return the base Python class name as a fallback.

Returns
The type name.

Return type
str

Raises
StormRuntimeError – If the valu does not resolve to a known type and basetypes=False.

async synapse.lib.stormtypes.**typeerr**(*name*, *reqt*)

synapse.lib.stormwhois module

class synapse.lib.stormwhois.**LibWhois**(*runt*, *name=()*)

Bases: *Lib*

A Storm Library for providing a consistent way to generate guids for WHOIS / Registration Data in Storm.

getObjLocals()

Get the default list of key-value pairs which may be added to the object .locls dictionary.

Returns
A key/value pairs.

Return type
dict

synapse.lib.structlog module

class synapse.lib.structlog.JsonFormatter(*args, **kwargs)

Bases: Formatter

format(*record: LogRecord*)

Format the specified record as text.

The record's attribute dictionary is used as the operand to a string formatting operation which yields the returned string. Before formatting the dictionary, a couple of preparatory steps are carried out. The message attribute of the record is computed using LogRecord.getMessage(). If the formatting string uses the time (as determined by a call to usesTime(), formatTime() is called to format the event time. If there is exception information, it is formatted using formatException() and appended to the message.

synapse.lib.task module

class synapse.lib.task.Task

Bases: *Base*

The synapse Task object implements concepts similar to process trees for asyncio.Task instances.

async kill()

pack()

packv2()

async worker(*coro*, *name='worker'*)

synapse.lib.task.current()

Return the current synapse task.

async synapse.lib.task.executor(*func*, **args*, ***kwargs*)

Execute a function in an executor thread.

Parameters
todo (*((func,args,kwargs)*) – A todo tuple.

synapse.lib.task.loop()

synapse.lib.task.syntask(*task*)

Return the synapse task associated with the provided asyncio task.

synapse.lib.task.user()

Return the current task user.

synapse.lib.task.username()

Return the current task user name.

synapse.lib.task.**vardefault**(*name*, *func*)

Add a default constructor for a particular task-local variable

All future calls to taskVarGet with the same name will return the result of calling func

synapse.lib.task.**varget**(*name*, *defval=None*, *task=None*)

Access a task local variable by name

Precondition:
If task is None, this must be called from task context

synapse.lib.task.**varinit**(*task=None*)

Initializes (or re-initializes for testing purposes) all of a task's task-local variables

Precondition:
If task is None, this must be called from task context

synapse.lib.task.**varset**(*name*, *valu*, *task=None*)

Set a task-local variable

Parameters
task – If task is None, uses current task

Precondition:
If task is None, this must be called from task context

synapse.lib.thishost module

synapse.lib.thishost.**get**(*prop*)

Retrieve a property from the hostinfo dictionary.

Example

import synapse.lib.thishost as s_thishost

if s_thishost.get('platform') == 'windows':
dostuff()

synapse.lib.thishost.**hostaddr**(*dest='8.8.8.8'*)

Retrieve the ipv4 address for this host (optionally as seen from dest). .. rubric:: Example

addr = s_socket.hostaddr()

synapse.lib.thisplat module

synapse.lib.threads module

synapse.lib.threads.**current**()

synapse.lib.threads.**iden**()

synapse.lib.time module

Time related utilities for synapse "epoch millis" time values.

synapse.lib.time.**day**(*tick*)

synapse.lib.time.**dayofmonth**(*tick*)

synapse.lib.time.**dayofweek**(*tick*)

synapse.lib.time.**dayofyear**(*tick*)

synapse.lib.time.**delta**(*text*)

Parse a simple time delta string and return the delta.

synapse.lib.time.**hour**(*tick*)

synapse.lib.time.**ival**(**times*)

synapse.lib.time.**minute**(*tick*)

synapse.lib.time.**month**(*tick*)

synapse.lib.time.**parse**(*text*, *base=None*, *chop=False*)

Parse a time string into an epoch millis value.

Parameters

- **text** (*str*) – Time string to parse
- **base** (*int or None*) – Milliseconds to offset the time from
- **chop** (*bool*) – Whether to chop the digit-only string to 17 chars

Returns

Epoch milliseconds

Return type

int

synapse.lib.time.**parsetz**(*text*)

Parse timezone from time string, with UTC as the default.

Parameters

text (*str*) – Time string

Returns

A tuple of text with tz chars removed and base milliseconds to offset time.

Return type

tuple

synapse.lib.time.**repr**(*tick*, *pack=False*)

Return a date string for an epoch-millis timestamp.

Parameters

tick (*int*) – The timestamp in milliseconds since the epoch.

Returns

A date time string

Return type

(str)

synapse.lib.time.**second**(*tick*)

synapse.lib.time.**toUTC**(*tick*, *fromzone*)

synapse.lib.time.**wildrange**(*text*)

Parse an interval from a wild card time stamp: 2021/10/31*

synapse.lib.time.**year**(*tick*)

synapse.lib.trigger module

class synapse.lib.trigger.**Trigger**(*view*, *tdef*)

Bases: object

async execute(*node*, *vars=None*)

Actually execute the query

get(*name*)

getStorNode(*form*)

pack()

async set(*name*, *valu*)

Set one of the dynamic elements of the trigger definition.

class synapse.lib.trigger.**Triggers**(*view*)

Bases: object

Manages "triggers", conditions where changes in data result in new storm queries being executed.

> **Note**
>
> These methods should not be called directly under normal circumstances. Use the owning "View" object to ensure that mirrors/clusters members get the same changes.

get(*iden*)

list()

async load(*tdef*)

pop(*iden*)

async runEdgeAdd(*n1*, *verb*, *n2*)

async runEdgeDel(*n1*, *verb*, *n2*)

async runNodeAdd(*node*)

async runNodeDel(*node*)

async runPropSet(*node*, *prop*, *oldv*)

async runTagAdd(*node*, *tag*)

async runTagDel(*node*, *tag*)

synapse.lib.trigger.**reqValidTdef**(*conf*)

synapse.lib.types module

class synapse.lib.types.**Array**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

isarray = True

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.lib.types.**Bool**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 2

class synapse.lib.types.**Comp**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

getCompOffs(*name*)

If this type is a compound, return the field offset for the given property name or None.

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 13

class synapse.lib.types.**Data**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

norm(*valu*)

Normalize the value for a given type.

Parameters
valu (*obj*) – The value to normalize.

Returns
The normalized valu, info tuple.

Return type
((obj,dict))

Notes

The info dictionary uses the following key conventions:
subs (dict): The normalized sub-fields as name: valu entries.

postTypeInit()

stortype: int = 13

class synapse.lib.types.**Duration**(*modl*, *name*, *info*, *opts*)

Bases: *IntBase*

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 5

class synapse.lib.types.**Edge**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

getCompOffs(*name*)

If this type is a compound, return the field offset for the given property name or None.

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 13

class synapse.lib.types.**FieldHelper**(*modl*, *tname*, *fields*)

Bases: defaultdict

Helper for Comp types. Performs Type lookup/creation upon first use.

class synapse.lib.types.**Float**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 22

class synapse.lib.types.**Guid**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

stortype: int = 10

class synapse.lib.types.**Hex**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

stortype: int = 1

class synapse.lib.types.**HugeNum**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

norm(*valu*)

Normalize the value for a given type.

Parameters

valu (*obj*) – The value to normalize.

Returns

The normalized valu, info tuple.

Return type
((obj,dict))

Notes

The info dictionary uses the following key conventions:
subs (dict): The normalized sub-fields as name: valu entries.

stortype: int = 23

class synapse.lib.types.**Int**(*modl*, *name*, *info*, *opts*)

Bases: *IntBase*

merge(*oldv*, *newv*)

Allow types to "merge" data from two sources based on value precedence.

Parameters

- **valu** (*object*) – The current value.
- **newv** (*object*) – The updated value.

Returns
The merged value.

Return type
(object)

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.lib.types.**IntBase**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

class synapse.lib.types.**Ival**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

An interval, i.e. a range, of times

merge(*oldv*, *newv*)

Allow types to "merge" data from two sources based on value precedence.

Parameters

- **valu** (*object*) – The current value.
- **newv** (*object*) – The updated value.

Returns
The merged value.

Return type
(object)

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 12

class synapse.lib.types.**Loc**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stems(*valu*)

stortype: int = 15

class synapse.lib.types.**Ndef**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 25

class synapse.lib.types.**NodeProp**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

stortype: int = 13

class synapse.lib.types.**Range**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 13

class synapse.lib.types.**Str**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 1

class synapse.lib.types.**Tag**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.lib.types.**TagPart**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.lib.types.**Taxon**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.lib.types.**Taxonomy**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.lib.types.**Time**(*modl*, *name*, *info*, *opts*)

Bases: *IntBase*

getTickTock(*vals*)

Get a tick, tock time pair.

Parameters
vals (*list*) – A pair of values to norm.

Returns
A ordered pair of integers.

Return type
(int, int)

merge(*oldv*, *newv*)

Allow types to "merge" data from two sources based on value precedence.

Parameters

- **valu** (*object*) – The current value.
- **newv** (*object*) – The updated value.

Returns
The merged value.

Return type
(object)

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 11

class synapse.lib.types.**TimeEdge**(*modl*, *name*, *info*, *opts*)

Bases: *Edge*

getCompOffs(*name*)

If this type is a compound, return the field offset for the given property name or None.

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 13

class synapse.lib.types.**Type**(*modl*, *name*, *info*, *opts*)

Bases: object

clone(*opts*)

Create a new instance of this type with the specified options.

Parameters
opts (*dict*) – The type specific options for the new instance.

cmpr(*val1*, *name*, *val2*)

Compare the two values using the given type specific comparator.

extend(*name*, *opts*, *info*)

Extend this type to construct a sub-type.

Parameters

- **name** (*str*) – The name of the new sub-type.
- **opts** (*dict*) – The type options for the sub-type.
- **info** (*dict*) – The type info for the sub-type.

Returns
A new sub-type instance.

Return type
(synapse.types.Type)

getCmprCtor(*name*)

getCompOffs(*name*)

If this type is a compound, return the field offset for the given property name or None.

getLiftHintCmpr(*valu*, *cmpr*)

getLiftHintCmprCtor(*name*)

getStorCmprs(*cmpr*, *valu*)

getStorNode(*form*)

getTypeDef()

getTypeVals(*valu*)

isarray = False

merge(*oldv*, *newv*)

Allow types to "merge" data from two sources based on value precedence.

Parameters

- **valu** (*object*) – The current value.
- **newv** (*object*) – The updated value.

Returns
The merged value.

Return type
(object)

norm(*valu*)

Normalize the value for a given type.

Parameters
valu (*obj*) – The value to normalize.

Returns
The normalized valu, info tuple.

Return type
((obj,dict))

Notes

The info dictionary uses the following key conventions:
subs (dict): The normalized sub-fields as name: valu entries.

pack()

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

setCmprCtor(*name*, *func*)

Set a comparator ctor for a given named comparison operation.

Parameters

- **name** (*str*) – Name of the comparison operation.
- **func** – Function which returns a comparator.

Notes

Comparator ctors should expect to get the right-hand-side of the comparison as their argument, and the returned function should expect to get the left hand side of the comparison and return a boolean from there.

setLiftHintCmprCtor(*name*, *func*)

setNormFunc(*typo*, *func*)

Register a normalizer function for a given python type.

Parameters

- **typo** (*type*) – A python type/class to normalize.

- **func** (*function*) – A callback which normalizes a python value.

stortype: int = None

class synapse.lib.types.**Velocity**(*modl*, *name*, *info*, *opts*)

Bases: *IntBase*

oflight = 299792458000

postTypeInit()

stortype: int = 9

synapse.lib.urlhelp module

synapse.lib.urlhelp.**chopurl**(*url*)

A sane "stand alone" url parser.

Example

info = chopurl(url)

synapse.lib.urlhelp.**sanitizeUrl**(*url*)

Returns a URL with the password (if present) replaced with ****

RFC 3986 3.2.1 'Applications should not render as clear text any data after the first colon (":") character found within a userinfo subcomponent unless the data after the colon is the empty string (indicating no password)'

Essentially, replace everything between the 2nd colon (if it exists) and the first succeeding at sign. Return the original string otherwise.

Note: this depends on this being a reasonably-well formatted URI that starts with a scheme (e.g. http) and '//:' Failure of this condition yields the original string.

synapse.lib.version module

Synapse utilites for dealing with Semvar versioning. This includes the Synapse version information.

synapse.lib.version.**fmtVersion**(**vsnparts*)

Join a string of parts together with a . separator.

Parameters
***vsnparts**

Returns:

synapse.lib.version.**matches**(*vers*, *cmprvers*)

Check if a version string matches a version comparison string.

synapse.lib.version.**packVersion**(*major*, *minor=0*, *patch=0*)

Pack a set of major/minor/patch integers into a single integer for storage.

Parameters

- **major** (*int*) – Major version level integer.
- **minor** (*int*) – Minor version level integer.
- **patch** (*int*) – Patch version level integer.

Returns
System normalized integer value to represent a software version.

Return type
int

synapse.lib.version.**parseSemver**(*text*)

Parse a Semantic Version string into is component parts.

Parameters

- **text** (*str*) – A text string to parse into semver components. This string has whitespace and leading 'v'
- **it.** (*characters stripped off of*)

Examples

Parse a string into it semvar parts:

```
parts = parseSemver('v1.2.3')
```

Returns
The dictionary will contain the keys 'major', 'minor' and 'patch' pointing to integer values. The dictionary may also contain keys for 'build' and 'pre' information if that data is parsed out of a semver string. None is returned if the string is not a valid Semver string.

Return type
dict

synapse.lib.version.**parseVersionParts**(*text*, *seps=('.', '-', '_', '+')*)

Extract a list of major/minor/version integer strings from a string.

Parameters

- **text** (*str*) – String to parse
- **seps** (*tuple*) – A tuple or list of separators to use when parsing the version string.

Examples

Parse a simple version string into a major and minor parts:

```
parts = parseVersionParts('1.2')
```

Parse a complex version string into a major and minor parts:

```
parts = parseVersionParts('wowsoft_1.2')
```

Parse a simple version string into a major, minor and patch parts. Parts after the "3." are dropped from the results:

```
parts = parseVersionParts('1.2.3.4.5')
```

Notes

This attempts to brute force out integers from the version string by stripping any leading ascii letters and part separators, and then regexing out numeric parts optionally followed by part separators. It will stop at the first mixed-character part encountered. For example, "1.2-3a" would only parse out the "1" and "2" from the string.

Returns
Either a empty dictionary or dictionary containing up to three keys, 'major', 'minor' and 'patch'.

Return type
dict

synapse.lib.version.**reqVersion**(*valu*, *reqver*, *exc=<class 'synapse.exc.BadVersion'>*, *mesg='Provided version does not match required version.'*)

Require a given version tuple is valid for a given requirements string.

Parameters

- **Optional[Tuple[int** (*valu*) – Major, minor and patch value to check.
- **int** – Major, minor and patch value to check.
- **int]]** – Major, minor and patch value to check.
- **reqver** (*str*) – A requirements version string.
- **exc** (*s_exc.SynErr*) – The synerr class to raise.
- **mesg** (*str*) – The message to pass in the exception.

Returns
If the value is in bounds of minver and maxver.

Return type
None

Raises
s_exc.BadVersion – If a precondition is incorrect or a version value is out of bounds.

synapse.lib.version.**unpackVersion**(*ver*)

Unpack a system normalized integer representing a softare version into its component parts.

Parameters
ver (*int*) – System normalized integer value to unpack into a tuple.

Returns
A tuple containing the major, minor and patch values shifted out of the integer.

Return type
(int, int, int)

synapse.lib.view module

class synapse.lib.view.**View**

Bases: *Pusher*

A view represents a cortex as seen from a specific set of layers.

The view class is used to implement Copy-On-Write layers as well as interact with a subset of the layers configured in a Cortex.

async addLayer(*layriden*, *indx=None*)

async addNode(*form*, *valu*, *props=None*, *user=None*)

async addNodeEdits(*edits*, *meta*)

A telepath compatible way to apply node edits to a view.

NOTE: This does cause trigger execution.

async addTrigQueue(*triginfo*, *nexsitem*)

async addTrigger(*tdef*)

Adds a trigger to the view.

async callStorm(*text*, *opts=None*)

async callStormIface(*name*, *todo*)

async children()

async delMergeRequest()

async delMergeVote(*useriden*)

async delTrigQueue(*offs*)

async delTrigger(*iden*)

async delete()

Delete the metadata for this view.

Note: this does not delete any layer storage.

async detach()

Detach the view from its parent but do not change the layers. (this is not reversible!)

async eval(*text*, *opts=None*)

Evaluate a storm query and yield Nodes only.

async finiMergeTask()

async finiTrigTask()

async fork(*ldef=None*, *vdef=None*)

Make a new view inheriting from this view with the same layers and a new write layer on top

Parameters

- **ldef** – layer parameter dict
- **vdef** – view parameter dict
- **cortex.addLayer** (*Passed through to*)

Returns

new view object, with an iden the same as the new write layer iden

async getEdgeVerbs()

async getEdges(*verb=None*)

async getFormCounts()

getMergeRequest()

async getMergeVotes()

async getMerges()

Yield the historical merges into this view.

async getMergingViews()

async getPropArrayCount(*propname*, *valu=<synapse.common.NoValu object>*)

async getPropCount(*propname*, *valu=<synapse.common.NoValu object>*)

async getStorNodes(*buid*)

Return a list of storage nodes for the given buid in layer order.

async getTagPropCount(*form*, *tag*, *propname*, *valu=<synapse.common.NoValu object>*)

async getTrigger(*iden*)

hasKids()

init2()

We have a second round of initialization so the views can get a handle to their parents which might not be initialized yet

async initMergeTask()

async initTrigTask()

async insertParentFork(*useriden*, *name=None*)

Insert a new View between a forked View and its parent.

Returns

New view definition with the same perms as the current fork.

isForkOf(*viewiden*)

async isMergeReady()

isafork()

async iterPropValues(*propname*)

async iterStormPodes(*text*, *opts=None*)

async listTriggers()

List all the triggers in the view.

async merge(*useriden=None*, *force=False*)

Merge this view into its parent. All changes made to this view will be applied to the parent. Parent's triggers will be run.

async mergeAllowed(*user=None*, *force=False*)

Check whether a user can merge a view into its parent.

NOTE: This API may not be used to check for merges based on quorum votes.

async mergeStormIface(*name*, *todo*)

Allow an interface which specifies a generator use case to yield (priority, value) tuples and merge results from multiple generators yielded in ascending priority order.

async nodes(*text*, *opts=None*)

A simple non-streaming way to return a list of nodes.

async pack()

reqNoParentQuorum()

reqParentQuorum()

reqValidVoter(*useriden*)

async runEdgeAdd(*n1*, *edge*, *n2*)

async runEdgeDel(*n1*, *edge*, *n2*)

async runNodeAdd(*node*)

async runNodeDel(*node*)

async runPropSet(*node*, *prop*, *oldv*)

Handle when a prop set trigger event fired

async runTagAdd(*node*, *tag*, *valu*)

async runTagDel(*node*, *tag*, *valu*)

async runViewMerge()

async scrapeIface(*text*, *unique=False*, *refang=True*)

async setLayers(*layers*)

Set the view layers from a list of idens. NOTE: view layers are stored "top down" (the write layer is self.layers[0])

async setMergeComment(*comment*)

async setMergeRequest(*mergeinfo*)

async setMergeVote(*vote*)

async setMergeVoteComment(*useriden*, *comment*)

async setTriggerInfo(*iden*, *name*, *valu*)

async setViewInfo(*name*, *valu*)

Set a mutable view property.

async snap(*user*)

async classmethod snapctor(**args*, ***kwargs*)

async storNodeEdits(*edits*, *meta*)

async storm(*text*, *opts=None*)

Evaluate a storm query and yield result messages. :Yields: *((str,dict))* – Storm messages.

async stormlist(*text*, *opts=None*)

async swapLayer()

async tryToMerge(*tick*)

async wipeAllowed(*user=None*)

Check whether a user can wipe the write layer in the current view.

async wipeLayer(*useriden=None*)

Delete the data in the write layer by generating del nodeedits. Triggers will be run.

class synapse.lib.view.**ViewApi**

Bases: *CellApi*

async getCellIden()

async getEditSize()

saveNodeEdits(*edits*, *meta*)

async storNodeEdits(*edits*, *meta*)

async syncNodeEdits2(*offs*, *wait=True*)

synapse.lookup package

Submodules

synapse.lookup.cvss module

synapse.lookup.iana module

synapse.lookup.iso3166 module

Provides data for the ISO 3166-1 Country codes.

Reference:
https://en.wikipedia.org/wiki/ISO_3166

synapse.lookup.iso3166.**makeColLook**(*rows*, *scol*, *dcol*)

synapse.lookup.macho module

synapse.lookup.macho.**getLoadCmdTypes**()

synapse.lookup.macho.**getSectionTypes**()

synapse.lookup.pe module

synapse.lookup.pe.**getLangCodes**()

synapse.lookup.pe.**getRsrcTypes**()

synapse.lookup.phonenum module

synapse.lookup.phonenum.**formPhoneNode**(*node*, *valu*)

synapse.lookup.phonenum.**getPhoneInfo**(*numb*)

Walk the phone info tree to find the best-match info for the given number.

Example

info = getPhoneInfo(17035551212) country = info.get('cc')

synapse.lookup.phonenum.**initPhoneTree**()

synapse.lookup.phonenum.**phnode**(*valu*)

synapse.lookup.timezones module

Timezones are defined per RFC822 5.1 (plus GMT and UTC), with values representing offsets from UTC in milliseconds.

synapse.lookup.timezones.**getTzNames**()

Return a tuple of all supported timezone names.

synapse.lookup.timezones.**getTzOffset**(*name*, *defval=None*)

Return tuple of the UTC offset in milliseconds and an info dict.

synapse.models package

Subpackages

synapse.models.gov package

Submodules

synapse.models.gov.cn module

class synapse.models.gov.cn.**GovCnModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.gov.intl module

class synapse.models.gov.intl.**GovIntlModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.gov.us module

class synapse.models.gov.us.**GovUsModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

Submodules

synapse.models.auth module

class synapse.models.auth.**AuthModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.base module

class synapse.models.base.**BaseModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.belief module

class synapse.models.belief.**BeliefModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.biz module

class synapse.models.biz.**BizModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.crypto module

class synapse.models.crypto.**CryptoModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.dns module

class synapse.models.dns.**DnsModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

class synapse.models.dns.**DnsName**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

synapse.models.doc module

class synapse.models.doc.**DocModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.economic module

class synapse.models.economic.**EconModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.entity module

class synapse.models.entity.**EntityModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.files module

class synapse.models.files.**FileBase**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.files.**FileBytes**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.files.**FileModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

async initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

class synapse.models.files.**FilePath**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

synapse.models.geopol module

class synapse.models.geopol.**PolModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.geospace module

class synapse.models.geospace.**Area**(*modl*, *name*, *info*, *opts*)

Bases: *Int*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.models.geospace.**Dist**(*modl*, *name*, *info*, *opts*)

Bases: *Int*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.models.geospace.**GeoModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

class synapse.models.geospace.**LatLong**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 14

synapse.models.inet module

class synapse.models.inet.**Addr**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.inet.**Cidr4**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.inet.**Cidr6**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.inet.**Email**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

class synapse.models.inet.**Fqdn**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 17

class synapse.models.inet.**HttpCookie**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

getTypeVals(*valu*)

class synapse.models.inet.**IPv4**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

The base type for an IPv4 address.

getCidrRange(*text*)

getNetRange(*text*)

getTypeVals(*valu*)

postTypeInit()

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 4

class synapse.models.inet.**IPv4Range**(*modl*, *name*, *info*, *opts*)

Bases: *Range*

postTypeInit()

class synapse.models.inet.**IPv6**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

getCidrRange(*text*)

getNetRange(*text*)

getTypeVals(*valu*)

postTypeInit()

stortype: int = 18

class synapse.models.inet.**IPv6Range**(*modl*, *name*, *info*, *opts*)

Bases: *Range*

postTypeInit()

class synapse.models.inet.**InetModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

async initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

class synapse.models.inet.**Rfc2822Addr**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

An RFC 2822 compatible email address parser

postTypeInit()

class synapse.models.inet.**Url**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

synapse.models.inet.**getAddrScope**(*ipv6*)

synapse.models.inet.**getAddrType**(*ip*)

synapse.models.infotech module

class synapse.models.infotech.**Cpe22Str**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

CPE 2.2 Formatted String https://cpe.mitre.org/files/cpe-specification_2.2.pdf

class synapse.models.infotech.**Cpe23Str**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

CPE 2.3 Formatted String

```
https://nvlpubs.nist.gov/nistpubs/Legacy/IR/nistir7695.pdf

(Section 6.2)

cpe:2.3: part : vendor : product : version : update : edition :
    language : sw_edition : target_sw : target_hw : other

* = "any"
- = N/A
```

class synapse.models.infotech.**ItModule**(*core*, *conf=None*)

Bases: *CoreModule*

bruteVersionStr(*valu*)

This API is deprecated.

Brute force the version out of a string.

Parameters
valu (*str*) – String to attempt to get version information for.

Notes

This first attempts to parse strings using the it:semver normalization before attempting to extract version parts out of the string.

Returns
The system normalized version integer and a subs dictionary.

Return type
int, dict

getModelDefs()

async initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

class synapse.models.infotech.**SemVer**(*modl*, *name*, *info*, *opts*)

Bases: *Int*

Provides support for parsing a semantic version string into its component parts. This normalizes a version string into an integer to allow version ordering. Prerelease information is disregarded for integer comparison purposes, as we cannot map an arbitrary pre-release version into a integer value

Major, minor and patch levels are represented as integers, with a max width of 20 bits. The comparable integer value representing the semver is the bitwise concatenation of the major, minor and patch levels.

Prerelease and build information will be parsed out and available as strings if that information is present.

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

synapse.models.infotech.**chopCpe22**(*text*)

CPE 2.2 Formatted String https://cpe.mitre.org/files/cpe-specification_2.2.pdf

synapse.models.infotech.**cpesplit**(*text*)

synapse.models.infotech.**fsb_escape**(*text*)

synapse.models.infotech.**fsb_unescape**(*text*)

synapse.models.infotech.**isValidCpe22**(*text*)

synapse.models.infotech.**isValidCpe23**(*text*)

synapse.models.infotech.**uri_pack**(*edition*, *sw_edition*, *target_sw*, *target_hw*, *other*)

synapse.models.infotech.**uri_quote**(*text*)

synapse.models.infotech.**uri_unpack**(*edition*)

synapse.models.infotech.**uri_unquote**(*text*)

synapse.models.infotech.**zipCpe22**(*parts*)

synapse.models.language module

class synapse.models.language.**LangModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.material module

A data model focused on material objects.

class synapse.models.material.**MatModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.math module

class synapse.models.math.**MathModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.media module

class synapse.models.media.**MediaModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.orgs module

class synapse.models.orgs.**OuModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.person module

class synapse.models.person.**PsModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.planning module

class synapse.models.planning.**PlanModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.proj module

class synapse.models.proj.**ProjectModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

async initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

synapse.models.risk module

class synapse.models.risk.**CvssV2**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

class synapse.models.risk.**CvssV3**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

class synapse.models.risk.**RiskModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.science module

class synapse.models.science.**ScienceModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.syn module

class synapse.models.syn.**SynModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

class synapse.models.syn.**SynRole**(*modl*, *name*, *info*, *opts*)

Bases: *Guid*

repr(*iden*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.models.syn.**SynUser**(*modl*, *name*, *info*, *opts*)

Bases: *Guid*

repr(*iden*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

synapse.models.telco module

class synapse.models.telco.**Imei**(*modl*, *name*, *info*, *opts*)

Bases: *Int*

postTypeInit()

class synapse.models.telco.**Imsi**(*modl*, *name*, *info*, *opts*)

Bases: *Int*

postTypeInit()

class synapse.models.telco.**Phone**(*modl*, *name*, *info*, *opts*)

Bases: *Str*

postTypeInit()

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

class synapse.models.telco.**TelcoModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.models.telco.**chop_imei**(*imei*)

synapse.models.telco.**digits**(*text*)

synapse.models.telco.**imeicsum**(*text*)

Calculate the imei check byte.

synapse.models.transport module

class synapse.models.transport.**TransportModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

synapse.servers package

Submodules

synapse.servers.aha module

synapse.servers.axon module

synapse.servers.cell module

async synapse.servers.cell.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.servers.cortex module

synapse.servers.cryotank module

synapse.servers.jsonstor module

synapse.servers.stemcell module

synapse.servers.stemcell.**getStemCell**(*dirn*)

async synapse.servers.stemcell.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tests package

Submodules

synapse.tests.nopmod module

A python module used for testing dmon dynamic module loading.

synapse.tests.utils module

This contains the core test helper code used in Synapse.

This gives the opportunity for third-party users of Synapse to test their code using some of the same helpers used to test Synapse.

The core class, synapse.tests.utils.SynTest is a subclass of unittest.TestCase, with several wrapper functions to allow for easier calls to assert* functions, with less typing. There are also Synapse specific helpers, to load Cortexes and whole both multi-component environments into memory.

Since SynTest is built from unittest.TestCase, the use of SynTest is compatible with the unittest, nose and pytest frameworks. This does not lock users into a particular test framework; while at the same time allowing base use to be invoked via the built-in Unittest library, with one important exception: due to an unfortunate design approach, you cannot use the unittest module command line to run a *single* async unit test. pytest works fine though.

class synapse.tests.utils.**AsyncStreamEvent**(**args*, ***kwargs*)

Bases: `_StreamIOMixin`, `Event`

A combination of a io.StringIO object and an asyncio.Event object.

async wait(*timeout=None*)

Block until the internal flag is true.

If the internal flag is true on entry, return True immediately. Otherwise, block until another coroutine calls set() to set the flag to true, then return True.

class synapse.tests.utils.**CmdGenerator**(*cmds*)

Bases: `object`

addCmd(*cmd*)

Add a command to the end of the list of commands returned by the CmdGenerator.

Parameters
cmd (*str*) – Command to add to the list of commands to return.

class synapse.tests.utils.**DeprModule**(*core*, *conf=None*)

Bases: *CoreModule*

getModelDefs()

class synapse.tests.utils.**HttpReflector**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *Handler*

Test handler which reflects get/post data back to the caller

async get()

async head()

async post()

class synapse.tests.utils.**LibDepr**(*runt*, *name=()*)

Bases: *Lib*

Deprecate me!

addLibFuncs()

async boop(*valu*)

class synapse.tests.utils.**LibTst**(*runt*, *name=()*)

Bases: *Lib*

LibTst for testing!

addLibFuncs()

async beep(*valu*)

Example storm func

async someargs(*valu*, *bar=True*, *faz=None*)

Example storm func

class synapse.tests.utils.**PickleableMagicMock**(**args*, ***kw*)

Bases: MagicMock

class synapse.tests.utils.**ReloadCell**

Bases: *Cell*

async addTestBadReload()

async addTestReload()

async getCellInfo()

Return metadata specific for the Cell.

Notes

By default, this function returns information about the base Cell implementation, which reflects the base information in the Synapse Cell.

It is expected that implementers override the following Class attributes in order to provide meaningful version information:

COMMIT - A Git Commit VERSION - A Version tuple. VERSTRING - A Version string.

Returns
A Dictionary of metadata.

Return type
Dict

async postAnit()

Method called after self.__anit__() has completed, but before anit() returns the object to the caller.

class synapse.tests.utils.**StormPkgTest**(**args*, ***kwargs*)

Bases: *SynTest*

assetdir = None

getTestCore(*conf=None*, *dirn=None*, *prepkghook=None*)

Get a simple test Cortex as an async context manager.

Returns
A Cortex object.

Return type
s_cortex.Cortex

async initTestCore(*core*)

This is executed after the package has been loaded and a VCR context has been entered.

pkgprotos = ()

vcr = None

class synapse.tests.utils.**StreamEvent**(**args*, ***kwargs*)

Bases: _StreamIOMixin, Event

A combination of a io.StringIO object and a threading.Event object.

class synapse.tests.utils.**SynTest**(**args*, ***kwargs*)

Bases: TestCase

Mark all async test methods as s_glob.synchelp decorated.

> **Note**
>
> This precludes running a single unit test via path using the unittest module.

async addCreatorDeleterRoles(*core*)

Add two roles to a Cortex *proxy*, the *creator* and *deleter* roles. Creator allows for node:add, prop:set and tag:add actions. Deleter allows for node:del, prop:del and tag:del actions.

Parameters

core – Auth enabled cortex.

addSvcToAha(*aha*, *svcname*, *ctor*, *conf=None*, *dirn=None*, *provinfo=None*)

Creates a service and provisions it in an Aha network via the provisioning API.

This assumes the Aha cell has a provision:listen and aha:urls set.

Parameters

- **aha** (*s_aha.AhaCell*) – Aha cell.
- **svcname** (*str*) – Service name.
- **ctor** – Service class to add.
- **conf** (*dict*) – Optional service conf.
- **dirn** (*str*) – Optional directory.
- **provinfo** (*dict*) – Optional provisioning info.

Notes

The config data for the cell is pushed into dirn/cell.yaml. The cells are created with the ctor.anit() function.

async addSvcToCore(*svc*, *core*, *svcname='svc'*)

Add a service to a Cortex using telepath over tcp.

async agenlen(*x*, *obj*, *msg=None*)

Assert that the async generator produces x items

async agenraises(*exc*, *gfunc*)

Helper to validate that an async generator will throw an exception.

Parameters

- **exc** – Exception class to catch

- **gfunc** – async Generator

async asyncraises(*exc*, *coro*)

checkNode(*node*, *expected*)

async checkNodes(*core*, *ndefs*)

eq(*x*, *y*, *msg=None*)

Assert X is equal to Y

eqOrNan(*x*, *y*, *msg=None*)

Assert X is equal to Y or they are both NaN (needed since NaN != NaN)

eqish(*x*, *y*, *places=6*, *msg=None*)

Assert X is equal to Y within places decimal places

async execToolMain(*func*, *argv*)

extendOutpFromPatch(*outp*, *patch*)

Extend an Outp with lines from a magicMock object from withCliPromptMock.

Parameters

- **outp** (TstOutPut) – The outp to extend.
- **patch** (*mock.MagicMock*) – The patch object.

Returns

Returns none.

Return type

None

false(*x*, *msg=None*)

Assert X is False

ge(*x*, *y*, *msg=None*)

Assert that X is greater than or equal to Y

genraises(*exc*, *gfunc*, **args*, ***kwargs*)

Helper to validate that a generator function will throw an exception.

Parameters

- **exc** – Exception class to catch
- **gfunc** – Generator function to call.
- ***args** – Args passed to the generator function.
- ****kwargs** – Kwargs passed to the generator function.

Notes

Wrap a generator function in a list() call and execute that in a bound local using `self.raises(exc, boundlocal)`. The `list()` will consume the generator until complete or an exception occurs.

getAsyncLoggerStream(*logname*, *mesg=''*) → AbstractContextManager[*StreamEvent*, None, None]

Async version of getLoggerStream.

Parameters

- **logname** (*str*) – Name of the logger to get.
- **mesg** (*str*) – A string which, if provided, sets the StreamEvent event if a message containing the string is written to the log.

Notes

The event object mixed in for the AsyncStreamEvent is a asyncio.Event object. This requires the user to await the Event specific calls as neccesary.

Examples

Do an action and wait for a specific log message to be written:

```
with self.getAsyncLoggerStream('synapse.foo.bar',
                               'big badda boom happened') as stream:
    # Do something that triggers a log message
    await doSomething()
    # Wait for the mesg to be written to the stream
    await stream.wait(timeout=10)

stream.seek(0)
mesgs = stream.read()
# Do something with messages
```

Returns
An AsyncStreamEvent object.

Return type
AsyncStreamEvent

getCellConf(*conf=None*)

getHttpSess(*auth=None*, *port=None*)

Get an aiohttp ClientSession with a CookieJar.

Parameters

- **auth** (*str, str*) – A tuple of username and password information for http auth.
- **port** (*int*) – Port number to connect to.

Notes

If auth and port are provided, the session will login to a Synapse cell hosted at localhost:port.

Returns
An aiohttp.ClientSession object.

Return type
aiohttp.ClientSession

getLoggerStream(*logname*, *mesg=''*)

Get a logger and attach a io.StringIO object to the logger to capture log messages.

Parameters

- **logname** (*str*) – Name of the logger to get.
- **mesg** (*str*) – A string which, if provided, sets the StreamEvent event if a message

- **log.**(*containing the string is written to the*)

Examples

Do an action and get the stream of log messages to check against:

```
with self.getLoggerStream('synapse.foo.bar') as stream:
    # Do something that triggers a log message
    doSomething()

stream.seek(0)
mesgs = stream.read()
# Do something with messages
```

Do an action and wait for a specific log message to be written:

```
with self.getLoggerStream('synapse.foo.bar', 'big badda boom happened') as␣
↪stream:
    # Do something that triggers a log message
    doSomething()
    stream.wait(timeout=10)  # Wait for the mesg to be written to the stream

stream.seek(0)
mesgs = stream.read()
# Do something with messages
```

You can also reset the message and wait for another message to occur:

```
with self.getLoggerStream('synapse.foo.bar', 'big badda boom happened') as␣
↪stream:
    # Do something that triggers a log message
    doSomething()
    stream.wait(timeout=10)
    stream.setMesg('yo dawg')  # This will now wait for the 'yo dawg' string to␣
↪be written.
    stream.wait(timeout=10)

stream.seek(0)
mesgs = stream.read()
# Do something with messages
```

Notes

This **only** captures logs for the current process.

Yields
StreamEvent – A StreamEvent object

getMagicPromptColors(*patch*)

Get the colored lines from a MagicMock object from withCliPromptMock.

Parameters
patch (*mock.MagicMock*) – The MagicMock object from withCliPromptMock.

Returns
A list of tuples, containing color and line data.

Return type
list

getMagicPromptLines(*patch*)

Get the text lines from a MagicMock object from withCliPromptMock.

Parameters
patch (*mock.MagicMock*) – The MagicMock object from withCliPromptMock.

Returns
A list of lines.

Return type
list

getRegrAxon(*vers*, *conf=None*)

getRegrCore(*vers*, *conf=None*, *maxvers=None*)

getRegrDir(**path*)

getStructuredAsyncLoggerStream(*logname*, *mesg=''*) → AbstractContextManager[*AsyncStreamEvent*, None, None]

Async version of getLoggerStream which uses structured logging.

Parameters

- **logname** (*str*) – Name of the logger to get.
- **mesg** (*str*) – A string which, if provided, sets the StreamEvent event if a message containing the string is written to the log.

Notes

The event object mixed in for the AsyncStreamEvent is a asyncio.Event object. This requires the user to await the Event specific calls as needed. The messages written to the stream will be JSON lines.

Examples

Do an action and wait for a specific log message to be written:

```
with self.getStructuredAsyncLoggerStream('synapse.foo.bar',
                                         '"some JSON string"') as stream:
    # Do something that triggers a log message
    await doSomething()
    # Wait for the mesg to be written to the stream
    await stream.wait(timeout=10)

msgs = stream.jsonlines()
# Do something with messages
```

Returns
An AsyncStreamEvent object.

Return type
AsyncStreamEvent

getTestAha(*conf=None*, *dirn=None*, *ctor=None*)

getTestAxon(*dirn=None*, *conf=None*)

Get a test Axon as an async context manager.

Returns
A Axon object.

Return type
s_axon.Axon

getTestCell(*ctor=<class 'synapse.lib.cell.Cell'>*, *conf=None*, *dirn=None*)

Get a test Cell.

getTestCertDir(*dirn*)

Patch the synapse.lib.certdir.certdir singleton and supporting functions with a CertDir instance backed by the provided directory.

Parameters
dirn (*str*) – The directory used to back the new CertDir singleton.

Returns
The patched CertDir object that is the current singleton.

Return type
s_certdir.CertDir

getTestConfDir(*name*, *conf=None*)

getTestCore(*conf=None*, *dirn=None*)

Get a simple test Cortex as an async context manager.

Returns
A Cortex object.

Return type
s_cortex.Cortex

getTestCoreAndProxy(*conf=None*, *dirn=None*)

Get a test Cortex and the Telepath Proxy to it.

Returns
The Cortex and a Proxy representing a CoreApi object.

Return type
(s_cortex.Cortex, s_cortex.CoreApi)

getTestCoreProxSvc(*ssvc*, *ssvc_conf=None*, *core_conf=None*)

Get a test Cortex, the Telepath Proxy to it, and a test service instance.

Parameters

- **ssvc** – Ctor to the Test Service.
- **ssvc_conf** – Service configuration.
- **core_conf** – Cortex configuration.

Returns
The Cortex, Proxy, and service instance.

Return type
(s_cortex.Cortex, s_cortex.CoreApi, testsvc)

getTestCryo(*dirn=None*, *conf=None*)

Get a simple test Cryocell as an async context manager.

Returns
Test cryocell.

Return type
s_cryotank.CryoCell

getTestCryoAndProxy(*dirn=None*)

Get a test Cryocell and the Telepath Proxy to it.

Returns
CryoCell, s_cryotank.CryoApi): The CryoCell and a Proxy representing a CryoApi object.

Return type
(s_cryotank

getTestDir(*mirror=None*, *copyfrom=None*, *chdir=False*, *startdir=None*) → AbstractContextManager[str, None, None]

Get a temporary directory for test purposes. This destroys the directory afterwards.

Parameters

- **mirror** (*str*) – A Synapse test directory to mirror into the test directory.
- **copyfrom** (*str*) – An arbitrary directory to copy into the test directory.
- **chdir** (*boolean*) – If true, chdir the current process to that directory. This is undone when the context manager exits.
- **startdir** (*str*) – The directory under which to place the temporary directory

Notes

The mirror argument is normally used to mirror test directory under `synapse/tests/files`. This is accomplished by passing in the name of the directory (such as `testcore`) as the mirror argument.

If the `mirror` argument is an absolute directory, that directory will be copied to the test directory.

Returns
The path to a temporary directory.

Return type
str

getTestDmon()

getTestFilePath(**names*)

getTestHive()

getTestHiveFromDirn(*dirn*)

getTestJsonStor(*dirn=None*, *conf=None*)

getTestOutp()

Get a Output instance with a expects() function.

Returns
A TstOutPut instance.

Return type
TstOutPut

getTestProxy(*dmon*, *name*, ***kwargs*)

getTestReadWriteCores(*conf=None*, *dirn=None*)

Get a read/write core pair.

Notes

By default, this returns the same cortex. It is expected that a test which needs two distinct Cortexes implements the bridge themselves.

Returns
A tuple of Cortex objects.

Return type
(s_cortex.Cortex, s_cortex.Cortex)

getTestSynDir()

Combines getTestDir() and setSynDir() into one.

getTestUrl(*dmon*, *name*, ***opts*)

gt(*x*, *y*, *msg=None*)

Assert that X is greater than Y

isin(*member*, *container*, *msg=None*)

Assert a member is inside of a container.

isinstance(*obj*, *cls*, *msg=None*)

Assert a object is the instance of a given class or tuple of classes.

istufo(*obj*)

Check to see if an object is a tufo.

Parameters
obj (*object*) – Object being inspected.

Notes

This does not make any assumptions about the contents of the dictionary. This validates the object to be a tuple of length two, containing a str or None as the first value, and a dict as the second value.

Returns
None

le(*x*, *y*, *msg=None*)

Assert that X is less than or equal to Y

len(*x*, *obj*, *msg=None*)

Assert that the length of an object is equal to X

lt(*x*, *y*, *msg=None*)

Assert that X is less than Y

mayTestDir(*dirn: str | None*) → AbstractContextManager[str, None, None]

Convenience method to make a temporary directory or use an existing one.

Parameters
dirn – Directory to use, or None.

Returns
The directory to use.

ne(*x*, *y*)

Assert X is not equal to Y

nn(*x*, *msg=None*)

Assert X is not None

none(*x*, *msg=None*)

Assert X is None

noprop(*info*, *prop*)

Assert a property is not present in a dictionary.

notin(*member*, *container*, *msg=None*)

Assert a member is not inside of a container.

printed(*msgs*, *text*)

raises(**args*, ***kwargs*)

Assert a function raises an exception.

redirectStdin(*new_stdin*)

Temporary replace stdin.

Parameters
new_stdin (*file-like object*) – file-like object.

Examples

Patch stdin with a string buffer:

```
inp = io.StringIO('stdin stuff\nanother line\n')
with self.redirectStdin(inp):
    main()
```

Here's a way to use this for code that's expecting the stdin buffer to have bytes:

```
inp = Mock()
inp.buffer = io.BytesIO(b'input data')
with self.redirectStdin(inp):
    main()
```

Returns
None

async runCoreNodes(*core*, *query*, *opts=None*)

Run a storm query through a Cortex as a SchedCoro and return the results.

setSynDir(*dirn*)

Sets s_common.syndir to a specific directory and then unsets it afterwards.

Parameters
dirn (*str*) – Directory to set syndir to.

Notes

This is to be used as a context manager.

setTstEnvars(***props*)

Set Environment variables for the purposes of running a specific test.

Parameters

- ****props** – A kwarg list of envars to set. The values set are run
- **strings.** (*through str() to ensure we're setting*)

Examples

Run a test while a envar is set:

```
with self.setEnvars(magic='haha') as nop:
    ret = dostuff()
    self.true(ret)
```

Notes

This helper explicitly sets and unsets values in os.environ, as os.putenv does not automatically updates the os.environ object.

Yields

None. This context manager yields None. Upon exiting, envars are either removed from os.environ or reset to their previous values.

skip(*mesg*)

skipIfNexusReplay()

Allow skipping a test if SYNDEV_NEXUS_REPLAY envar is set.

Raises

unittest.SkipTest if SYNDEV_NEXUS_REPLAY envar is set to true value. –

skipIfNoInternet()

Allow skipping a test if SYN_TEST_SKIP_INTERNET envar is set.

Raises

unittest.SkipTest if SYN_TEST_SKIP_INTERNET envar is set to a integer greater than 1. –

skipIfNoPath(*path*, *mesg=None*)

Allows skipping a test if the test/files path does not exist.

Parameters

- **path** (*str*) – Path to check.
- **mesg** (*str*) – Optional additional message.

Raises

unittest.SkipTest if the path does not exist. –

skipLongTest()

Allow skipping a test if SYN_TEST_SKIP_LONG envar is set.

Raises
unittest.SkipTest if SYN_TEST_SKIP_LONG envar is set to a integer greater than 1. –

sorteq(*x*, *y*, *msg=None*)

Assert two sorted sequences are the same.

stormHasNoErr(*mesgs*)

Raise an AssertionError if there is a message of type "err" in the list.

Parameters
mesgs (*list*) – A list of storm messages.

stormHasNoWarnErr(*mesgs*)

Raise an AssertionError if there is a message of type "err" or "warn" in the list.

Parameters
mesgs (*list*) – A list of storm messages.

stormIsInErr(*mesg*, *mesgs*)

Check if a string is present in all of the error messages from a stream of storm messages.

Parameters

- **mesg** (*str*) – A string to check.
- **mesgs** (*list*) – A list of storm messages.

stormIsInPrint(*mesg*, *mesgs*, *deguid=False*, *whitespace=True*)

Check if a string is present in all of the print messages from a stream of storm messages.

Parameters

- **mesg** (*str*) – A string to check.
- **mesgs** (*list*) – A list of storm messages.

stormIsInWarn(*mesg*, *mesgs*)

Check if a string is present in all of the warn messages from a stream of storm messages.

Parameters

- **mesg** (*str*) – A string to check.
- **mesgs** (*list*) – A list of storm messages.

stormNotInPrint(*mesg*, *mesgs*)

Assert a string is not present in all of the print messages from a stream of storm messages.

Parameters

- **mesg** (*str*) – A string to check.
- **mesgs** (*list*) – A list of storm messages.

stormNotInWarn(*mesg*, *mesgs*)

Assert a string is not present in all of the warn messages from a stream of storm messages.

Parameters

- **mesg** (*str*) – A string to check.
- **mesgs** (*list*) – A list of storm messages.

thisEnvMust(**envvars*)

Requires a host must have environment variables set to truthy values.

Parameters
***envars** – Environment variables to require being present.

thisEnvMustNot(**envvars*)

Requires a host must not have environment variables set to truthy values.

Parameters
***envars** – Environment variables to require being absent or set to falsey values.

thisHostMust(***props*)

Requires a host having a specific property.

Parameters
****props**

Raises
unittest.SkipTest if the required property is missing. –

thisHostMustNot(***props*)

Requires a host to not have a specific property.

Parameters
****props**

Raises
unittest.SkipTest if the required property is missing. –

true(*x*, *msg=None*)

Assert X is True

withCliPromptMock()

Context manager to mock our use of Prompt Toolkit's print_formatted_text function.

Returns
Yields a mock.MagikMock object.

Return type
mock.MagicMock

withCliPromptMockExtendOutp(*outp*)

Context manager to mock our use of Prompt Toolkit's print_formatted_text function and extend the lines to an an output object.

Parameters
outp (TstOutPut) – The outp to extend.

Notes

This extends the outp with the lines AFTER the context manager has exited.

Returns
Yields a mock.MagicMock object.

Return type
mock.MagicMock

withNexusReplay(*replay=False*)

Patch so that the Nexus apply log is applied twice. Useful to verify idempotency.

Parameters
replay (*bool*) – Set the default value of resolving the existence of SYNDEV_NEXUS_REPLAY variable. This can be used to force the apply patch without using the environment variable.

Notes

This is applied if the environment variable SYNDEV_NEXUS_REPLAY is set to a non zero value or the replay argument is set to True.

Returns
An exitstack object.

Return type
contextlib.ExitStack

withSetLoggingMock()

Context manager to mock calls to the setlogging function to avoid unittests calling logging.basicconfig.

Returns
Yields a mock.MagicMock object.

Return type
mock.MagicMock

withTestCmdr(*cmdg*)

class synapse.tests.utils.**TestCmd**(*runt*, *runtsafe*)

Bases: *Cmd*

A test command

async execStormCmd(*runt*, *genr*)

Abstract base method

forms = {'input': ['test:str', 'inet:ipv6'], 'nodedata': [('foo', 'inet:ipv4'), ('bar', 'inet:fqdn')], 'output': ['inet:fqdn']}

getArgParser()

name = 'testcmd'

class synapse.tests.utils.**TestModule**(*core*, *conf=None*)

Bases: *CoreModule*

async addTestRecords(*snap*, *items*)

getModelDefs()

getStormCmds()

Module implementers may override this to provide a list of Storm commands which will be loaded into the Cortex.

Returns
A list of Storm Command classes (not instances).

Return type
list

async initCoreModule()

Module implementers may override this method to initialize the module after the Cortex has completed and is accessible to perform storage operations.

Notes

This is the preferred function to override for implementing custom code that needs to be executed during Cortex startup.

Any exception raised within this method will remove the module from the list of currently loaded modules.

This is called for modules after getModelDefs() and getStormCmds() has been called, in order to allow for model loading and storm command loading prior to code execution offered by initCoreModule.

A failure during initCoreModule will not unload data model or storm commands registered by the module.

Returns
None

testguid = '8f1401de15918358d5247e21ca29a814'

class synapse.tests.utils.TestRunt(*name*, ***kwargs*)

Bases: object

getStorNode(*form*)

class synapse.tests.utils.TestSubType(*modl*, *name*, *info*, *opts*)

Bases: *Type*

norm(*valu*)

Normalize the value for a given type.

Parameters
valu (*obj*) – The value to normalize.

Returns
The normalized valu, info tuple.

Return type
((obj,dict))

Notes

The info dictionary uses the following key conventions:
subs (dict): The normalized sub-fields as name: valu entries.

repr(*norm*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 4

class synapse.tests.utils.TestType(*modl*, *name*, *info*, *opts*)

Bases: *Type*

postTypeInit()

stortype: int = 1

class synapse.tests.utils.**ThreeType**(*modl*, *name*, *info*, *opts*)

Bases: *Type*

norm(*valu*)

Normalize the value for a given type.

Parameters
valu (*obj*) – The value to normalize.

Returns
The normalized valu, info tuple.

Return type
((obj,dict))

Notes

The info dictionary uses the following key conventions:
subs (dict): The normalized sub-fields as name: valu entries.

repr(*valu*)

Return a printable representation for the value. This may return a string or a tuple of values for display purposes.

stortype: int = 2

class synapse.tests.utils.**TstEnv**

Bases: object

add(*name*, *item*, *fini=False*)

async fini()

class synapse.tests.utils.**TstOutPut**

Bases: *OutPutStr*

clear()

expect(*substr*, *throw=True*, *whitespace=True*)

Check if a string is present in the messages captured by the OutPutStr object.

Parameters

- **substr** (*str*) – String to check for the existence of.
- **throw** (*bool*) – If True, a missing substr results in a Exception being thrown.

Returns
True if the string is present; False if the string is not present and throw is False.

Return type
bool

async synapse.tests.utils.**alist**(*coro*)

synapse.tests.utils.**deguidify**(*x*)

synapse.tests.utils.**jsonlines**(*text: str*)

synapse.tests.utils.**matchContexts**(*testself*)

synapse.tests.utils.**norm**(*z*)

async synapse.tests.utils.**waitForBehold**(*core*, *events*)

synapse.tools package

Subpackages

synapse.tools.aha package

Subpackages

synapse.tools.aha.provision package

Submodules

synapse.tools.aha.provision.service module

async synapse.tools.aha.provision.service.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.provision.user module

async synapse.tools.aha.provision.user.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

Submodules

synapse.tools.aha.clone module

async synapse.tools.aha.clone.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.easycert module

synapse.tools.aha.easycert.**getArgParser**()

async synapse.tools.aha.easycert.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.enroll module

async synapse.tools.aha.enroll.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.list module

async synapse.tools.aha.list.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.mirror module

synapse.tools.aha.mirror.**build_status_list**(*members*, *cell_infos*)

synapse.tools.aha.mirror.**check_sync_status**(*group_status*)

async synapse.tools.aha.mirror.**get_cell_infos**(*prox*, *iden*, *members*, *timeout*)

async synapse.tools.aha.mirror.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.aha.mirror.**output_status**(*outp*, *vname*, *group_status*)

synapse.tools.aha.mirror.**timeout_type**(*valu*)

synapse.tools.axon package

Submodules

synapse.tools.axon.dump module

async synapse.tools.axon.dump.**dumpBlobs**(*opts*, *outp*)

synapse.tools.axon.dump.**getTarName**(*celliden*, *start*, *end*)

async synapse.tools.axon.dump.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.axon.load module

async synapse.tools.axon.load.**loadBlobs**(*opts*, *outp*, *tarfiles*)

async synapse.tools.axon.load.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.cortex package

Subpackages

synapse.tools.cortex.layer package

Submodules

synapse.tools.cortex.layer.dump module

async synapse.tools.cortex.layer.dump.**exportLayer**(*opts*, *outp*)

async synapse.tools.cortex.layer.dump.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.cortex.layer.load module

async synapse.tools.cortex.layer.load.**importLayer**(*infiles*, *opts*, *outp*)

async synapse.tools.cortex.layer.load.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.cryo package

Submodules

synapse.tools.cryo.cat module

async synapse.tools.cryo.cat.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.cryo.list module

async synapse.tools.cryo.list.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.docker package

Submodules

synapse.tools.docker.validate module

synapse.tools.docker.validate.**checkCRL**(*outp*, *sigd*, *certdir*)

synapse.tools.docker.validate.**checkCosign**(*outp*)

synapse.tools.docker.validate.**checkCosignSignature**(*outp*, *pubk_byts*, *image_to_verify*)

synapse.tools.docker.validate.**getArgParser**()

synapse.tools.docker.validate.**getCosignSignature**(*outp*, *image*)

synapse.tools.docker.validate.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.hive package

Submodules

synapse.tools.hive.load module

async synapse.tools.hive.load.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.hive.save module

async synapse.tools.hive.save.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

Submodules

synapse.tools.apikey module

async synapse.tools.apikey.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.apikey.**printkey**(*outp*, *info*, *apikey=None*)

synapse.tools.autodoc module

class synapse.tools.autodoc.**DocHelp**(*ctors*, *types*, *forms*, *props*, *univs*)

Bases: object

Helper to pre-compute all doc strings hierarchically

async synapse.tools.autodoc.**docConfdefs**(*ctor*)

async synapse.tools.autodoc.**docModel**(*outp*, *core*)

async synapse.tools.autodoc.**docStormTypes**()

async synapse.tools.autodoc.**docStormpkg**(*pkgpath*)

async synapse.tools.autodoc.**docStormsvc**(*ctor*)

synapse.tools.autodoc.**has_popts_data**(*props*)

synapse.tools.autodoc.**lookupedgesforform**(*form: str*, *edges: List[Tuple[Tuple[str | None, str, str | None], Dict[str, str]]]*) → Dict[str, List[Tuple[Tuple[str | None, str, str | None], Dict[str, str]]]]

async synapse.tools.autodoc.**main**(*argv*, *outp=None*)

synapse.tools.autodoc.**makeargparser**()

synapse.tools.autodoc.**processCtors**(*rst*, *dochelp*, *ctors*)

Parameters

- **rst** (RstHelp)
- **dochelp** (DocHelp)
- **ctors** (*list*)

Returns
None

synapse.tools.autodoc.**processFormsProps**(*rst*, *dochelp*, *forms*, *univ_names*, *alledges*)

async synapse.tools.autodoc.**processStormCmds**(*rst*, *pkgname*, *commands*)

Parameters

- **rst** (RstHelp)
- **pkgname** (*str*)
- **commands** (*list*)

Returns
None

async synapse.tools.autodoc.**processStormModules**(*rst*, *pkgname*, *modules*)

synapse.tools.autodoc.**processTypes**(*rst*, *dochelp*, *types*)

Parameters

- **rst** (RstHelp)
- **dochelp** (DocHelp)
- **ctors** (*list*)

Returns
None

synapse.tools.autodoc.**processUnivs**(*rst*, *dochelp*, *univs*)

synapse.tools.axon2axon module

async synapse.tools.axon2axon.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.backup module

synapse.tools.backup.**backup**(*srcdir*, *dstdir*, *skipdirs=None*)

Create a backup of a Synapse application.

Parameters

- **srcdir** (*str*) – Path to the directory to backup.
- **dstdir** (*str*) – Path to backup target directory.
- **skipdirs** (*list or None*) – Optional list of relative directory name glob patterns to exclude from the backup.

> **Note**
>
> Running this method from the same process as a running user of the directory may lead to a segmentation fault

synapse.tools.backup.**backup_lmdb**(*env: Environment*, *dstdir: str*, *txn=None*)

synapse.tools.backup.**capturelmdbs**(*srcdir*, *skipdirs=None*, *onlydirs=None*)

A context manager that opens all the lmdb files under a srcdir and makes a read transaction. All transactions are aborted and environments closed when the context is exited.

Yields

Dict[str, Tuple[lmdb.Environment, lmdb.Transaction]] – Maps path to environment, transaction

synapse.tools.backup.**main**(*argv*)

synapse.tools.backup.**parse_args**(*argv*)

synapse.tools.backup.**txnbackup**(*lmdbinfo*, *srcdir*, *dstdir*, *skipdirs=None*)

Create a backup of a Synapse application under a (hopefully consistent) set of transactions.

Parameters

- **lmdbinfo** (*Dict[str, Tuple[lmdb.Environment, lmdb.Transaction]]*) – Maps of path to environment, transaction
- **srcdir** (*str*) – Path to the directory to backup.
- **dstdir** (*str*) – Path to backup target directory.
- **skipdirs** (*list or None*) – Optional list of relative directory name glob patterns to exclude from the backup.

> **Note**
>
> Running this method from the same process as a running user of the directory may lead to a segmentation fault

synapse.tools.cellauth module

async synapse.tools.cellauth.**handleList**(*opts*)

async synapse.tools.cellauth.**handleModify**(*opts*)

async synapse.tools.cellauth.**main**(*argv*, *outprint=None*)

synapse.tools.cellauth.**makeargparser**()

async synapse.tools.cellauth.**printuser**(*user*, *details=False*, *cell=None*)

synapse.tools.cellauth.**reprrule**(*rule*)

synapse.tools.changelog module

class synapse.tools.changelog.**ModelDiffer**(*current_model: dict*, *reference_model: dict*)

Bases: object

diffModl(*outp:* OutPut) → dict | None

async synapse.tools.changelog.**format**(*opts: Namespace*, *outp:* OutPut)

async synapse.tools.changelog.**gen**(*opts: Namespace*, *outp:* OutPut)

async synapse.tools.changelog.**main**(*argv*, *outp=None*)

synapse.tools.changelog.**makeargparser**()

async synapse.tools.changelog.**model**(*opts: Namespace*, *outp:* OutPut)

synapse.tools.cmdr module

async synapse.tools.cmdr.**main**(*argv*)

async synapse.tools.cmdr.**runcmdr**(*argv*, *item*)

synapse.tools.csvtool module

async synapse.tools.csvtool.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.csvtool.**makeargparser**(*outp*)

async synapse.tools.csvtool.**runCsvExport**(*opts*, *outp*, *text*, *stormopts*)

async synapse.tools.csvtool.**runCsvImport**(*opts*, *outp*, *text*, *stormopts*)

synapse.tools.demote module

async synapse.tools.demote.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.easycert module

synapse.tools.easycert.**main**(*argv*, *outp=None*)

synapse.tools.feed module

async synapse.tools.feed.**addFeedData**(*core*, *outp*, *feedformat*, *debug=False*, **paths*, *chunksize=1000*, *offset=0*, *viewiden=None*)

synapse.tools.feed.**getItems**(**paths*)

async synapse.tools.feed.**main**(*argv*, *outp=None*)

synapse.tools.feed.**makeargparser**()

synapse.tools.genpkg module

synapse.tools.genpkg.**getStormStr**(*fn*)

synapse.tools.genpkg.**loadOpticFiles**(*pkgdef*, *path*)

synapse.tools.genpkg.**loadOpticWorkflows**(*pkgdef*, *path*)

synapse.tools.genpkg.**loadPkgProto**(*path*, *opticdir=None*, *no_docs=False*, *readonly=False*)

Get a Storm Package definition from disk.

Parameters

- **path** (*str*) – Path to the package .yaml file on disk.
- **opticdir** (*str*) – Path to optional Optic module code to add to the Storm Package.
- **no_docs** (*bool*) – If true, omit inline documentation content if it is not present on disk.
- **readonly** (*bool*) – If set, open files in read-only mode. If files are missing, that will raise a NoSuchFile exception.

Returns

A Storm package definition.

Return type

dict

async synapse.tools.genpkg.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.genpkg.**tryLoadPkgProto**(*fp*, *opticdir=None*, *readonly=False*)

Try to get a Storm Package prototype from disk with or without inline documentation.

Parameters

- **fp** (*str*) – Path to the package .yaml file on disk.
- **opticdir** (*str*) – Path to optional Optic module code to add to the Storm Package.
- **readonly** (*bool*) – If set, open files in read-only mode. If files are missing, that will raise a NoSuchFile exception.

Returns

A Storm package definition.

Return type

dict

synapse.tools.guid module

synapse.tools.guid.**main**(*argv*, *outp=None*)

synapse.tools.healthcheck module

synapse.tools.healthcheck.**format_component**(*e*, *mesg: str*) → dict

async synapse.tools.healthcheck.**main**(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.tools.healthcheck.**makeargparser**()

synapse.tools.healthcheck.**serialize**(*ret*)

synapse.tools.json2mpk module

synapse.tools.json2mpk.**getArgParser**()

synapse.tools.json2mpk.**main**(*argv*, *outp=None*)

synapse.tools.livebackup module

async synapse.tools.livebackup.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.modrole module

async synapse.tools.modrole.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.modrole.**printrole**(*role*, *outp*)

synapse.tools.moduser module

async synapse.tools.moduser.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.moduser.**printuser**(*user*, *outp*)

synapse.tools.promote module

async synapse.tools.promote.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.pullfile module

async synapse.tools.pullfile.**main**(*argv*, *outp=None*)

synapse.tools.pullfile.**setup**()

synapse.tools.pushfile module

async synapse.tools.pushfile.**main**(*argv*, *outp=None*)

synapse.tools.pushfile.**makeargparser**()

synapse.tools.reload module

synapse.tools.reload.**getArgParser**()

async synapse.tools.reload.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.rstorm module

async synapse.tools.rstorm.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.shutdown module

async synapse.tools.shutdown.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.snapshot module

async synapse.tools.snapshot.**main**(*argv*, *outp*=<*synapse.lib.output.OutPut object*>)

synapse.tools.storm module

class synapse.tools.storm.**ExportCmd**(*cli*, ***opts*)

Bases: *StormCliCmd*

Export the results of a storm query into a nodes file.

Example

// Export nodes to a file !export dnsa.nodes { inet:fqdn#mynodes -> inet:dns:a }

// Export nodes to a file and only include specific tags !export fqdn.nodes { inet:fqdn#mynodes } –include-tags footag

getArgParser()

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.tools.storm.**HelpCmd**(*cli*, ***opts*)

Bases: *CmdHelp*

List interpreter extended commands and display help output.

Example

!help foocmd

class synapse.tools.storm.**PullFileCmd**(*cli*, ***opts*)

Bases: *StormCliCmd*

Download a file by sha256 and store it locally.

Example

!pullfile c00adfcc316f8b00772cdbce2505b9ea539d74f42861801eceb1017a44344ed3 /path/to/savefile

getArgParser()

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.tools.storm.**PushFileCmd**(*cli*, ***opts*)

Bases: *StormCliCmd*

Upload a file and create a file:bytes node.

Example

!pushfile /path/to/file

getArgParser()

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.tools.storm.QuitCmd(*cli*, ***opts*)

Bases: *CmdQuit*

Quit the current command line interpreter.

Example

!quit

class synapse.tools.storm.RunFileCmd(*cli*, ***opts*)

Bases: *StormCliCmd*

Run a local storm file.

Example

!runfile /path/to/file.storm

getArgParser()

async runCmdOpts(*opts*)

Perform the command actions. Must be implemented by Cmd implementers.

Parameters
opts (*dict*) – Options dictionary.

class synapse.tools.storm.StormCli

Bases: *Cli*

async handleErr(*mesg*)

histfile = 'storm_history'

initCmdClasses()

printf(*mesg*, *addnl=True*, *color=None*)

async runCmdLine(*line*, *opts=None*)

Run a single command line.

Parameters
line (*str*) – Line to execute.

Examples

Execute the 'woot' command with the 'help' switch:

await cli.runCmdLine('woot –help')

Returns
Arbitrary data from the cmd class.

Return type
object

async storm(*text*, *opts=None*)

class synapse.tools.storm.StormCliCmd(*cli*, ***opts*)

Bases: *Cmd*

getArgParser()

getCmdOpts(*text*)

Use the _cmd_syntax def to split/parse/normalize the cmd line.

Parameters
text (*str*) – Command to process.

Notes

This is implemented independent of argparse (et al) due to the need for syntax aware argument splitting. Also, allows different split per command type

Returns
An opts dictionary.

Return type
dict

class synapse.tools.storm.StormCompleter(*cli*)

Bases: Completer

get_completions(*document*, *complete_event*)

This should be a generator that yields Completion instances.

If the generation of completions is something expensive (that takes a lot of time), consider wrapping this *Completer* class in a *ThreadedCompleter*. In that case, the completer algorithm runs in a background thread and completions will be displayed as soon as they arrive.

Parameters

- **document** – Document instance.
- **complete_event** – CompleteEvent instance.

async get_completions_async(*document*, *complete_event*)

Asynchronous generator for completions. (Probably, you won't have to override this.)

Asynchronous generator of Completion objects.

async load()

synapse.tools.storm.cmplgenr(**genrs*, *prefix=''*)

Iterate over all the generators/iterators passed in as args and return Completions from them. If prefix is specified, make sure the current item in the generator starts with the prefix value.

synapse.tools.storm.getArgParser()

async synapse.tools.storm.main(*argv*, *outp=<synapse.lib.output.OutPut object>*)

synapse.utils package

Subpackages

synapse.utils.stormcov package

synapse.utils.stormcov.coverage_init(*reg*, *options*)

Submodules

synapse.utils.stormcov.plugin module

class synapse.utils.stormcov.plugin.**PivotTracer**(*parent*)

Bases: FileTracer

PARSE_METHODS = {'getNodeByNdef', 'nodesByPropArray', 'nodesByPropValu', 'nodesByTag'}

dynamic_source_filename(*filename*, *frame*)

Get a dynamically computed source file name.

Some plug-ins need to compute the source file name dynamically for each frame.

This function will not be invoked if *has_dynamic_source_filename()* returns False.

Returns the source file name for this frame, or None if this frame shouldn't be measured.

has_dynamic_source_filename()

Does this FileTracer have dynamic source file names?

FileTracers can provide dynamically determined file names by implementing *dynamic_source_filename()*. Invoking that function is expensive. To determine whether to invoke it, coverage.py uses the result of this function to know if it needs to bother invoking *dynamic_source_filename()*.

See CoveragePlugin.file_tracer() for details about static and dynamic file names.

Returns True if *dynamic_source_filename()* should be called to get dynamic source file names.

line_number_range(*frame*)

Get the range of source line numbers for a given a call frame.

The call frame is examined, and the source line number in the original file is returned. The return value is a pair of numbers, the starting line number and the ending line number, both inclusive. For example, returning (5, 7) means that lines 5, 6, and 7 should be considered executed.

This function might decide that the frame doesn't indicate any lines from the source file were executed. Return (-1, -1) in this case to tell coverage.py that no lines should be recorded for this frame.

class synapse.utils.stormcov.plugin.**StormCtrlTracer**(*parent*)

Bases: FileTracer

dynamic_source_filename(*filename*, *frame*)

Get a dynamically computed source file name.

Some plug-ins need to compute the source file name dynamically for each frame.

This function will not be invoked if *has_dynamic_source_filename()* returns False.

Returns the source file name for this frame, or None if this frame shouldn't be measured.

has_dynamic_source_filename()

Does this FileTracer have dynamic source file names?

FileTracers can provide dynamically determined file names by implementing *dynamic_source_filename()*. Invoking that function is expensive. To determine whether to invoke it, coverage.py uses the result of this function to know if it needs to bother invoking *dynamic_source_filename()*.

See CoveragePlugin.file_tracer() for details about static and dynamic file names.

Returns True if *dynamic_source_filename()* should be called to get dynamic source file names.

line_number_range(*frame*)

Get the range of source line numbers for a given a call frame.

The call frame is examined, and the source line number in the original file is returned. The return value is a pair of numbers, the starting line number and the ending line number, both inclusive. For example, returning (5, 7) means that lines 5, 6, and 7 should be considered executed.

This function might decide that the frame doesn't indicate any lines from the source file were executed. Return (-1, -1) in this case to tell coverage.py that no lines should be recorded for this frame.

class synapse.utils.stormcov.plugin.**StormPlugin**(*options*)

Bases: CoveragePlugin, FileTracer

PARSE_METHODS = {'compute', 'getPivsIn', 'getPivsOut', 'lift', 'once'}

dynamic_source_filename(*filename*, *frame*, *force=False*)

Get a dynamically computed source file name.

Some plug-ins need to compute the source file name dynamically for each frame.

This function will not be invoked if *has_dynamic_source_filename()* returns False.

Returns the source file name for this frame, or None if this frame shouldn't be measured.

file_reporter(*filename*)

Get the FileReporter class to use for a file.

Plug-in type: file tracer.

This will only be invoked if *filename* returns non-None from *file_tracer()*. It's an error to return None from this method.

Returns a FileReporter object to use to report on *filename*, or the string *"python"* to have coverage.py treat the file as Python.

file_tracer(*filename*)

Get a FileTracer object for a file.

Plug-in type: file tracer.

Every Python source file is offered to your plug-in to give it a chance to take responsibility for tracing the file. If your plug-in can handle the file, it should return a FileTracer object. Otherwise return None.

There is no way to register your plug-in for particular files. Instead, this method is invoked for all files as they are executed, and the plug-in decides whether it can trace the file or not. Be prepared for *filename* to refer to all kinds of files that have nothing to do with your plug-in.

The file name will be a Python file being executed. There are two broad categories of behavior for a plug-in, depending on the kind of files your plug-in supports:

- Static file names: each of your original source files has been converted into a distinct Python file. Your plug-in is invoked with the Python file name, and it maps it back to its original source file.
- Dynamic file names: all of your source files are executed by the same Python file. In this case, your plug-in implements FileTracer.dynamic_source_filename() to provide the actual source file for each execution frame.

filename is a string, the path to the file being considered. This is the absolute real path to the file. If you are comparing to other paths, be sure to take this into account.

Returns a FileTracer object to use to trace *filename*, or None if this plug-in cannot trace this file.

find_executable_files(*src_dir*)

Yield all of the executable files in *src_dir*, recursively.

Plug-in type: file tracer.

Executability is a plug-in-specific property, but generally means files which would have been considered for coverage analysis, had they been included automatically.

Returns or yields a sequence of strings, the paths to files that could have been executed, including files that had been executed.

find_storm_files(*dirn*)

find_subqueries(*tree*, *path*)

has_dynamic_source_filename()

Does this FileTracer have dynamic source file names?

FileTracers can provide dynamically determined file names by implementing *dynamic_source_filename()*. Invoking that function is expensive. To determine whether to invoke it, coverage.py uses the result of this function to know if it needs to bother invoking *dynamic_source_filename()*.

See `CoveragePlugin.file_tracer()` for details about static and dynamic file names.

Returns True if *dynamic_source_filename()* should be called to get dynamic source file names.

line_number_range(*frame*)

Get the range of source line numbers for a given a call frame.

The call frame is examined, and the source line number in the original file is returned. The return value is a pair of numbers, the starting line number and the ending line number, both inclusive. For example, returning (5, 7) means that lines 5, 6, and 7 should be considered executed.

This function might decide that the frame doesn't indicate any lines from the source file were executed. Return (-1, -1) in this case to tell coverage.py that no lines should be recorded for this frame.

class synapse.utils.stormcov.plugin.**StormReporter**(*filename*, *parser*)

Bases: `FileReporter`

excluded_lines()

Get the excluded executable lines in this file.

Your plug-in can use any method it likes to allow the user to exclude executable lines from consideration.

Returns a set of line numbers.

The base implementation returns the empty set.

lines()

Get the executable lines in this file.

Your plug-in must determine which lines in the file were possibly executable. This method returns a set of those line numbers.

Returns a set of line numbers.

source()

Get the source for the file.

Returns a Unicode string.

The base implementation simply reads the *self.filename* file and decodes it as UTF-8. Override this method if your file isn't readable as a text file, or if you need other encoding support.

Submodules

synapse.utils.getrefs module

synapse.utils.getrefs.**download_refs**(*schema*)

synapse.utils.getrefs.**download_refs_handler**(*uri*)

This function downloads the JSON schema at the given URI, parses the given URI to get the path component, and then saves the referenced schema to the 'jsonschemas' directory of synapse.data.

This function runs its own asyncio loop for each URI being requested.

synapse.utils.getrefs.**main**(*argv*)

synapse.utils.getrefs.**parse_args**(*argv*)

10.1.2 Submodules

10.1.3 synapse.axon module

class synapse.axon.**Axon**

Bases: *Cell*

byterange = False

cellapi

alias of *AxonApi*

confdefs = {'http:proxy': {'description': 'An aiohttp-socks compatible proxy URL to use in the wget API.', 'type': 'string'}, 'max:bytes': {'description': 'The maximum number of bytes that can be stored in the Axon.', 'hidecmdl': True, 'minimum': 1, 'type': 'integer'}, 'max:count': {'description': 'The maximum number of files that can be stored in the Axon.', 'hidecmdl': True, 'minimum': 1, 'type': 'integer'}, 'tls:ca:dir': {'description': 'An optional directory of CAs which are added to the TLS CA chain for wget and wput APIs.', 'type': 'string'}}

async csvrows(*sha256*, *dialect='excel'*, *errors='ignore'*, ***fmtparams*)

async del_(*sha256*)

Remove the given bytes from the Axon by sha256.

Parameters
sha256 (*bytes*) – The sha256, in bytes, to remove from the Axon.

Returns
True if the file is removed; false if the file is not present.

Return type
boolean

async dels(*sha256s*)

Given a list of sha256 hashes, delete the files from the Axon.

Parameters
sha256s (*list*) – A list of sha256 hashes in bytes form.

Returns
A list of booleans, indicating if the file was deleted or not.

Return type
list

async get(*sha256*, *offs=None*, *size=None*)

Get bytes of a file.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file in bytes.
- **offs** (*int*) – The offset to start reading from.
- **size** (*int*) – The total number of bytes to read.

Examples

Get the bytes from an Axon and process them:

```
buf = b''
async for bytz in axon.get(sha256):
    buf =+ bytz

await dostuff(buf)
```

Yields
bytes – Chunks of the file bytes.

Raises
synapse.exc.NoSuchFile – If the file does not exist.

async has(*sha256*)

Check if the Axon has a file.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
True if the Axon has the file; false otherwise.

Return type
boolean

async hashes(*offs*, *wait=False*, *timeout=None*)

Yield hash rows for files that exist in the Axon in added order starting at an offset.

Parameters

- **offs** (*int*) – The index offset.
- **wait** (*boolean*) – Wait for new results and yield them in realtime.
- **timeout** (*int*) – Max time to wait for new results.

Yields
(int, (bytes, int)) – An index offset and the file SHA-256 and size.

Note

If the same hash was deleted and then added back, the same hash will be yielded twice.

async hashset(*sha256*)

Calculate additional hashes for a file in the Axon.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
A dictionary containing hashes of the file.

Return type
dict

async history(*tick*, *tock=None*)

Yield hash rows for files that existing in the Axon after a given point in time.

Parameters

- **tick** (*int*) – The starting time (in epoch milliseconds).
- **tock** (*int*) – The ending time to stop iterating at (in epoch milliseconds).

Yields
(int, (bytes, int)) – A tuple containing time of the hash was added and the file SHA-256 and size.

holdHashLock(*hashbyts*)

A context manager that synchronizes edit access to a blob.

Parameters
hashbyts (*bytes*) – The blob to hold the lock for.

async initServiceRuntime()

async initServiceStorage()

async iterMpkFile(*sha256*)

Yield items from a MsgPack (.mpk) file in the Axon.

Parameters
sha256 (*str*) – The sha256 hash of the file as a string.

Yields
Unpacked items from the bytes.

async jsonlines(*sha256*, *errors='ignore'*)

async metrics()

Get the runtime metrics of the Axon.

Returns
A dictionary of runtime data about the Axon.

Return type
dict

async postfiles(*fields*, *url*, *params=None*, *headers=None*, *method='POST'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

Send files from the axon as fields in a multipart/form-data HTTP request.

Parameters

- **fields** (*list*) – List of dicts containing the fields to add to the request as form-data.

- **url** (*str*) – The URL to retrieve.
- **params** (*dict*) – Additional parameters to add to the URL.
- **headers** (*dict*) – Additional HTTP headers to add in the request.
- **method** (*str*) – The HTTP method to use.
- **ssl** (*bool*) – Perform SSL verification.
- **timeout** (*int*) – The timeout of the request, in seconds.
- **proxy** (*str|bool*) – The proxy value.
- **ssl_opts** (*dict*) – Additional SSL/TLS options.

Notes

The dictionaries in the fields list may contain the following values:

```
{
    'name': <str> - Name of the field.
    'sha256': <str> - SHA256 hash of the file to submit for this field.
    'value': <str> - Value for the field. Ignored if a sha256 has been␣
↪specified.
    'filename': <str> - Optional filename for the field.
    'content_type': <str> - Optional content type for the field.
    'content_transfer_encoding': <str> - Optional content-transfer-encoding␣
↪header for the field.
}
```

The ssl_opts dictionary may contain the following values:

```
{
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl␣
↪argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can␣
↪be included in client_cert.
}
```

The following proxy arguments are supported:

```
None: Deprecated - Use the proxy defined by the http:proxy configuration option␣
↪if set.
True: Use the proxy defined by the http:proxy configuration option if set.
False: Do not use the proxy defined by the http:proxy configuration option if␣
↪set.
<str>: A proxy URL string.
```

The dictionary returned by this may contain the following values:

```
{
    'ok': <boolean> - False if there were exceptions retrieving the URL.
    'err': <tuple> - Tuple of the error type and information if an exception␣
↪occurred.
    'url': <str> - The URL retrieved (which could have been redirected)
    'code': <int> - The response code.
```

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```
    'body': <bytes> - The response body.
    'reason': <str> - The reason phrase for the HTTP status code.
    'headers': <dict> - The response headers as a dictionary.
}
```

Returns
An information dictionary containing the results of the request.

Return type
dict

async put(*byts*)

Store bytes in the Axon.

Parameters
byts (*bytes*) – The bytes to store in the Axon.

Notes

This API should not be used for files greater than 128 MiB in size.

Returns
A tuple with the file size and sha256 hash of the bytes.

Return type
tuple(int, bytes)

async puts(*files*)

Store a set of bytes in the Axon.

Parameters
files (*list*) – A list of bytes to store in the Axon.

Notes

This API should not be used for storing more than 128 MiB of bytes at once.

Returns
A list containing tuples of file size and sha256 hash of the saved bytes.

Return type
list(tuple(int, bytes))

async readlines(*sha256*, *errors='ignore'*)

async save(*sha256*, *genr*, *size*)

Save a generator of bytes to the Axon.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file in bytes.
- **genr** – The bytes generator function.

Returns
The size of the bytes saved.

Return type
int

async size(*sha256*)

Get the size of a file in the Axon.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
The size of the file, in bytes. If not present, None is returned.

Return type
int

async unpack(*sha256*, *fmt*, *offs=0*)

Unpack bytes from a file in the Axon using struct.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file in bytes.
- **fmt** (*str*) – The struct format string.
- **offs** (*int*) – The offset to start reading from.

Returns
The unpacked values.

Return type
tuple

Raises

- ***synapse.exc.NoSuchFile*** – If the file does not exist.
- ***synapse.exc.BadArg*** – If the struct format is invalid.
- ***synapse.exc.BadDataValu*** – If the expected number of bytes is not received.
- ***synapse.exc.FeatureNotSupported*** – Feature is not supported.

async upload()

Get an Upload object.

Notes

The UpLoad object should be used to manage uploads greater than 128 MiB in size.

Examples

Use an UpLoad object to upload a file to the Axon:

```
async with await axon.upload() as upfd:
    # Assumes bytesGenerator yields bytes
    async for byts in bytsgenerator():
        await upfd.write(byts)
    await upfd.save()
```

Use a single UpLoad object to save multiple files:

```
async with await axon.upload() as upfd:
    for fp in file_paths:
        # Assumes bytesGenerator yields bytes
```

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```
        async for byts in bytsgenerator(fp):
            await upfd.write(byts)
        await upfd.save()
```

Returns
An Upload manager object.

Return type
UpLoad

async wants(*sha256s*)

Get a list of sha256 values the axon does not have from a input list.

Parameters
sha256s (*list*) – A list of sha256 values as bytes.

Returns
A list of bytes containing the sha256 hashes the Axon does not have.

Return type
list

async wget(*url*, *params=None*, *headers=None*, *json=None*, *body=None*, *method='GET'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

Stream a file download directly into the Axon.

Parameters

- **url** (*str*) – The URL to retrieve.
- **params** (*dict*) – Additional parameters to add to the URL.
- **headers** (*dict*) – Additional HTTP headers to add in the request.
- **json** – A JSON body which is included with the request.
- **body** – The body to be included in the request.
- **method** (*str*) – The HTTP method to use.
- **ssl** (*bool*) – Perform SSL verification.
- **timeout** (*int*) – The timeout of the request, in seconds.
- **proxy** (*str|bool*) – The proxy value.
- **ssl_opts** (*dict*) – Additional SSL/TLS options.

Notes

The response body will be stored, regardless of the response code. The ok value in the response does not reflect that a status code, such as a 404, was encountered when retrieving the URL.

The ssl_opts dictionary may contain the following values:

```
{
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl␣
↪argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can␣
```

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```
↪be included in client_cert.
}
```

The following proxy arguments are supported:

```
None: Deprecated - Use the proxy defined by the http:proxy configuration option␣
↪if set.
True: Use the proxy defined by the http:proxy configuration option if set.
False: Do not use the proxy defined by the http:proxy configuration option if␣
↪set.
<str>: A proxy URL string.
```

The dictionary returned by this may contain the following values:

```
{
    'ok': <boolean> - False if there were exceptions retrieving the URL.
    'url': <str> - The URL retrieved (which could have been redirected). This␣
↪is a url-decoded string.
    'code': <int> - The response code.
    'reason': <str> - The reason phrase for the HTTP status code.
    'mesg': <str> - An error message if there was an exception when retrieving␣
↪the URL.
    'err': <tuple> - An error tuple if there was an exception when retrieving␣
↪the URL.
    'headers': <dict> - The response headers as a dictionary.
    'size': <int> - The size in bytes of the response body.
    'hashes': {
        'md5': <str> - The MD5 hash of the response body.
        'sha1': <str> - The SHA1 hash of the response body.
        'sha256': <str> - The SHA256 hash of the response body.
        'sha512': <str> - The SHA512 hash of the response body.
    },
    'request': {
        'url': The request URL. This is a url-decoded string.
        'headers': The request headers.
        'method': The request method.
    }
    'history': A sequence of response bodies to track any redirects, not␣
↪including hashes.
}
```

Returns
An information dictionary containing the results of the request.

Return type
dict

async wput(*sha256*, *url*, *params=None*, *headers=None*, *method='PUT'*, *ssl=True*, *timeout=None*, *filename=None*, *filemime=None*, *proxy=True*, *ssl_opts=None*)

Stream a blob from the axon as the body of an HTTP request.

class synapse.axon.**AxonApi**

Bases: *CellApi*, *Share*

async csvrows(*sha256*, *dialect='excel'*, *errors='ignore'*, ***fmtparams*)

Yield CSV rows from a CSV file.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file.
- **dialect** (*str*) – The CSV dialect to use.
- **errors** (*str*) – Specify how encoding errors should handled.
- ****fmtparams** – The CSV dialect format parameters.

Notes

The dialect and fmtparams expose the Python csv.reader() parameters.

Examples

Get the rows from a CSV file and process them:

```
async for row in axon.csvrows(sha256):
    await dostuff(row)
```

Get the rows from a tab separated file and process them:

```
async for row in axon.csvrows(sha256, delimiter='	'):
    await dostuff(row)
```

Yields

list – Decoded CSV rows.

async del_(*sha256*)

Remove the given bytes from the Axon by sha256.

Parameters

sha256 (*bytes*) – The sha256, in bytes, to remove from the Axon.

Returns

True if the file is removed; false if the file is not present.

Return type

boolean

async dels(*sha256s*)

Given a list of sha256 hashes, delete the files from the Axon.

Parameters

sha256s (*list*) – A list of sha256 hashes in bytes form.

Returns

A list of booleans, indicating if the file was deleted or not.

Return type

list

async get(*sha256*, *offs=None*, *size=None*)

Get bytes of a file.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file in bytes.
- **offs** (*int*) – The offset to start reading from.
- **size** (*int*) – The total number of bytes to read.

Examples

Get the bytes from an Axon and process them:

```
buf = b''
async for bytz in axon.get(sha256):
    buf += bytz

await dostuff(buf)
```

Yields
bytes – Chunks of the file bytes.

Raises
synapse.exc.NoSuchFile – If the file does not exist.

async has(*sha256*)

Check if the Axon has a file.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
True if the Axon has the file; false otherwise.

Return type
boolean

async hashes(*offs*, *wait=False*, *timeout=None*)

Yield hash rows for files that exist in the Axon in added order starting at an offset.

Parameters

- **offs** (*int*) – The index offset.
- **wait** (*boolean*) – Wait for new results and yield them in realtime.
- **timeout** (*int*) – Max time to wait for new results.

Yields
(int, (bytes, int)) – An index offset and the file SHA-256 and size.

async hashset(*sha256*)

Calculate additional hashes for a file in the Axon.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
A dictionary containing hashes of the file.

Return type
dict

async history(*tick*, *tock=None*)

Yield hash rows for files that existing in the Axon after a given point in time.

Parameters

- **tick** (*int*) – The starting time (in epoch milliseconds).
- **tock** (*int*) – The ending time to stop iterating at (in epoch milliseconds).

Yields

(int, (bytes, int)) – A tuple containing time of the hash was added and the file SHA-256 and size.

async iterMpkFile(*sha256*)

Yield items from a MsgPack (.mpk) file in the Axon.

Parameters

sha256 (*bytes*) – The sha256 hash of the file in bytes.

Yields

Unpacked items from the bytes.

async jsonlines(*sha256*, *errors='ignore'*)

Yield JSON objects from JSONL (JSON lines) file.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file.
- **errors** (*str*) – Specify how encoding errors should handled.

Yields

object – Decoded JSON objects.

async metrics()

Get the runtime metrics of the Axon.

Returns

A dictionary of runtime data about the Axon.

Return type

dict

async postfiles(*fields*, *url*, *params=None*, *headers=None*, *method='POST'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

async put(*byts*)

Store bytes in the Axon.

Parameters

byts (*bytes*) – The bytes to store in the Axon.

Notes

This API should not be used for files greater than 128 MiB in size.

Returns

A tuple with the file size and sha256 hash of the bytes.

Return type

tuple(int, bytes)

async puts(*files*)

Store a set of bytes in the Axon.

Parameters
files (*list*) – A list of bytes to store in the Axon.

Notes

This API should not be used for storing more than 128 MiB of bytes at once.

Returns
A list containing tuples of file size and sha256 hash of the saved bytes.

Return type
list(tuple(int, bytes))

async readlines(*sha256*, *errors='ignore'*)

Yield lines from a multi-line text file in the axon.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file.
- **errors** (*str*) – Specify how encoding errors should handled.

Yields
str – Lines of text

async size(*sha256*)

Get the size of a file in the Axon.

Parameters
sha256 (*bytes*) – The sha256 hash of the file in bytes.

Returns
The size of the file, in bytes. If not present, None is returned.

Return type
int

async unpack(*sha256*, *fmt*, *offs=0*)

Unpack bytes from a file in the Axon using struct.

Parameters

- **sha256** (*bytes*) – The sha256 hash of the file in bytes.
- **fmt** (*str*) – The struct format string.
- **offs** (*int*) – The offset to start reading from.

Returns
The unpacked values.

Return type
tuple

Raises

- ***synapse.exc.NoSuchFile*** – If the file does not exist.
- ***synapse.exc.BadArg*** – If the struct format is invalid or reads too much data.
- ***synapse.exc.BadDataValu*** – If the file does not contain the expected number of bytes.

- *synapse.exc.FeatureNotSupported* – Feature is not supported.

async upload()

Get an Upload object.

Notes

The UpLoad object should be used to manage uploads greater than 128 MiB in size.

Examples

Use an UpLoad object to upload a file to the Axon:

```
async with axonProxy.upload() as upfd:
    # Assumes bytesGenerator yields bytes
    async for byts in bytsgenerator():
        upfd.write(byts)
    upfd.save()
```

Use a single UpLoad object to save multiple files:

```
async with axonProxy.upload() as upfd:
    for fp in file_paths:
        # Assumes bytesGenerator yields bytes
        async for byts in bytsgenerator(fp):
            upfd.write(byts)
        upfd.save()
```

Returns
An Upload manager object.

Return type
UpLoadShare

async wants(*sha256s*)

Get a list of sha256 values the axon does not have from an input list.

Parameters
sha256s (*list*) – A list of sha256 values as bytes.

Returns
A list of bytes containing the sha256 hashes the Axon does not have.

Return type
list

async wget(*url*, *params=None*, *headers=None*, *json=None*, *body=None*, *method='GET'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

Stream a file download directly into the Axon.

Parameters

- **url** (*str*) – The URL to retrieve.
- **params** (*dict*) – Additional parameters to add to the URL.
- **headers** (*dict*) – Additional HTTP headers to add in the request.
- **json** – A JSON body which is included with the request.

- **body** – The body to be included in the request.
- **method** (*str*) – The HTTP method to use.
- **ssl** (*bool*) – Perform SSL verification.
- **timeout** (*int*) – The timeout of the request, in seconds.
- **proxy** (*str|bool*) – The proxy value.
- **ssl_opts** (*dict*) – Additional SSL/TLS options.

Notes

The response body will be stored, regardless of the response code. The ok value in the response does not reflect that a status code, such as a 404, was encountered when retrieving the URL.

The ssl_opts dictionary may contain the following values:

```
{
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl␣
↪argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can␣
↪be included in client_cert.
}
```

The following proxy arguments are supported:

```
None: Deprecated - Use the proxy defined by the http:proxy configuration option␣
↪if set.
True: Use the proxy defined by the http:proxy configuration option if set.
False: Do not use the proxy defined by the http:proxy configuration option if␣
↪set.
<str>: A proxy URL string.
```

The dictionary returned by this may contain the following values:

```
{
    'ok': <boolean> - False if there were exceptions retrieving the URL.
    'url': <str> - The URL retrieved (which could have been redirected). This␣
↪is a url-decoded string.
    'code': <int> - The response code.
    'reason': <str> - The reason phrase for the HTTP status code.
    'mesg': <str> - An error message if there was an exception when retrieving␣
↪the URL.
    'err': <tuple> - An error tuple if there was an exception when retrieving␣
↪the URL.
    'headers': <dict> - The response headers as a dictionary.
    'size': <int> - The size in bytes of the response body.
    'hashes': {
        'md5': <str> - The MD5 hash of the response body.
        'sha1': <str> - The SHA1 hash of the response body.
        'sha256': <str> - The SHA256 hash of the response body.
        'sha512': <str> - The SHA512 hash of the response body.
    },
    'request': {
```

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```
        'url': The request URL. This is a url-decoded string.
        'headers': The request headers.
        'method': The request method.
    }
    'history': A sequence of response bodies to track any redirects, not␣
↪including hashes.
}
```

Returns
An information dictionary containing the results of the request.

Return type
dict

async wput(*sha256*, *url*, *params=None*, *headers=None*, *method='PUT'*, *ssl=True*, *timeout=None*, *proxy=True*, *ssl_opts=None*)

class synapse.axon.**AxonFileHandler**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonHandlerMixin*, *Handler*

async getAxonInfo()

class synapse.axon.**AxonHandlerMixin**

Bases: object

getAxon()
Get a reference to the Axon interface used by the handler.

class synapse.axon.**AxonHttpBySha256InvalidV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonFileHandler*

async delete(*sha256*)

async get(*sha256*)

async head(*sha256*)

class synapse.axon.**AxonHttpBySha256V1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonFileHandler*

async delete(*sha256*)

async get(*sha256*)

async head(*sha256*)

class synapse.axon.**AxonHttpDelV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonHandlerMixin*, *Handler*

async post()

class synapse.axon.**AxonHttpHasV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonHandlerMixin*, *Handler*

async get(*sha256*)

class synapse.axon.**AxonHttpUploadV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *AxonHandlerMixin*, *StreamHandler*

async data_received(*chunk*)

Implement this method to handle streamed request data.

Requires the *.stream_request_body* decorator.

May be a coroutine for flow control.

on_connection_close()

Called in async handlers if the client closed the connection.

Override this to clean up resources associated with long-lived connections. Note that this method is called only if the connection was closed during asynchronous processing; if you need to do cleanup after every request override *on_finish* instead.

Proxies may keep a connection open for a time (perhaps indefinitely) after the client has gone away, so this method may not be called promptly after the end user closes their connection.

on_finish()

Called after the end of a request.

Override this method to perform cleanup, logging, etc. This method is primarily intended as a counterpart to *prepare*. However, there are a few error cases where `on_finish` may be called when `prepare` has not. (These are considered bugs and may be fixed in the future, but for now you may need to check to see if the initialization work done in `prepare` has occurred)

`on_finish` may not produce any output, as it is called after the response has been sent to the client.

async post()

Called after all data has been read.

async prepare()

Called at the beginning of a request before *get*/*post*/etc.

Override this method to perform common initialization regardless of the request method. There is no guarantee that `prepare` will be called if an error occurs that is handled by the framework.

Asynchronous support: Use `async def` or decorate this method with *.gen.coroutine* to make it asynchronous. If this method returns an `Awaitable` execution will not proceed until the `Awaitable` is done.

Added in version 3.1: Asynchronous support.

async put()

class synapse.axon.**UpLoad**

Bases: *Base*

An object used to manage uploads to the Axon.

async save()

Save the currently uploaded bytes to the Axon.

Notes

This resets the Upload object, so it can be reused.

Returns
A tuple of sizes in bytes and the sha256 hash of the saved files.

Return type
tuple(int, bytes)

async write(*byts*)

Write bytes to the Upload object.

Parameters
byts (*bytes*) – Bytes to write to the current Upload object.

Returns
Returns None.

Return type
(None)

class synapse.axon.**UpLoadProxy**

Bases: *Share*

async save()

async write(*byts*)

class synapse.axon.**UpLoadShare**

Bases: *UpLoad*, *Share*

typename = 'upload'

10.1.4 synapse.cells module

10.1.5 synapse.common module

class synapse.common.**NoValu**

Bases: object

async synapse.common.**agen**(**items*)

async synapse.common.**aspin**(*genr*)

Async version of spin

synapse.common.**buid**(*valu=None*)

A binary GUID like sequence of 32 bytes.

Parameters

- **valu** (*object*) – Optional, if provided, the hash of the msgpack
- **to** (*encoded form of the object is returned. This can be used*)
- **buids.** (*create stable*)

Notes

By default, this returns a random 32 byte value.

Returns
A 32 byte value.

Return type
bytes

synapse.common.**chunks**(*item*, *size*)

Divide an iterable into chunks.

Parameters

- **item** – Item to slice
- **size** (*int*) – Maximum chunk size.

Notes

This supports Generator objects and objects which support calling the __getitem__() method with a slice object.

Yields
Slices of the item containing up to "size" number of items.

synapse.common.**config**(*conf*, *confdefs*)

Initialize a config dict using the given confdef tuples.

synapse.common.**debase64**(*b*)

synapse.common.**deprdate**(*name*, *date*)

synapse.common.**deprecated**(*name*, *curv='2.x'*, *eolv='3.0.0'*)

synapse.common.**ehex**(*byts*)

Encode a bytes variable to a string using binascii.hexlify.

Parameters
byts (*bytes*) – Bytes to encode.

Returns
A string representing the bytes.

Return type
str

synapse.common.**enbase64**(*b*)

synapse.common.**envbool**(*name*, *defval='false'*)

Resolve an environment variable to a boolean value.

Parameters

- **name** (*str*) – Environment variable to resolve.
- **defval** (*str*) – Default string value to resolve as.

Notes

False values will be consider strings “0” or “false” after lower casing.

Returns
True if the envar is set, false if it is set to a false value.

Return type
boolean

synapse.common.**err**(*e*, *fulltb=False*)

synapse.common.**errinfo**(*name*, *mesg*)

synapse.common.**excinfo**(*e*)

Populate err,errmsg,errtrace info from exc.

synapse.common.**firethread**(*f*)

A decorator for making a function fire a thread.

synapse.common.**flatten**(*item*)

Normalize a primitive object for cryptographic signing.

Parameters
item – The python primitive object to normalize.

Notes

Only None, bool, int, bytes, strings, lists, tuples and dictionaries are acceptable input. List objects will be converted to tuples. Dictionary objects must have keys which can be sorted.

Returns
A new copy of the object.

synapse.common.**format**(*text*, ***kwargs*)

Similar to python str.format() but treats tokens as opaque.

synapse.common.**gendir**(**paths*, ***opts*)

Return the absolute path of the joining of the arguments, creating a directory at the resulting path if one does not exist.

Performs home directory(~) and environment variable expansion.

Parameters

- ***paths** (*[str,...]*) – A list of path elements
- ****opts** – arguments as kwargs to os.makedirs

synapse.common.**genfile**(**paths*) → BinaryIO

Create or open (for read/write) a file path join.

Parameters
***paths** – A list of paths to join together to make the file.

Notes

If the file already exists, the fd returned is opened in `r+b` mode. Otherwise, the fd is opened in `w+b` mode.

The file position is set to the start of the file. The user is responsible for truncating (`fd.truncate()`) if the existing file contents are not desired, or seeking to the end (`fd.seek(0, 2)`) to append.

Returns
A file-object which can be read/written too.

synapse.common.**genpath**(**paths*)

Return an absolute path of the joining of the arguments as path elements

Performs home directory(~) and environment variable expansion on the joined path

Parameters
***paths** (*[str,...]*) – A list of path elements

> **Note**
>
> All paths used by Synapse operations (i.e. everything but the data) shall use this function or one of its callers before storing as object properties.

synapse.common.**getDirSize**(**paths*)

Get the size of a directory.

Parameters
***paths** (*str*) – A list of path elements.

Returns
Tuple of total real and total apparent size of all normal files and directories underneath `*paths` plus `*paths` itself.

Return type
tuple

synapse.common.**getSslCtx**(*cadir*, *purpose=Purpose.SERVER_AUTH*)

Create as SSL Context and load certificates from a given directory.

Parameters

- **cadir** (*str*) – Path to load certificates from.
- **purpose** – SSLContext purposes flags.

Returns
A SSL Context object.

Return type
ssl.SSLContext

synapse.common.**getSynDir**(**paths*)

synapse.common.**getSynPath**(**paths*)

synapse.common.**getTempDir**(*dirn=None*)

synapse.common.**getbytes**(**paths*, ***opts*)

synapse.common.**getfile**(**paths*, ***opts*)

Return a file at the path resulting from joining of the arguments, or None if the file does not exist.

Parameters

- ***paths** (*[str,...]*) – A list of path elements
- ****opts** – arguments as kwargs to io.open

Returns
A file-object which can be read/written too.

Return type
io.BufferedRandom

synapse.common.**guid**(*valu=None*)

Get a 16 byte guid value.

By default, this is a random guid value.

Parameters
valu – Object used to construct the guid valu from. This must be able to be msgpack'd.

Returns
32 character, lowercase ascii string.

Return type
str

synapse.common.**httpcodereason**(*code*)

Get the reason for an HTTP status code.

Parameters
code (*int*) – The code.

Note

If the status code is unknown, a string indicating it is unknown is returned.

Returns
A string describing the status code.

Return type
str

synapse.common.**hugeadd**(*x*, *y*)

Add two decimal.Decimal with proper precision to support synapse hugenums.

synapse.common.**hugediv**(*x*, *y*)

Divide two decimal.Decimal with proper precision to support synapse hugenums.

synapse.common.**hugemod**(*x*, *y*)

synapse.common.**hugemul**(*x*, *y*)

Multiply two decimal.Decimal with proper precision to support synapse hugenums.

synapse.common.**hugenum**(*valu*)

Return a decimal.Decimal with proper precision for use as a synapse hugenum.

synapse.common.**hugepow**(*x*, *y*)

Return the first operand to the power of the second operand.

synapse.common.**hugeround**(*x*)

Round a decimal.Decimal with proper precision for synapse hugenums.

synapse.common.**hugescaleb**(*x*, *y*)

Return the first operand with its exponent adjusted by the second operand.

synapse.common.**hugesub**(*x*, *y*)

Subtract two decimal.Decimal with proper precision to support synapse hugenums.

synapse.common.**int64en**(*i*)

Encode an unsigned 64-bit int into 8 byte big-endian bytes

synapse.common.**int64un**(*b*)

Decode an unsigned 64-bit int from 8 byte big-endian

synapse.common.**intify**(*x*)

Ensure (or coerce) a value into being an integer or None.

Parameters
x (*obj*) – An object to intify

Returns
The int value (or None)

Return type
(int)

synapse.common.**isbuidhex**(*text*)

synapse.common.**isguid**(*text*)

synapse.common.**iterfd**(*fd*, *size=10000000*)

Generator which yields bytes from a file descriptor.

Parameters

- **fd** (*file*) – A file-like object to read bytes from.
- **size** (*int*) – Size, in bytes, of the number of bytes to read from the
- **time.** (*fd at a given*)

Notes

If the first read call on the file descriptor is a empty bytestring, that zero length bytestring will be yielded and the generator will then be exhausted. This behavior is intended to allow the yielding of contents of a zero byte file.

Yields
bytes – Bytes from the file descriptor.

synapse.common.**iterzip**(**args*, *fillvalue=None*)

synapse.common.**jsonsafe_nodeedits**(*nodeedits*)

Hexlify the buid of each node:edits

synapse.common.**listdir**(**paths*, *glob=None*)

List the (optionally glob filtered) full paths from a dir.

Parameters

- ***paths** (*[str,...]*) – A list of path elements
- **glob** (*str*) – An optional fnmatch glob str

synapse.common.**makedirs**(*path*, *mode=511*)

async synapse.common.**merggenr**(*genrs*, *cmprkey*)

Iterate multiple sorted async generators and yield their results in order.

Parameters

- **genrs** (*Sequence[AsyncGenerator[T]]*) – a sequence of async generator that each yield sorted items
- **cmprkey** (*Callable[T, T, bool]*) – a comparison function over the items yielded

Note

If the genrs yield increasing items, cmprkey should return True if the first parameter is less than the second parameter, e.g lambda x, y: x < y.

async synapse.common.**merggenr2**(*genrs*, *cmprkey=None*, *reverse=False*)

Optimized version of merggenr based on heapq.merge

synapse.common.**mononow**()

Get the current monotonic clock time in milliseconds.

This relies on time.monotonic_ns(), which is a relative time.

Returns
Monotonic clock time in milliseconds.

Return type
int

synapse.common.**normLogLevel**(*valu*)

Norm a log level value to a integer.

Parameters
valu – The value to norm (a string or integer).

Returns
A valid Logging log level.

Return type
int

synapse.common.**now**()

Get the current epoch time in milliseconds.

This relies on time.time_ns(), which is system-dependent in terms of resolution.

Returns
Epoch time in milliseconds.

Return type
int

synapse.common.**queryhash**(*text*)

synapse.common.**reprauthrule**(*rule*)

synapse.common.**reqbytes**(**paths*)

synapse.common.**reqdir**(**paths*)

Return the absolute path of the joining of the arguments, raising an exception if a directory does not exist at the resulting path.

Performs home directory(~) and environment variable expansion.

Parameters
***paths** (*[str,...]*) – A list of path elements

synapse.common.**reqfile**(**paths*, ***opts*)

Return a file at the path resulting from joining of the arguments, raising an exception if the file does not exist.

Parameters

- ***paths** (*[str,...]*) – A list of path elements
- ****opts** – arguments as kwargs to io.open

Returns
A file-object which can be read/written too.

Return type
io.BufferedRandom

synapse.common.**reqpath**(**paths*)

Return the absolute path of the joining of the arguments, raising an exception if a file doesn't exist at resulting path

Parameters
***paths** (*[str,...]*) – A list of path elements

synapse.common.**result**(*retn*)

Return a value or raise an exception from a retn tuple.

synapse.common.**retnexc**(*e*)

Construct a retn tuple for the given exception.

synapse.common.**setlogging**(*mlogger*, *defval=None*, *structlog=None*, *log_setup=True*, *datefmt=None*)

Configure synapse logging.

Parameters

- **mlogger** (*logging.Logger*) – Reference to a logging.Logger()
- **defval** (*str*) – Default log level. May be an integer.
- **structlog** (*bool*) – Enabled structured (jsonl) logging output.
- **datefmt** (*str*) – Optional strftime format string.

Notes

This calls logging.basicConfig and should only be called once per process.

Returns
None

synapse.common.**signedint64en**(*i*)

Encode a signed 64-bit int into 8 byte big-endian bytes

synapse.common.**signedint64un**(*b*)

Decode a signed 64-bit int from 8 byte big-endian

synapse.common.**spin**(*genr*)

Crank through a generator but discard the yielded values.

Parameters
genr – Any generator or iterable valu.

Notes

This generator is exhausted via the `collections.dequeue()` constructor with a `maxlen=0`, which will quickly exhaust an iterator staying in C code as much as possible.

Returns
None

synapse.common.**switchext**(**paths*, *ext*)

Return an absolute path of the joining of the arguments with the extension replaced.

If an extension does not exist, it will be added.

Parameters

- ***paths** (*[str,...]*) – A list of path elements
- **ext** (*str*) – A file extension (e.g. '.txt'). It should begin with a period.

synapse.common.**todo**(*_todoname*, **args*, ***kwargs*)

Construct and return a todo tuple of (name, args, kwargs).

Note: the odd name for the first parameter is to avoid collision with keys in kwargs.

synapse.common.**trimText**(*text: str*, *n: int = 256*, *placeholder: str = '...'*) → str

Trim a text string larger than n characters and add a placeholder at the end.

Parameters

- **text** – String to trim.
- **n** – Number of characters to allow.
- **placeholder** – Placeholder text.

Returns
The original string or the trimmed string.

synapse.common.**tuplify**(*obj*)

Convert a nested set of python primitives into tupleized forms via msgpack.

synapse.common.**uhex**(*text*)

Decode a hex string into bytes.

Parameters
text (*str*) – Text to decode.

Returns
The decoded bytes.

Return type
bytes

synapse.common.**unjsonsafe_nodeedits**(*nodeedits*)

synapse.common.**verstr**(*vtup*)

Convert a version tuple to a string.

synapse.common.**vertup**(*vstr*)

Convert a version string to a tuple.

Example

ver = vertup('1.3.30')

async synapse.common.**wait_for**(*fut*, *timeout*)

async synapse.common.**waitgenr**(*genr*, *timeout*)

async synapse.common.**waitretn**(*futu*, *timeout*)

synapse.common.**worker**(*meth*, **args*, ***kwargs*)

synapse.common.**yamldump**(*obj*, *stream: BinaryIO | None = None*) → bytes

Dump a object to yaml.

Parameters

- **obj** – The object to serialize.
- **stream** – The optional stream to write the stream too.

Returns

The raw yaml bytes if stream is not provided.

synapse.common.**yamlload**(**paths*)

synapse.common.**yamlloads**(*data*)

synapse.common.**yamlmod**(*obj*, **paths*)

Combines/creates a yaml file and combines with obj. obj and file must be maps/dict or empty.

synapse.common.**yamlpop**(*key*, **paths*)

Pop a key out of a yaml file.

Parameters

- **key** (*str*) – Name of the key to remove.
- ***paths** – Path to a yaml file. The file must be a map / dictionary.

Returns

None

synapse.common.**yamlsave**(*obj*, **paths*)

10.1.6 synapse.cortex module

class synapse.cortex.**CoreApi**

Bases: *CellApi*

The CoreApi is exposed when connecting to a Cortex over Telepath.

Many CoreApi methods operate on packed nodes consisting of primitive data structures which can be serialized with msgpack/json.

An example of a packaged Node:

```
( (<form>, <valu>), {

    "props": {
        <name>: <valu>,
        ...
    },
    "tags": {
        "foo": <time>,
        "foo.bar": <time>,
    },
})
```

async addFeedData(*name*, *items*, *, *viewiden=None*)

async addForm(*formname*, *basetype*, *typeopts*, *typeinfo*)

Add an extended form to the data model.

Extended forms *must* begin with _

async addFormProp(*form*, *prop*, *tdef*, *info*)

Add an extended property to the given form.

Extended properties *must* begin with _

async addNode(*form*, *valu*, *props=None*)

Deprecated in 2.0.0.

async addNodes(*nodes*)

Add a list of packed nodes to the cortex.

Parameters

nodes (*list*) – [((form, valu), {'props':{}, 'tags':{}}), ...]

Yields

(tuple) – Packed node tuples ((form,valu), {'props': {}, 'tags':{}})

Deprecated in 2.0.0

addStormDmon(*ddef*)

async addStormPkg(*pkgdef*, *verify=False*)

async addTagProp(*name*, *tdef*, *info*)

Add a tag property to record data about tags on nodes.

async addUnivProp(*name*, *tdef*, *info*)

Add an extended universal property.

Extended properties *must* begin with _

addUserNotif(*useriden*, *mesgtype*, *mesgdata=None*)

bumpStormDmon(*iden*)

async callStorm(*text*, *opts=None*)

Return the value expressed in a return() statement within storm.

cloneLayer(*iden*, *ldef=None*)

async count(*text*, *opts=None*)

Count the number of nodes which result from a storm query.

Parameters

- **text** (*str*) – Storm query text.
- **opts** (*dict*) – Storm query options.

Returns
The number of nodes resulting from the query.

Return type
(int)

async delForm(*formname*)

Remove an extended form from the data model.

async delFormProp(*form*, *name*)

Remove an extended property from the given form.

delStormDmon(*iden*)

async delStormPkg(*iden*)

async delTagProp(*name*)

Remove a previously added tag property.

async delUnivProp(*name*)

Remove an extended universal property.

delUserNotif(*indx*)

disableStormDmon(*iden*)

enableStormDmon(*iden*)

async exportStorm(*text*, *opts=None*)

Execute a storm query and package nodes for export/import.

NOTE: This API yields nodes after an initial complete lift
in order to limit exported edges.

async feedFromAxon(*sha256*, *opts=None*)

Import a msgpack .nodes file from the axon.

async getAxonBytes(*sha256*)

async getAxonUpload()

getCoreInfo()

Return static generic information about the cortex including model definition

async getCoreInfoV2()

Return static generic information about the cortex including model definition

getCoreMods()

async getFeedFuncs()

Get a list of Cortex feed functions.

Notes

Each feed dictionary has the name of the feed function, the full docstring for the feed function, and the first line of the docstring broken out in their own keys for easy use.

Returns
A tuple of dictionaries.

Return type
tuple

getHttpExtApiByPath(*path*)

async getModelDefs()

async getModelDict()

Return a dictionary which describes the data model.

Returns
A model description dictionary.

Return type
(dict)

async getPropNorm(*prop*, *valu*, *typeopts=None*)

Get the normalized property value based on the Cortex data model.

Parameters

- **prop** (*str*) – The property to normalize.
- **valu** – The value to normalize.
- **typeopts** – A Synapse type opts dictionary used to further normalize the value.

Returns
A two item tuple, containing the normed value and the info dictionary.

Return type
(tuple)

Raises

- **s_exc.NoSuchProp** – If the prop does not exist.
- **s_exc.BadTypeValu** – If the value fails to normalize.

getStormDmon(*iden*)

getStormDmonLog(*iden*)

getStormDmons()

getStormPkg(*name*)

getStormPkgs()

async getStormVar(*name*, *default=None*)

async getTypeNorm(*name*, *valu*, *typeopts=None*)

Get the normalized type value based on the Cortex data model.

Parameters

- **name** (*str*) – The type to normalize.

- **valu** – The value to normalize.
- **typeopts** – A Synapse type opts dictionary used to further normalize the value.

Returns
A two item tuple, containing the normed value and the info dictionary.

Return type
(tuple)

Raises

- **s_exc.NoSuchType** – If the type does not exist.
- **s_exc.BadTypeValu** – If the value fails to normalize.

getUserNotif(*indx*)

async iterFormRows(*layriden*, *form*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes of a single form, optionally (re)starting at startvalue

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **form** (*str*) – A form name
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async iterPropRows(*layriden*, *form*, *prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular secondary property, optionally (re)starting at startvalue

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **form** (*str*) – A form name.
- **prop** (*str*) – A secondary property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async iterTagPropRows(*layriden*, *tag*, *prop*, *form=None*, *stortype=None*, *startvalu=None*)

Yields (buid, valu) that match a tag:prop, optionally (re)starting at startvalu.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **tag** (*str*) – tag name
- **prop** (*str*) – prop name
- **form** (*Optional[str]*) – optional form name

- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async iterTagRows(*layriden*, *tag*, *form=None*, *starttupl=None*)

Yields (buid, (valu, form)) values that match a tag and optional form, optionally (re)starting at starttupl.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **tag** (*str*) – the tag to match
- **form** (*Optional[str]*) – if present, only yields buids of nodes that match the form.
- **starttupl** (*Optional[Tuple[buid, form]]*) – if present, (re)starts the stream of values there.

Returns
AsyncIterator[Tuple(buid, (valu, form))]

> **Note**
>
> This yields (buid, (tagvalu, form)) instead of just buid, valu in order to allow resuming an interrupted call by feeding the last value retrieved into starttupl

async iterUnivRows(*layriden*, *prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular universal property, optionally (re)starting at startvalue

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **prop** (*str*) – A universal property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

iterUserNotifs(*useriden*, *size=None*)

async popStormVar(*name*, *default=None*)

async reqValidStorm(*text*, *opts=None*)

Parse a Storm query to validate it.

Parameters

- **text** (*str*) – The text of the Storm query to parse.
- **opts** (*dict*) – A Storm options dictionary.

Returns
If the query is valid.

Return type
True

Raises
BadSyntaxError – If the query is invalid.

saveLayerNodeEdits(*layriden*, *edits*, *meta*)

async setStormVar(*name*, *valu*)

async storm(*text*, *opts=None*)

Evaluate a storm query and yield result messages.

Yields
((str,dict)) – Storm messages.

async syncIndexEvents(*matchdef*, *offsdict=None*, *wait=True*)

async syncLayerNodeEdits(*offs*, *layriden=None*, *wait=True*)

Yield (indx, mesg) nodeedit sets for the given layer beginning at offset.

Once caught up, this API will begin yielding nodeedits in real-time. The generator will only terminate on network disconnect or if the consumer falls behind the max window size of 10,000 nodeedit messages.

async syncLayersEvents(*offsdict=None*, *wait=True*)

watchAllUserNotifs(*offs=None*)

class synapse.cortex.**Cortex**

Bases: *OAuthMixin*, *Cell*

A Cortex implements the synapse hypergraph.

The bulk of the Cortex API lives on the Snap() object which can be obtained by calling Cortex.snap() in a with block. This allows callers to manage transaction boundaries explicitly and dramatically increases performance.

async addCoreQueue(*name*, *info*)

async addCronEdits(*iden*, *edits*)

Take a dictionary of edits and apply them to the appointment (cron job)

async addCronJob(*cdef*)

Add a cron job to the cortex. Convenience wrapper around agenda.add

A cron job is a persistently-stored item that causes storm queries to be run in the future. The specification for the times that the queries run can be one-shot or recurring.

Parameters

- **query** (*str*) – The storm query to execute in the future
- **reqs** (*Union[Dict[str, Union[int, List[int]]], List[Dict[...]]]*) – Either a dict of the fixed time fields or a list of such dicts. The keys are in the set ('year', 'month', 'dayofmonth', 'dayofweek', 'hour', 'minute'. The values must be positive integers, except for the key of 'dayofmonth' in which it may also be a negative integer which represents the number of days from the end of the month with -1 representing the last day of the month. All values may also be lists of valid values.
- **incunit** (*Optional[str]*) – A member of the same set as above, with an additional member 'day'. If is None (default), then the appointment is one-shot and will not recur.
- **incvals** (*Union[int, List[int]]*) – A integer or a list of integers of the number of units

Returns (bytes):
An iden that can be used to later modify, query, and delete the job.

Notes

reqs must have fields present or incunit must not be None (or both) The incunit if not None it must be larger in unit size than all the keys in all reqs elements. Non-recurring jobs may also have a req of 'now' which will cause the job to also execute immediately.

async addEdge(*edge*, *edgeinfo*)

async addExtModel(*model*)

Add an extended model definition to a Cortex from the output of getExtModel().

Parameters
model (*dict*) – An extended model dictionary.

Returns
True when the model was added.

Return type
Bool

Raises

- **s_exc.BadFormDef** – If a form exists with a different definition than the provided definition.
- **s_exc.BadPropDef** – If a property, tagprop, or universal property exists with a different definition than the provided definition.
- **s_exc.BadEdgeDef** – If an edge exists with a different definition than the provided definition.

async addFeedData(*name*, *items*, *, *viewiden=None*)

Add data using a feed/parser function.

Parameters

- **name** (*str*) – The name of the feed record format.
- **items** (*list*) – A list of items to ingest.
- **viewiden** (*str*) – The iden of a view to use. If a view is not specified, the default view is used.

async addForm(*formname*, *basetype*, *typeopts*, *typeinfo*)

async addFormProp(*form*, *prop*, *tdef*, *info*)

async addHttpExtApi(*adef*)

async addLayer(*ldef=None*, *nexs=True*)

Add a Layer to the cortex.

Parameters

- **ldef** (*Optional[Dict]*) – layer configuration
- **nexs** (*bool*) – whether to record a nexus transaction (internal use only)

async addLayrPull(*layriden*, *pdef*)

async addLayrPush(*layriden*, *pdef*)

async addNode(*user*, *form*, *valu*, *props=None*)

async addNodeTag(*user*, *iden*, *tag*, *valu=(None, None)*)

Add a tag to a node specified by iden.

Parameters

- **iden** (*str*) – A hex encoded node BUID.
- **tag** (*str*) – A tag string.
- **valu** (*tuple*) – A time interval tuple or (None, None).

async addNodes(*nodedefs*, *view=None*)

Quickly add/modify a list of nodes from node definition tuples. This API is the simplest/fastest way to add nodes, set node props, and add tags to nodes remotely.

Parameters
nodedefs (*list*) – A list of node definition tuples. See below.

A node definition tuple is defined as:

((form, valu), {'props':{}, 'tags':{}})

The "props" or "tags" keys may be omitted.

addRuntLift(*prop*, *func*)

Register a runt lift helper for a given prop.

Parameters

- **prop** (*str*) – Full property name for the prop to register the helper for.
- **func**

Returns
None.

Return type
None

addRuntPropDel(*full*, *func*)

Register a prop set helper for a runt form

addRuntPropSet(*full*, *func*)

Register a prop set helper for a runt form

addStormCmd(*ctor*)

Add a synapse.lib.storm.Cmd class to the cortex.

async addStormDmon(*ddef*)

Add a storm dmon task.

async addStormGraph(*gdef*, *user=None*)

addStormLib(*path*, *ctor*)

async addStormMacro(*mdef*, *user=None*)

async addStormPkg(*pkgdef*, *verify=False*)

Add the given storm package to the cortex.

This will store the package for future use.

async addStormSvc(*sdef*)

Add a registered storm service to the cortex.

async addTagProp(*name*, *tdef*, *info*)

async addType(*typename*, *basetype*, *typeopts*, *typeinfo*)

async addUnivProp(*name*, *tdef*, *info*)

async addUserNotif(*useriden*, *mesgtype*, *mesgdata=None*)

async addVault(*vdef*)

Create a new vault.

Parameters

vdef (*dict*) – The vault to add.

Raises

- *synapse.exc.SchemaViolation* – *vdef* does not conform to the vault schema.
- *synapse.exc.DupName* –
  - Vault already exists for type/scope/owner. - Vault already exists with specified name.
- *synapse.exc.BadArg* –
  - Invalid vault definition provided. - Owner required for unscoped, user, and role vaults. - Vault secrets is not msgpack safe. - Vault configs is not msgpack safe.

Returns: iden of new vault

async addView(*vdef*, *nexs=True*)

async bumpStormDmon(*iden*)

async callStorm(*text*, *opts=None*)

cellapi

alias of *CoreApi*

async cloneLayer(*iden*, *ldef=None*)

Make a copy of a Layer in the cortex.

Parameters

- **iden** (*str*) – Layer iden to clone
- **ldef** (*Optional[Dict]*) – Layer configuration overrides

Note

This should only be called with a reasonably static Cortex due to possible races.

confbase = {'_log_conf': {'description': 'Opaque structure used for logging by spawned processes.', 'hideconf': True, 'type': 'object'}, 'aha:admin': {'description': 'An AHA client certificate CN to register as a local admin user.', 'type': 'string'}, 'aha:leader': {'description': 'The AHA service name to claim as the active instance of a storm service.', 'type': 'string'}, 'aha:name': {'description': 'The name of the cell service in the aha service registry.', 'type': 'string'}, 'aha:network': {'description': 'The AHA service network.', 'type': 'string'}, 'aha:promotable': {'default': True, 'description': 'Set to false to prevent this service from being promoted to leader.', 'type': 'boolean'}, 'aha:provision': {'description': 'The telepath URL of the aha provisioning service.', 'items': {'type': 'string'}, 'type': ['string', 'array']}, 'aha:registry': {'description': 'The telepath URL of the aha service registry.', 'items': {'type': 'string'}, 'type': ['string', 'array']}, 'aha:svcinfo': {'description': 'An AHA svcinfo object. If set, this overrides self discovered Aha service information.', 'hidecmdl': True, 'hidedocs': True, 'properties': {'urlinfo': {'properties': {'host': {'type': 'string'}, 'port': {'type': 'integer'}, 'schema': {'type': 'string'}}, 'required': ('host', 'port', 'scheme'), 'type': 'object'}}, 'required': ('urlinfo',), 'type': 'object'}, 'aha:user': {'description': 'The username of this service when connecting to others.', 'type': 'string'}, 'auth:anon': {'description': 'Allow anonymous telepath access by mapping to the given user name.', 'type': 'string'}, 'auth:conf': {'description': 'Extended configuration to be used by an alternate auth constructor.', 'hideconf': True, 'type': 'object'}, 'auth:ctor': {'description': 'Allow the construction of the cell auth object to be hooked at runtime.', 'hideconf': True, 'type': 'string'}, 'auth:passwd': {'description': 'Set to <passwd> (local only) to bootstrap the root user password.', 'type': 'string'}, 'auth:passwd:policy': {'description': 'Specify password policy/complexity requirements.', 'type': 'object'}, 'backup:dir': {'description': 'A directory outside the service directory where backups will be saved. Defaults to ./backups in the service storage directory.', 'type': 'string'}, 'cell:ctor': {'description': 'An optional python path to the Cell class. Used by stemcell.', 'hideconf': True, 'type': 'string'}, 'cell:guid': {'description': 'An optional hard-coded GUID to store as the permanent GUID for the service.', 'hideconf': True, 'type': 'string'}, 'dmon:listen': {'description': 'A config-driven way to specify the telepath bind URL.', 'type': ['string', 'null']}, 'health:sysctl:checks': {'default': True, 'description': 'Enable sysctl parameter checks and warn if values are not optimal.', 'type': 'boolean'}, 'https:headers': {'description': 'Headers to add to all HTTPS server responses.', 'hidecmdl': True, 'type': 'object'}, 'https:parse:proxy:remoteip': {'default': False, 'description': 'Enable the HTTPS server to parse X-Forwarded-For and X-Real-IP headers to determine requester IP addresses.', 'type': 'boolean'}, 'https:port': {'description': 'A config-driven way to specify the HTTPS port.', 'type': ['integer', 'null']}, 'inaugural': {'description': 'Data used to drive configuration of the service upon first startup.', 'hidedocs': True, 'properties': {'roles': {'items': {'additionalProperties': False, 'properties': {'name': {'pattern': '^(?!all$).+$', 'type': 'string'}, 'rules': {'items': {'items': [{'type': 'boolean'}, {'items': {'type': 'string'}, 'type': 'array'}], 'maxItems': 2, 'minItems': 2, 'type': 'array'}, 'type': 'array'}}, 'required': ['name'], 'type': 'object'}, 'type': 'array'}, 'users': {'items': {'additionalProperties': False, 'properties': {'admin': {'default': False, 'type': 'boolean'}, 'email': {'type': 'string'}, 'name': {'pattern': '^(?!root$).+$', 'type': 'string'}, 'roles': {'items': {'type': 'string'}, 'type': 'array'}, 'rules': {'items': {'items': [{'type': 'boolean'}, {'items': {'type': 'string'}, 'type': 'array'}], 'maxItems': 2, 'minItems': 2, 'type': 'array'}, 'type': 'array'}}, 'required': ['name'], 'type': 'object'}, 'type': 'array'}}, 'type': 'object'}, 'limit:disk:free': {'default': 5, 'description': 'Minimum disk free space percentage before setting the cell read-only.', 'maximum': 100, 'minimum': 0, 'type': ['integer', 'null']}, 'max:users': {'default': 0, 'description': 'Maximum number of users allowed on system, not including root or locked/archived users (0 is no limit).', 'minimum': 0, 'type': 'integer'}, 'mirror':

confdefs = {'axon': {'description': 'A telepath URL for a remote axon.', 'type': 'string'}, 'cron:enable': {'default': True, 'description': 'Deprecated. This option no longer controls cron execution and will be removed in Synapse 3.0.', 'type': 'boolean'}, 'http:proxy': {'description': 'An aiohttp-socks compatible proxy URL to use storm HTTP API.', 'type': 'string'}, 'jsonstor': {'description': 'A telepath URL for a remote jsonstor.', 'type': 'string'}, 'layer:lmdb:map_async': {'default': True, 'description': 'Deprecated. This value is ignored.', 'hidecmdl': True, 'hideconf': True, 'type': 'boolean'}, 'layer:lmdb:max_replay_log': {'default': 10000, 'description': 'Deprecated. This value is ignored.', 'hidecmdl': True, 'hideconf': True, 'type': 'integer'}, 'layers:lockmemory': {'default': False, 'description': 'Should new layers lock memory for performance by default.', 'type': 'boolean'}, 'layers:logedits': {'default': True, 'description': 'Whether nodeedits are logged in each layer.', 'type': 'boolean'}, 'max:nodes': {'description': 'Maximum number of nodes which are allowed to be stored in a Cortex.', 'hidecmdl': True, 'minimum': 1, 'type': 'integer'}, 'modules': {'default': [], 'description': 'Deprecated. A list of module classes to load.', 'type': 'array'}, 'provenance:en': {'default': False, 'description': 'This no longer does anything.', 'hideconf': True, 'type': 'boolean'}, 'storm:interface:scrape': {'default': True, 'description': 'Enable Storm scrape interfaces when using $lib.scrape APIs.', 'type': 'boolean'}, 'storm:interface:search': {'default': True, 'description': 'Enable Storm search interfaces for lookup mode.', 'type': 'boolean'}, 'storm:log': {'default': False, 'description': 'Log storm queries via system logger.', 'type': 'boolean'}, 'storm:log:level': {'default': 'INFO', 'description': 'Logging log level to emit storm logs at.', 'type': ['integer', 'string']}, 'tls:ca:dir': {'description': 'An optional directory of CAs which are added to the TLS CA chain for Storm HTTP API calls.', 'type': 'string'}, 'trigger:enable': {'default': True, 'description': 'Deprecated. This option no longer controls trigger execution and will be removed in Synapse 3.0.', 'type': 'boolean'}}

confirmPropDel(*user*, *prop*, *layriden*)

confirmPropSet(*user*, *prop*, *layriden*)

async coreQueueCull(*name*, *offs*)

async coreQueueGet(*name*, *offs=0*, *cull=True*, *wait=False*)

async coreQueueGets(*name*, *offs=0*, *cull=True*, *wait=False*, *size=None*)

async coreQueuePop(*name*, *offs*)

async coreQueuePuts(*name*, *items*)

async coreQueueSize(*name*)

async count(*text*, *opts=None*)

async delCoreQueue(*name*)

async delCronJob(*iden*)

Delete a cron job

Parameters

iden (*bytes*) – The iden of the cron job to be deleted

async delEdge(*edge*)

async delForm(*formname*)

async delFormProp(*form*, *prop*)

async delHttpExtApi(*iden*)

async delJsonObj(*path*)

async delJsonObjProp(*path*, *prop*)

async delLayer(*iden*)

async delLayrPull(*layriden*, *pulliden*)

async delLayrPush(*layriden*, *pushiden*)

async delNodeTag(*user*, *iden*, *tag*)

Delete a tag from the node specified by iden.

Parameters

- **iden** (*str*) – A hex encoded node BUID.
- **tag** (*str*) – A tag string.

async delStormCmd(*name*)

Remove a previously set pure storm command.

async delStormDmon(*iden*)

Stop and remove a storm dmon.

async delStormGraph(*iden*, *user=None*)

async delStormMacro(*name*, *user=None*)

async delStormPkg(*name*)

async delStormPool()

async delStormSvc(*iden*)

async delTagModel(*tagname*)

Delete all the model specification properties for a tag.

Parameters

tagname (*str*) – The name of the tag.

async delTagProp(*name*)

async delType(*typename*)

async delUnivProp(*prop*)

async delUserNotif(*indx*)

async delVault(*iden*)

Delete a vault.

Parameters

iden (*str*) – Iden of the vault to delete.

Returns: None

async delView(*iden*)

async delViewWithLayer(*iden*)

Delete a Cortex View and its write Layer if not in use by other View stacks.

> **Note**
>
> Any children of the View will have their parent View updated to the deleted View's parent (if present). The deleted View's write Layer will also be removed from any child Views which contain it in their Layer stack. If the Layer is used in Views which are not children of the deleted View, the Layer will be preserved, otherwise it will be deleted as well.

async disableCronJob(*iden*)

Enable a cron job

Parameters

iden (*bytes*) – The iden of the cron job to be changed

async disableStormDmon(*iden*)

async editCronJob(*iden*, *name*, *valu*)

Modify a cron job definition.

async enableCronJob(*iden*)

Enable a cron job

Parameters

iden (*bytes*) – The iden of the cron job to be changed

async enableStormDmon(*iden*)

enterMigrationMode()

async exportStorm(*text*, *opts=None*)

async exportStormToAxon(*text*, *opts=None*)

async feedFromAxon(*sha256*, *opts=None*)

async finiStormPool()

async getAxon()

async getCellApi(*link*, *user*, *path*)

Get an instance of the telepath Client object for a given user, link and path.

Parameters

- **link** (*s_link.Link*) – The link object.
- **user** (*s_auth.User*) – The heavy user object.
- **path** (*str*) – The path requested.

Notes

This defaults to the self.cellapi class. Implementors may override the default class attribute for cellapi to share a different interface.

Returns
The shared object for this cell.

Return type
object

`getCoreInfo()`

This API is deprecated.

`async getCoreInfoV2()`

`getCoreMod(name)`

`getCoreMods()`

`async getCoreQueue(name)`

`getDataModel()`

`async getDeprLocks()`

Return a dictionary of deprecated properties and their lock status.

`async getExtModel()`

Get all extended model properties in the Cortex.

Returns
A dictionary containing forms, form properties, universal properties and tag properties.

Return type
dict

`getFeedFunc(name)`

Get a data ingest function.

`async getFeedFuncs()`

`async getFormCounts()`

Return total form counts for all existing layers

`async getHttpExtApi(iden)`

`async getHttpExtApiByPath(path)`

`async getHttpExtApis()`

`async getJsonObj(path)`

`async getJsonObjProp(path, prop)`

`async getJsonObjs(path)`

`getLayer(iden=None)`

Get a Layer object.

Parameters
iden (*str*) – The layer iden to retrieve.

Returns
A Layer object.

Return type
Layer

async getLayerDef(*iden=None*)

async getLayerDefs()

async getModelDefs()

async getModelDict()

async getNodeByNdef(*ndef*, *view=None*)
Return a single Node() instance by (form,valu) tuple.

async getPropNorm(*prop*, *valu*, *typeopts=None*)
Get the normalized property value based on the Cortex data model.

Parameters

- **prop** (*str*) – The property to normalize.
- **valu** – The value to normalize.
- **typeopts** – A Synapse type opts dictionary used to further normalize the value.

Returns
A two item tuple, containing the normed value and the info dictionary.

Return type
(tuple)

Raises

- **s_exc.NoSuchProp** – If the prop does not exist.
- **s_exc.BadTypeValu** – If the value fails to normalize.

getStormCmd(*name*)

getStormCmds()

async getStormDmon(*iden*)

async getStormDmonLog(*iden*)

async getStormDmons()

async getStormDocs()
Get a struct containing the Storm Types documentation.

Returns
A Dictionary of storm documentation information.

Return type
dict

async getStormGraph(*iden*, *user=None*)

async getStormGraphs(*user=None*)

async getStormIfaces(*name*)

getStormLib(*path*)

getStormMacro(*name*, *user=None*)

async getStormMacros(*user=None*)

async getStormMod(*name*, *reqvers=None*)

async getStormMods()

async getStormPkg(*name*)

async getStormPkgs()

async getStormPool()

async getStormQuery(*text*, *mode='storm'*)

getStormRuntime(*query*, *opts=None*)

getStormSvc(*name*)

getStormSvcPkgs(*iden*)

getStormSvcs()

async getStormVar(*name*, *default=None*)

async getTagModel(*tagname*)

Retrieve the tag model specification for a tag.

Returns
The tag model specification or None.

Return type
(dict)

async getTagPrune(*tagname*)

async getTypeNorm(*name*, *valu*, *typeopts=None*)

Get the normalized type value based on the Cortex data model.

Parameters

- **name** (*str*) – The type to normalize.
- **valu** – The value to normalize.
- **typeopts** – A Synapse type opts dictionary used to further normalize the value.

Returns
A two item tuple, containing the normed value and the info dictionary.

Return type
(tuple)

Raises

- **s_exc.NoSuchType** – If the type does not exist.
- **s_exc.BadTypeValu** – If the value fails to normalize.

async getUserNotif(*indx*)

getVault(*iden*)

Get a vault.

Parameters
iden (*str*) – Iden of the vault to get.

Returns: vault or None

getVaultByName(*name*)

Get a vault by name.

Parameters
name (*str*) – Name of the vault to get.

Returns: vault or None

getVaultByType(*vtype*, *useriden*, *scope=None*)

Get a vault of type *vtype* and scope *scope* for user with *iden*.

This function allows the caller to retrieve a vault of the specified *vtype* by searching for the first available vault that matches the *vtype* and *scope* criteria. The search order for opening vaults is as follows:

- If *scope* is specified, return the vault with *vtype* and *scope*. Return None if such a vault doesn't exist.
- Check 'user' scope for a vault of *vtype*. Continue if non-existent.
- Check 'role' scope for a vault of *vtype*. Continue if non-existent.
- Check 'global' scope for a vault of *vtype*. Continue if non-existent.
- Return None

Parameters

- **vtype** (*str*) – Type of the vault to open.
- **useriden** (*str*) – Iden of user trying to open the vault.
- **scope** (*str|None*) – The vault scope to open.

Raises
synapse.exc.BadArg – Invalid scope specified.

Returns: vault or None if matching vault could not be found.

getView(*iden=None*, *user=None*)

Get a View object.

Parameters
iden (*str*) – The View iden to retrieve.

Returns
A View object.

Return type
View

async getViewDef(*iden*)

async getViewDefs(*deporder=False*)

async **hasJsonObj**(*path*)

async **initServiceActive**()

async **initServicePassive**()

async **initServiceRuntime**()

async **initServiceStorage**()

async **initStormPool**()

isTagValid(*tagname*)

Check if a tag name is valid according to tag model regular expressions.

Returns
True if the tag is valid.

Return type
(bool)

async **itemsStormVar**()

async **iterFormRows**(*layriden*, *form*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes of a single form, optionally (re)starting at startvalu.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **form** (*str*) – A form name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async **iterPropRows**(*layriden*, *form*, *prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular secondary property, optionally (re)starting at startvalu.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **form** (*str*) – A form name.
- **prop** (*str*) – A universal property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async **iterTagPropRows**(*layriden*, *tag*, *prop*, *form=None*, *stortype=None*, *startvalu=None*)

Yields (buid, valu) that match a tag:prop, optionally (re)starting at startvalu.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes

- **tag** (*str*) – tag name
- **prop** (*str*) – prop name
- **form** (*Optional[str]*) – optional form name
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async iterTagRows(*layriden*, *tag*, *form=None*, *starttupl=None*)

Yields (buid, (valu, form)) values that match a tag and optional form, optionally (re)starting at starttupl.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **tag** (*str*) – the tag to match
- **form** (*Optional[str]*) – if present, only yields buids of nodes that match the form.
- **starttupl** (*Optional[Tuple[buid, form]]*) – if present, (re)starts the stream of values there.

Returns
AsyncIterator[Tuple(buid, (valu, form))]

> **Note**
>
> This yields (buid, (tagvalu, form)) instead of just buid, valu in order to allow resuming an interrupted call by feeding the last value retrieved into starttupl

async iterUnivRows(*layriden*, *prop*, *stortype=None*, *startvalu=None*)

Yields buid, valu tuples of nodes with a particular universal property, optionally (re)starting at startvalu.

Parameters

- **layriden** (*str*) – Iden of the layer to retrieve the nodes
- **prop** (*str*) – A universal property name.
- **stortype** (*Optional[int]*) – a STOR_TYPE_* integer representing the type of form:prop
- **startvalu** (*Any*) – The value to start at. May only be not None if stortype is not None.

Returns
AsyncIterator[Tuple(buid, valu)]

async iterUserNotifs(*useriden*, *size=None*)

async killCronTask(*iden*)

layerapi
alias of *LayerApi*

async classmethod layrctor(**args*, ***kwargs*)

async listCoreQueues()

async listCronJobs()

Get information about all the cron jobs accessible to the current user

listLayers()

async listTagModel()

Retrieve a list of the tag model specifications.

Returns
A list of tag model specification tuples.

Return type
([(str, dict), ...])

listVaults()

List all vaults.

Args: None

Raises: None

Yields: tuples of vault info: (<iden>, <name>, <type>, <scope>).

listViews()

async loadCoreModule(*ctor*, *conf=None*)

Load a single cortex module with the given ctor and conf.

Parameters

- **ctor** (*str*) – The python module class path
- **conf** (*dict*) – Config dictionary for the module

loadStormPkg(*pkgdef*)

Load a storm package into the storm library for this cortex.

NOTE: This will *not* persist the package (allowing service dynamism).

async modHttpExtApi(*iden*, *name*, *valu*)

async modStormGraph(*iden*, *info*, *user=None*)

async modStormMacro(*name*, *info*, *user=None*)

async moveCronJob(*useriden*, *croniden*, *viewiden*)

async nodes(*text*, *opts=None*)

A simple non-streaming way to return a list of nodes.

async popStormVar(*name*, *default=None*)

async popTagModel(*tagname*, *name*)

Pop a property from the model specification of a tag.

Parameters

- **tagname** (*str*) – The name of the tag.
- **name** (*str*) – The name of the specification property.

Returns
The current value of the property.

Return type
(object)

async renameVault(*iden*, *name*)

Rename a vault.

Parameters

- **iden** (*str*) – Iden of the vault to rename.
- **name** (*str*) – New vault name.

Raises

- ***synapse.exc.NoSuchIden*** – Vault with *iden* does not exist.
- ***synapse.exc.DupName*** – Vault with *name* already exists.

Returns: Updated vault.

async replaceVaultConfigs(*iden*, *valu*)

Replace the entire vault config.

Parameters

- **iden** (*str*) – The iden of the vault to edit.
- **valu** (*str*) – New configs object to store on the vault.

Raises

- ***synapse.exc.BadArg*** – *valu* is not a dictionary.
- ***synapse.exc.NoSuchIden*** – Vault with *iden* does not exist.
- ***synapse.exc.NotMsgpackSafe*** – *valu* is not msgpack safe.

Returns: New configs.

async replaceVaultSecrets(*iden*, *valu*)

Replace the entire vault config.

Parameters

- **iden** (*str*) – The iden of the vault to edit.
- **valu** (*str*) – New secrets object to store on the vault.

Raises

- ***synapse.exc.BadArg*** – *valu* is not a dictionary.
- ***synapse.exc.NoSuchIden*** – Vault with *iden* does not exist.
- ***synapse.exc.NotMsgpackSafe*** – *valu* is not msgpack safe.

Returns: New secrets.

reqExtProp(*form*, *prop*)

reqExtTagProp(*name*)

reqExtUniv(*prop*)

reqLayer(*iden=None*)

reqStormMacro(*name*, *user=None*)

async reqValidStorm(*text*, *opts=None*)

Parse a storm query to validate it.

Parameters

- **text** (*str*) – The text of the Storm query to parse.
- **opts** (*dict*) – A Storm options dictionary.

Returns

If the query is valid.

Return type

True

Raises

BadSyntaxError – If the query is invalid.

async reqValidStormGraph(*gdef*)

reqVault(*iden*)

Get a vault by iden.

Parameters

iden (*str*) – Iden of the vault to get.

Raises

synapse.exc.NoSuchIden – Vault with *iden* not found.

Returns: vault

reqVaultByName(*name*)

Get a vault by name.

Parameters

name (*str*) – Name of the vault to get.

Raises

synapse.exc.NoSuchName – Vault with *name* not found.

Returns: vault

reqVaultByType(*vtype*, *iden*, *scope=None*)

Get a vault by type.

Parameters

- **vtype** (*str*) – Type of the vault to get.
- **iden** (*str*) – Iden of the user or role for the vault type.
- **scope** (*str|None*) – Scope of the vault to get.

Raises

synapse.exc.NoSuchName – Vault with *vtype/iden/scope* not found.

Returns: vault

reqView(*iden*, *mesg=None*)

async runLayrPull(*layr*, *pdef*)

async runLayrPush(*layr*, *pdef*)

async runRuntLift(*full*, *valu=None*, *cmpr=None*, *view=None*)

Execute a runt lift function.

Parameters

- **full** (*str*) – Property to lift by.
- **valu**
- **cmpr**

Returns

Yields bytes, list tuples where the list contains a series of
key/value pairs which are used to construct a Node object.

Return type
bytes, list

async runRuntPropDel(*node*, *prop*)

async runRuntPropSet(*node*, *prop*, *valu*)

async runStormDmon(*iden*, *ddef*)

async runStormSvcEvent(*iden*, *name*)

async saveLayerNodeEdits(*layriden*, *edits*, *meta*)

async setDeprLock(*name*, *locked*)

setFeedFunc(*name*, *func*)

Set a data ingest function.

def func(snap, items):
loaditems…

async setHttpApiIndx(*iden*, *indx*)

async setJsonObj(*path*, *item*)

async setJsonObjProp(*path*, *prop*, *item*)

async setPropLocked(*name*, *locked*)

async setStormCmd(*cdef*)

async setStormGraphPerm(*gden*, *scope*, *iden*, *level*, *user=None*)

async setStormMacroPerm(*name*, *scope*, *iden*, *level*, *user=None*)

async setStormPool(*url*, *opts*)

async setStormSvcEvents(*iden*, *edef*)

Set the event callbacks for a storm service. Extends the sdef dict.

Parameters

- **iden** (*str*) – The service iden.
- **edef** (*dict*) – The events definition.

Notes

The edef is formatted like the following:

```
{
    <name> : {
        'storm': <storm>
    }
}
```

where name is one of the following items:

add

Run the given storm ‘*before* the service is first added (a la service.add), but not on a reconnect.

del

Run the given storm *after* the service is removed (a la service.del), but not on a disconnect.

Returns
An updated storm service definition dictionary.

Return type
dict

async setStormVar(*name*, *valu*)

async setTagModel(*tagname*, *name*, *valu*)

Set a model specification property for a tag.

Parameters

- **tagname** (*str*) – The name of the tag.
- **name** (*str*) – The name of the property.
- **valu** (*object*) – The value of the property.

Tag Model Properties:
regex - A list of None or regular expression strings to match each tag level. prune - A number that determines how many levels of pruning are desired.

Examples

await core.setTagModel(“cno.cve”, “regex”, (None, None, “[0-9]{4}”, “[0-9]{5}”))

async setTagPropLocked(*name*, *locked*)

async setUnivLocked(*name*, *locked*)

async setUserLocked(*iden*, *locked*)

async setVaultConfigs(*iden*, *key*, *valu*)

Set vault config item.

This function sets the *key*:*valu* into the vault configs.

Parameters

- **iden** (*str*) – The iden of the vault to edit.
- **key** (*str*) – Vault secret key.

- **valu** (*str*) – Vault secret value. s_common.novalu to delete a key.

Raises

- ***synapse.exc.NoSuchIden*** – Vault with *iden* does not exist.
- ***synapse.exc.NotMsgpackSafe*** – One of *key* or *valu* is not msgpack safe.

Returns: Updated vault.

async setVaultPerm(*viden*, *iden*, *level*)

Set vault permissions. :param viden: The iden of the vault to edit. :type viden: str :param iden: Iden of the user/role to add permissions for. :type iden: str :param level: Easy perms level. :type level: int

Raises

synapse.exc.NoSuchIden – Vault with *iden* does not exist.

Returns: Updated vault.

async setVaultSecrets(*iden*, *key*, *valu*)

Set vault secret item.

This function sets the *key*:*valu* into the vault secrets.

Parameters

- **iden** (*str*) – The iden of the vault to edit.
- **key** (*str*) – Vault secret key.
- **valu** (*str*) – Vault secret value. s_common.novalu to delete a key.

Raises

- ***synapse.exc.NoSuchIden*** – Vault with *iden* does not exist.
- ***synapse.exc.NotMsgpackSafe*** – One of *key* or *valu* is not msgpack safe.

Returns: Updated vault.

async setViewLayers(*layers*, *iden=None*)

Parameters

- **layers** (*[str]*) – A top-down list of of layer guids
- **iden** (*str*) – The view iden (defaults to default view).

async snap(*user=None*, *view=None*)

Return a transaction object for the default view.

Parameters

- **user** (*str*) – The user to get the snap for.
- **view** (View) – View object to use when making the snap.

Notes

This must be used as an asynchronous context manager.

Returns

A Snap object for the view.

Return type

s_snap.Snap

async storm(*text*, *opts=None*)

async stormlist(*text*, *opts=None*)

async swapLayer(*oldiden*, *newiden*)

Atomically swap out a layer from all views that contain it.

async syncIndexEvents(*matchdef*, *offsdict=None*, *wait=True*)

Yield (offs, layriden, <STYPE>, <item>) tuples from the nodeedit logs of all layers starting from the given nexus/layer offset (they are synchronized). Only edits that match the filter in matchdef will be yielded, plus EDIT_PROGRESS (see layer.syncIndexEvents) messages.

The format of the 4th element of the tuple depends on STYPE. STYPE is one of the following constants:

SYNC_LAYR_ADD: item is an empty tuple () SYNC_LAYR_DEL: item is an empty tuple () SYNC_NODEEDIT: item is (buid, form, ETYPE, VALS, META)) or (None, None, s_layer.EDIT_PROGRESS, (), ())

For edits in the past, events are yielded in offset order across all layers. For current data (wait=True), events across different layers may be emitted slightly out of offset order.

Note

Will not yield any values from layers created with logedits disabled

Parameters

- **matchdef** (*Dict[str, Sequence[str]]*) – a dict describing which events are yielded. See layer.syncIndexEvents for matchdef specification.
- **offsdict** (*Optional(Dict[str,int])*) – starting nexus/editlog offset by layer iden. Defaults to 0 for unspecified layers or if offsdict is None.
- **wait** (*bool*) – whether to pend and stream value until this layer is fini'd

async syncLayerNodeEdits(*iden*, *offs*, *wait=True*)

Yield (offs, mesg) tuples for nodeedits in a layer.

async syncLayersEvents(*offsdict=None*, *wait=True*)

Yield (offs, layriden, STYP, item, meta) tuples for nodeedits for *all* layers, interspersed with add/del layer messages.

STYP is one of the following constants:

SYNC_NODEEDITS: item is a nodeedits (buid, form, edits) SYNC_LAYR_ADD: A layer was added (item and meta are empty) SYNC_LAYR_DEL: A layer was deleted (item and meta are empty)

Parameters

- **offsdict** (*Optional(Dict[str,int])*) – starting nexus/editlog offset by layer iden. Defaults to 0 for unspecified layers or if offsdict is None.
- **wait** (*bool*) – whether to pend and stream value until this layer is fini'd

async updateCronJob(*iden*, *query*)

Change an existing cron job's query

Parameters

iden (*bytes*) – The iden of the cron job to be changed

async **verifyStormPkgDeps**(*pkgdef*)

viewapi

alias of *ViewApi*

async classmethod **viewctor**(**args*, ***kwargs*)

async **waitStormSvc**(*name*, *timeout=None*)

async **watchAllUserNotifs**(*offs=None*)

class synapse.cortex.**CortexAxonHttpBySha256InvalidV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *CortexAxonMixin*, *AxonHttpBySha256InvalidV1*

class synapse.cortex.**CortexAxonHttpBySha256V1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *CortexAxonMixin*, *AxonHttpBySha256V1*

class synapse.cortex.**CortexAxonHttpDelV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *CortexAxonMixin*, *AxonHttpDelV1*

class synapse.cortex.**CortexAxonHttpHasV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *CortexAxonMixin*, *AxonHttpHasV1*

class synapse.cortex.**CortexAxonHttpUploadV1**(*application: Application*, *request: HTTPServerRequest*, ***kwargs: Any*)

Bases: *CortexAxonMixin*, *AxonHttpUploadV1*

class synapse.cortex.**CortexAxonMixin**

Bases: object

getAxon()

async **getAxonInfo**()

async **prepare**()

synapse.cortex.**cmprkey_buid**(*x*)

synapse.cortex.**cmprkey_indx**(*x*)

synapse.cortex.**getTempCortex**(*mods=None*)

Get a proxy to a cortex backed by a temporary directory.

Parameters

mods (*list*) – A list of modules which are loaded into the cortex.

Notes

The cortex and temporary directory are town down on exit. This should only be called from synchronous code.

Returns

Proxy to the cortex.

synapse.cortex.**stormlogger = <Logger synapse.storm (WARNING)>**

A Cortex implements the synapse hypergraph object.

async synapse.cortex.**wrap_liftgenr**(*iden*, *genr*)

10.1.7 synapse.cryotank module

class synapse.cryotank.**CryoApi**

Bases: *CellApi*

The CryoCell API as seen by a telepath proxy.

This is the API to reference for remote CryoCell use.

delete(*name*)

async init(*name*, *conf=None*)

async last(*name*)

async list()

async metrics(*name*, *offs*, *size=None*)

async puts(*name*, *items*)

async rows(*name*, *offs*, *size*)

async slice(*name*, *offs*, *size=None*, *wait=False*, *timeout=None*)

class synapse.cryotank.**CryoCell**

Bases: *Cell*

cellapi

alias of *CryoApi*

async delete(*name*)

async getCellApi(*link*, *user*, *path*)

Get an instance of the telepath Client object for a given user, link and path.

Parameters

- **link** (*s_link.Link*) – The link object.
- **user** (*s_auth.User*) – The heavy user object.
- **path** (*str*) – The path requested.

Notes

This defaults to the self.cellapi class. Implementors may override the default class attribute for cellapi to share a different interface.

Returns
The shared object for this cell.

Return type
object

classmethod getEnvPrefix()

Get a list of envar prefixes for config resolution.

async **init**(*name*, *conf=None*, *user=None*)

Generate a new CryoTank with a given name or get a reference to an existing CryoTank.

Parameters

- **name** (*str*) – Name of the CryoTank.
- **user** (User) – The Telepath user.

Returns
A CryoTank instance.

Return type
CryoTank

async **initServiceStorage**()

async **list**(*user=None*)

Get a list of (name, info) tuples for the CryoTanks.

Returns
A list of tufos. user (User): The Telepath user.

Return type
list

tankapi

alias of *TankApi*

class synapse.cryotank.**CryoTank**

Bases: *Base*

A CryoTank implements a stream of structured data.

iden()

async **info**()

Returns information about the CryoTank instance.

Returns
A dict containing items and metrics indexes.

Return type
dict

last()

Return an (offset, item) tuple for the last element in the tank (or None).

async **metrics**(*offs*, *size=None*)

Yield metrics rows starting at offset.

Parameters

- **offs** (*int*) – The index offset.
- **size** (*int*) – The maximum number of records to yield.

Yields
((int, dict)) – An index offset, info tuple for metrics.

async puts(*items*)

Add the structured data from items to the CryoTank.

Parameters
items (*list*) – A list of objects to store in the CryoTank.

Returns
The ending offset of the items or seqn.

Return type
int

async rows(*offs*, *size=None*)

Yield a number of raw items from the CryoTank starting at a given offset.

Parameters

- **offs** (*int*) – The index of the desired datum (starts at 0)
- **size** (*int*) – The max number of items to yield.

Yields
((indx, bytes)) – Index and msgpacked bytes.

async slice(*offs*, *size=None*, *wait=False*, *timeout=None*)

Yield a number of items from the CryoTank starting at a given offset.

Parameters

- **offs** (*int*) – The index of the desired datum (starts at 0)
- **size** (*int*) – The max number of items to yield.
- **wait** (*bool*) – Once caught up, yield new results in realtime
- **timeout** (*int*) – Max time to wait for a new item.

Yields
((index, object)) – Index and item values.

class synapse.cryotank.**TankApi**

Bases: *CellApi*

async iden()

async metrics(*offs*, *size=None*)

async puts(*items*)

async slice(*offs*, *size=None*, *wait=False*, *timeout=None*)

10.1.8 synapse.daemon module

class synapse.daemon.**AsyncGenr**

Bases: *Share*

typename = 'genr'

class synapse.daemon.**Daemon**

Bases: *Base*

async getSessInfo()

async listen(*url*, ***opts*)

Bind and listen on the given host/port with possible SSL.

Parameters

- **host** (*str*) – A hostname or IP address.
- **port** (*int*) – The TCP port to bind.

async setReady(*ready*)

share(*name*, *item*)

Share an object via the telepath protocol.

Parameters

- **name** (*str*) – Name of the shared object
- **item** (*object*) – The object to share over telepath.

class synapse.daemon.**Genr**

Bases: *Share*

typename = 'genr'

class synapse.daemon.**Sess**

Bases: *Base*

getSessItem(*name*)

pack()

popSessItem(*name*)

setSessItem(*name*, *item*)

async synapse.daemon.**t2call**(*link*, *meth*, *args*, *kwargs*)

Call the given `meth(*args, **kwargs)` and handle the response to provide telepath task v2 events to the given link.

10.1.9 synapse.datamodel module

An API to assist with the creation and enforcement of cortex data models.

class synapse.datamodel.**Edge**(*modl*, *edgetype*, *edgeinfo*)

Bases: `object`

pack()

class synapse.datamodel.**Form**(*modl*, *name*, *info*)

Bases: `object`

The Form class implements data model logic for a node form.

delProp(*name*)

getFormDef()

getRefsOut()

getStorNode(*form*)

offAdd(*func*)

Unregister a callback for tag addition.

Parameters

- **name** (*str*) – The name of the tag.
- **func** (*function*) – The callback func(node)

onAdd(*func*)

Add a callback for adding this type of node.

The callback is executed after node construction.

Parameters
func (*function*) – A callback func(node)

def func(xact, node):
dostuff()

onDel(*func*)

pack()

prop(*name: str*)

Return a secondary property for this form by relative prop name.

Parameters
name (*str*) – The relative property name.

Returns
The property or None.

Return type
(*synapse.datamodel.Prop*)

reqProp(*name*, *extra=None*)

setProp(*name*, *prop*)

async wasAdded(*node*)

Fire the onAdd() callbacks for node creation.

async wasDeleted(*node*)

Fire the onDel() callbacks for node deletion.

class synapse.datamodel.**Model**(*core=None*)

Bases: object

The data model used by a Cortex hypergraph.

addBaseType(*item*)

Add a Type instance to the data model.

addDataModels(*mods*)

Add a list of (name, mdef) tuples.

A model definition (mdef) is structured as follows:

```
{
    "ctors":(
        ('name', 'class.path.ctor', {}, {'doc': 'The foo thing.'}),
    ),

    "types":(
        ('name', ('basetype', {typeopts}), {info}),
    ),

    "forms":(
        (formname, (typename, typeopts), {info}, (
            (propname, (typename, typeopts), {info}),
        )),
    ),
    "univs":(
        (propname, (typename, typeopts), {info}),
    )
    "tagprops":(
        (tagpropname, (typename, typeopts), {info}),
    )
    "interfaces":(
        (ifacename, {
            'props': ((propname, (typename, typeopts), {info}),),
            'doc': docstr,
            'interfaces': (ifacename,)
        }),
    )
}
```

Parameters
mods (*list*) – The list of tuples.

Returns
None

addEdge(*edgetype*, *edgeinfo*)

addForm(*formname*, *forminfo*, *propdefs*, *checks=True*)

addFormProp(*formname*, *propname*, *tdef*, *info*)

addIface(*name*, *info*)

addTagProp(*name*, *tdef*, *info*)

addType(*typename*, *basename*, *typeopts*, *typeinfo*)

addUnivProp(*name*, *tdef*, *info*)

delEdge(*edgetype*)

delForm(*formname*)

delFormProp(*formname*, *propname*)

delTagProp(*name*)

delType(*typename*)

delUnivProp(*propname*)

edge(*edgetype*)

form(*name*)

getAllUnivs(*name*)

getArrayPropsByType(*name*)

getFormsByPrefix(*prefix*)

getModelDefs()

Returns
A list of one model definition compatible with addDataModels that represents the current data model

getModelDict()

getProps()

getPropsByType(*name*)

getTagProp(*name*)

getTypeClone(*typedef*)

prop(*name*)

reqForm(*name*)

reqFormsByLook(*name*, *extra=None*)

reqFormsByPrefix(*prefix*, *extra=None*)

reqProp(*name*, *extra=None*)

reqPropsByLook(*name*, *extra=None*)

reqTagProp(*name*)

reqUniv(*name*)

tagprop(*name*)

type(*name*)
Return a synapse.lib.types.Type by name.

univ(*name*)

class synapse.datamodel.**Prop**(*modl*, *form*, *name*, *typedef*, *info*)
Bases: object

The Prop class represents a property defined within the data model.

getAlts()

Return a list of Prop instances that are considered alternative locations for our property value, including self.

getCompOffs()

Return the offset of this field within the compound primary prop or None.

getPropDef()

getStorNode(*form*)

onDel(*func*)

Add a callback for deleting this property.

The callback is executed after the property is deleted.

Parameters
func (*function*) – A prop del callback.

The callback is called within the current transaction, with the node, and the old property value (or None).

def func(node, oldv):
dostuff()

onSet(*func*)

Add a callback for setting this property.

The callback is executed after the property is set.

Parameters
func (*function*) – A prop set callback.

The callback is called within the current transaction, with the node, and the old property value (or None).

def func(node, oldv):
dostuff()

pack()

async wasDel(*node*, *oldv*)

async wasSet(*node*, *oldv*)

Fire the onset() handlers for this property.

Parameters

- **node** (synapse.lib.node.Node) – The node whose property was set.
- **oldv** (*obj*) – The previous value of the property.

class synapse.datamodel.**TagProp**(*model*, *name*, *tdef*, *info*)

Bases: object

getStorNode(*form*)

getTagPropDef()

pack()

10.1.10 synapse.exc module

Exceptions used by synapse, all inheriting from SynErr

exception synapse.exc.**AuthDeny**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BackupAlreadyRunning**(**args*, ***info*)

Bases: *SynErr*

Only one backup may be running at a time

exception synapse.exc.**BadArg**(**args*, ***info*)

Bases: *SynErr*

Improper function arguments

exception synapse.exc.**BadCast**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadCertBytes**(**args*, ***info*)

Bases: *SynErr*

Raised by certdir when the certificate fails to load.

exception synapse.exc.**BadCertHost**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadCertVerify**(**args*, ***info*)

Bases: *SynErr*

Raised by certdir when there is a failure to verify a certificate context.

exception synapse.exc.**BadCmdName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadCmprType**(**args*, ***info*)

Bases: *SynErr*

Attempt to compare two incomparable values

exception synapse.exc.**BadCmprValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadConfValu**(**args*, ***info*)

Bases: *SynErr*

The configuration value provided is not valid.

This should contain the config name, valu and mesg.

exception synapse.exc.**BadCoreStore**(**args*, ***info*)

Bases: *SynErr*

The storage layer has encountered an error

exception synapse.exc.**BadCtorType**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadDataValu**(**args*, ***info*)

Bases: *SynErr*

Cannot process the data as intended.

exception synapse.exc.**BadEccExchange**(**args*, ***info*)

Bases: *CryptoErr*

Raised when there is an issue doing a ECC Key Exchange

exception synapse.exc.**BadEdgeDef**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadFileExt**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadFormDef**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadHivePath**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadIndxValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadJsonText**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadLiftValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadMesgFormat**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadMesgVers**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadOperArg**(**args*, ***info*)

Bases: *SynErr*

Improper storm function arguments

exception synapse.exc.**BadOptValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadPkgDef**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadPropDef**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadState**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadStorageVersion**(**args*, ***info*)

Bases: *SynErr*

Stored persistent data is incompatible with running software

exception synapse.exc.**BadSyntax**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadTag**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadTime**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadTypeDef**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadTypeValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadUrl**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**BadVersion**(**args*, ***info*)

Bases: *SynErr*

Generic Bad Version exception.

exception synapse.exc.**CantDelCmd**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelForm**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelNode**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelProp**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelType**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelUniv**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantDelView**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantMergeView**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CantRevLayer**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**CliFini**(**args*, ***info*)

Bases: *SynErr*

Raised when the CLI is to exit.

exception synapse.exc.**CryptoErr**(**args*, ***info*)

Bases: *SynErr*

Raised when there is a synapse.lib.crypto error.

exception synapse.exc.**DataAlreadyExists**(**args*, ***info*)

Bases: *SynErr*

Cannot copy data to a location that already contains data

exception synapse.exc.**DbOutOfSpace**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DmonSpawn**(**args*, ***info*)

Bases: *SynErr*

Raised by a dispatched telepath method that has answered the call using a spawned process. (control flow that is compatible with aborting standard calls, generators, and async generators).

exception synapse.exc.**DupEdgeType**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*edge*, *mesg=None*)

exception synapse.exc.**DupFileName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupFormName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupIden**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupIndx**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupPropName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupRoleName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupStormSvc**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupTagPropName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**DupTypeName**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*name*, *mesg=None*)

exception synapse.exc.**DupUserName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**FatalErr**(**args*, ***info*)

Bases: *SynErr*

Raised when a fatal error has occurred which an application cannot recover from.

exception synapse.exc.**FeatureNotSupported**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**FileExists**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**HitLimit**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**InconsistentStorage**(**args*, ***info*)

Bases: *SynErr*

Stored persistent data is inconsistent

exception synapse.exc.**IsDeprLocked**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**IsFini**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**IsReadOnly**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**IsRuntForm**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**LayerInUse**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**LinkBadCert**(**args*, ***info*)

Bases: *LinkErr*

exception synapse.exc.**LinkErr**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**LinkShutDown**(**args*, ***info*)

Bases: *LinkErr*

exception synapse.exc.**LmdbLock**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**LowSpace**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**ModAlreadyLoaded**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**MustBeJsonSafe**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NeedConfValu**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoCertKey**(**args*, ***info*)

Bases: *SynErr*

Raised when a Cert object requires a RSA Private Key to perform an operation and the key is not present.

exception synapse.exc.**NoSuchAbrv**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchAct**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchAuthGate**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchCert**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchCmd**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchCmpr**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchCond**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchCtor**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchDecoder**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchDir**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchDyn**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchEdge**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*edge*, *mesg=None*)

exception synapse.exc.**NoSuchEncoder**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchFile**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchForm**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*name*, *mesg=None*)

exception synapse.exc.**NoSuchFunc**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchIden**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchImpl**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchIndx**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchLayer**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchLift**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchMeth**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*name*, *item*)

exception synapse.exc.**NoSuchName**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchObj**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchOpt**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchPath**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchPivot**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchPkg**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchProp**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*name*, *mesg=None*)

exception synapse.exc.**NoSuchRole**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchStormSvc**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchTagProp**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchType**(**args*, ***info*)

Bases: *SynErr*

classmethod init(*name*, *mesg=None*)

exception synapse.exc.**NoSuchUniv**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchUser**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchVar**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NoSuchView**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NotANumberCompared**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NotMsgpackSafe**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**NotReady**(**args*, ***info*)

Bases: *Retry*

exception synapse.exc.**ParserExit**(**args*, ***info*)

Bases: *SynErr*

Raised by synapse.lib.cmd.Parser on Parser exit()

exception synapse.exc.**PathExists**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**ReadOnlyLayer**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**ReadOnlyProp**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**RecursionLimitHit**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**Retry**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**SchemaViolation**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**ShuttingDown**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**SlabAlreadyOpen**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**SlabInUse**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**SpawnExit**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**StepTimeout**(**args*, ***info*)

Bases: *SynErr*

Raised when a TestStep.wait() call times out.

exception synapse.exc.**StormPkgConflicts**(**args*, ***info*)

Bases: *SynErr*

exception synapse.exc.**StormPkgRequires**(**args*, ***info*)
Bases: *SynErr*

exception synapse.exc.**StormRaise**(**args*, ***info*)
Bases: *SynErr*

This represents a user provided exception raised in the Storm runtime. It requires a errname key.

exception synapse.exc.**StormRuntimeError**(**args*, ***info*)
Bases: *SynErr*

exception synapse.exc.**StormVarListError**(**args*, ***info*)
Bases: *StormRuntimeError*

exception synapse.exc.**SynErr**(**args*, ***info*)
Bases: Exception

get(*name*, *defv=None*)
Return a value from the errinfo dict.

Example

try:
foothing()

except SynErr as e:
blah = e.get('blah')

items()

set(*name*, *valu*)
Set a value in the errinfo dict.

setdefault(*name*, *valu*)
Set a value in errinfo dict if it is not already set.

update(*items: dict*)
Update multiple items in the errinfo dict at once.

exception synapse.exc.**TimeOut**(**args*, ***info*)
Bases: *SynErr*

exception synapse.exc.**TypeMismatch**(**args*, ***info*)
Bases: *SynErr*

synapse.exc.**reprexc**(*e*)

10.1.11 synapse.glob module

synapse.glob.**iAmLoop**()

synapse.glob.**initloop**()

synapse.glob.**setGreedCoro**(*loop: AbstractEventLoop*)

synapse.glob.**sync**(*coro*, *timeout=None*)
Schedule a coroutine to run on the global loop and return it's result.

Parameters
coro (*coroutine*) – The coroutine instance.

Notes

This API is thread safe and should only be called by non-loop threads.

synapse.glob.**synchelp**(*f*)

The synchelp decorator allows the transparent execution of a coroutine using the global loop from a thread other than the event loop. In both use cases, the actual work is done by the global event loop.

Examples

Use as a decorator:

```
@s_glob.synchelp
async def stuff(x, y):
    await dostuff()
```

Calling the stuff function as regular async code using the standard await syntax:

```
valu = await stuff(x, y)
```

Calling the stuff function as regular sync code outside of the event loop thread:

```
valu = stuff(x, y)
```

10.1.12 synapse.mindmeld module

10.1.13 synapse.telepath module

An RMI framework for synapse.

class synapse.telepath.**Aware**

Bases: object

The telepath.Aware mixin allows shared objects to handle individual links managed by the Daemon.

async getTeleApi(*link*, *mesg*, *path*)

Return a shared object for this link. :param link: A network link. :type link: synapse.lib.link.Link :param mesg: The tele:syn handshake message. :type mesg: (str,dict)

async getTeleFeats()

onTeleShare(*dmon*, *name*)

class synapse.telepath.**Client**

Bases: *Base*

A Telepath client object which reconnects and allows waiting for link up.

Notes

The conf data allows changing parameters such as timeouts, retry period, and link pool size. The default conf data can be seen below:

```
conf = {
    'timeout': 10,
    'retrysleep': 0.2,
    'link_poolsize': 4,
}
```

async offlink(*func*)

async onlink(*func*)

async proxy(*timeout=10*)

setBootUrls(*urlinfo*)

async task(*todo*, *name=None*)

async waitready(*timeout=10*)

class synapse.telepath.ClientV2

Bases: *Base*

A telepath client which:

- connects to multiple services
- distributes API calls across them
- receives topology updates from AHA

NOTE: This must co-exist with Client until we eliminate uses that
attempt to call telepath APIs directly from the Client rather than awaiting a proxy()

getNextBootUrl()

async proxy(*timeout=None*)

setBootUrls(*urlinfo*)

size()

async waitready(*timeout=None*)

class synapse.telepath.Genr

Bases: *Share*

class synapse.telepath.GenrIter(*proxy*, *todo*, *share*)

Bases: object

An object to help delay a telepath call until iteration.

async list()

class synapse.telepath.GenrMethod(*proxy*, *name*, *share=None*)

Bases: *Method*

class synapse.telepath.Method(*proxy*, *name*, *share=None*)

Bases: object

The telepath Method is used to provide proxy method calls.

class synapse.telepath.Pipeline

Bases: *Base*

class synapse.telepath.Proxy

Bases: *Base*

A telepath Proxy is used to call remote APIs on a shared object.

Example

import synapse.telepath as s_telepath

open the "foo" object shared in a dmon on localhost:3344

async def doFooThing():

    proxy = await s_telepath.openurl('tcp://127.0.0.1:3344/foo')

    valu = await proxy.getFooValu(x, y)

The proxy (and openurl function) may also be used from sync code:

    proxy = s_telepath.openurl('tcp://127.0.0.1:3344/foo')

    valu = proxy.getFooValu(x, y)

async call(*methname*, **args*, ***kwargs*)

Call a remote method by name.

Parameters

- **methname** (*str*) – The name of the remote method.
- ***args** – Arguments to the method call.
- ****kwargs** – Keyword arguments to the method call.

Most use cases will likely use the proxy methods directly:

The following two are effectively the same:

valu = proxy.getFooBar(x, y) valu = proxy.call('getFooBar', x, y)

async getPipeline(*genr*, *name=None*)

Construct a proxy API call pipeline in order to make multiple telepath API calls while minimizing round trips.

Parameters

- **genr** (*async generator*) – An async generator that yields todo tuples.
- **name** (*str*) – The name of the shared object on the daemon.

Example

def genr():
    yield s_common.todo('getFooByBar', 10) yield s_common.todo('getFooByBar', 20)

for retn in proxy.getPipeline(genr()):
    valu = s_common.result(retn)

async getPoolLink()

async handshake(*auth=None*)

async task(*todo*, *name=None*)

async taskv2(*todo*, *name=None*)

class synapse.telepath.**Share**

Bases: *Base*

The telepath client side of a dynamically shared object.

class synapse.telepath.**Task**

Bases: object

A telepath Task is used to internally track calls/responses.

reply(*retn*)

async result()

class synapse.telepath.**TeleSSLObject**(**args*, ***kwargs*)

Bases: SSLObject

do_handshake()

Start the SSL/TLS handshake.

async synapse.telepath.**addAhaUrl**(*url*)

Add (incref) an aha registry URL.

NOTE: You may also add a list of redundant URLs.

synapse.telepath.**alias**(*name*)

Resolve a telepath alias via ~/.syn/aliases.yaml

Parameters

name (*str*) – Name of the alias to resolve.

Notes

An exact match against the aliases will always be returned first. If no exact match is found and the name contains a '/' in it, the value before the slash is looked up and the remainder of the path is joined to any result. This is done to support dynamic Telepath share names.

Returns

The url string, if present in the alias. None will be returned if there are no matches.

Return type

str

synapse.telepath.**chopurl**(*url*, ***opts*)

async synapse.telepath.**delAhaUrl**(*url*)

Remove (decref) an aha registry URL.

NOTE: You may also remove a list of redundant URLs.

async synapse.telepath.**getAhaProxy**(*urlinfo*)

Return a telepath proxy by looking up a host from an AHA registry.

synapse.telepath.**loadTeleCell**(*dirn*)

async synapse.telepath.**loadTeleEnv**(*path*)

synapse.telepath.**mergeAhaInfo**(*info0*, *info1*)

synapse.telepath.**modurl**(*url*, ***info*)

async synapse.telepath.**open**(*url*, *onlink=None*)

Open a new telepath ClientV2 object based on the given URL.

Parameters

- **url** (*str*) – The URL to connect to.

- **onlink** – An optional async callback function to run when connections are made.

Notes

The onlink callback function has the call signature `(proxy, urlinfo)`. The proxy is the Telepath Proxy object. The urlinfo is the parsed URL information used to create the proxy object. The urlinfo structure may change between versions of Synapse.

Returns
A ClientV2 object.

Return type
ClientV2

async synapse.telepath.**openinfo**(*info*)

synapse.telepath.**withTeleEnv**()

synapse.telepath.**zipurl**(*info*)

Reconstruct a URL string from a parsed telepath info dict.

CHAPTER

ELEVEN

SYNAPSE HTTP/REST API

Many components within the Synapse ecosystem provide HTTP/REST APIs to provide a portable interface. Some of these APIs are RESTful, while other (streaming data) APIs are technically not.

11.1 HTTP/REST API Conventions

All Synapse RESTful APIs use HTTP GET/POST methods to retrieve and modify data. All POST requests expect a JSON body. Each RESTful API call will return a result wrapper dictionary with one of two conventions.

For a successful API call:

```
{"status": "ok", "result": "some api result here"}
```

or for an unsuccessful API call:

```
{"status": "err": "code": "ErrCodeString", "mesg": "A human friendly message."}
```

Streaming HTTP API endpoints, such as the interface provided to retrieve nodes from a Synapse Cortex, provide JSON results via HTTP chunked encoding where each chunk is a single result.

The client example code in these docs is given with the Python "aiohttp" and "requests" modules. They should be enough to understand the basic operation of the APIs.

For additional examples, see the code examples at HTTPAPI Examples.

11.2 Authentication

Most Synapse HTTP APIs require an authenticated user. HTTP API endpoints requiring authentication may be accessed using either HTTP Basic authentication via the HTTP "Authorization" header, using an API Key with the "X-API-KEY" header, or as part of an authenticated session.

11.2.1 API Key Support

A Cortex user can create their own API key via Storm. The following is an example of generating a user API key:

```
storm> ($key, $info)= $lib.auth.users.byname($lib.user.name()).genApiKey('Test␣
↪Key') $lib.print($key)
XauBgBIUKgWJEm7VyvkmcuaGZbIl6M2nmueWjRtnYtA=
```

This API Key can then be used to make HTTP API calls. The following example shows the use of `curl` and `jq` to make a Storm call with the API key and then format the response:

```
$ curl -k -s -H "X-API-KEY: XauBgBIUKgWJEm7VyvkmcuaGZbIl6M2nmueWjRtnYtA=" \
--data '{"query": "return($lib.user.name())"}' \
https://localhost:4443/api/v1/storm/call | jq

{
  "status": "ok",
  "result": "root"
}
```

11.2.2 /api/v1/login

The login API endpoint may be used to create an authenticated session. To create and use an authenticated session, the HTTP client library must support cookies. This session may then be used to call other HTTP API endpoints as the authenticated user. This expects a `user` and `passwd` provided in the body of a `POST` request. The reusable session cookie is returned in a `Set-Cookie` header.

Both of the Python examples use session managers which manage the session cookie automatically.

```python
import aiohttp

async def logInExample(ssl=False):

    async with aiohttp.ClientSession() as sess:

        info = {'user': 'visi', 'passwd': 'secret'}
        async with sess.post('https://localhost:4443/api/v1/login', json=info, ssl=ssl)␣
↪as resp:
            item = await resp.json()
            if item.get('status') != 'ok':
                code = item.get('code')
                mesg = item.get('mesg')
                raise Exception(f'Login error ({code}): {mesg}')

            # we are now clear to make additional HTTP API calls using sess
```

```python
import requests

def logInExample(ssl=False):

    sess = requests.session()

    url = 'https://localhost:4443/api/v1/login'
    info = {'user': 'visi', 'passwd': 'secret'}
    resp = sess.post(url, json=info, verify=ssl)
    item = resp.json()

    if item.get('status') != 'ok':
        code = item.get('code')
        mesg = item.get('mesg')
        raise Exception(f'Login error ({code}): {mesg}')

    # we are now clear to make additional HTTP API calls using sess
```

11.2.3 /api/v1/logout

The logout API endpoint may be used to end an authenticated session. This invalidates the session, and any further requests to authenticated endpoints will fail on authentication failed errors.

Both of the Python examples use session managers which manage the session cookie automatically.

```
import aiohttp

def logoutExample(sess, ssl):
    url = 'https://localhost:4443/api/v1/logout'
    resp = sess.get(url, ssl=ssl)
    item = resp.json()
    if item.get('status') != 'ok':
        code = item.get('code')
        mesg = item.get('mesg')
        raise Exception(f'Logout error ({code}): {mesg}')
```

```
import requests

def logoutExample(sess, ssl):
    url = 'https://localhost:4443/api/v1/logout'
    resp = sess.get(url, verify=ssl)
    item = resp.json()
    if item.get('status') != 'ok':
        code = item.get('code')
        mesg = item.get('mesg')
        raise Exception(f'Logout error ({code}): {mesg}')
```

11.2.4 /api/v1/active

Method

GET

This is an unauthenticated API that returns the leader status of Cell.

Returns

A dictionary with the `active` key set to True or False.

11.2.5 /api/v1/auth/users

Method

GET

Returns

A list of dictionaries, each of which represents a user on the system.

11.2.6 /api/v1/auth/roles

Method

GET

Returns

A list of dictionaries, each of which represents a role on the system.

11.2.7 /api/v1/auth/adduser

Method

POST

This API endpoint allows the caller to add a user to the system.

Input

This API expects the following JSON body:

```
{ "name": "myuser" }
```

Any additional "user dictionary" fields (other than "iden") may be specified.

Returns

The newly created user dictionary.

11.2.8 /api/v1/auth/addrole

Method

POST

This API endpoint allows the caller to add a role to the system.

Input

This API expects the following JSON body:

```
{ "name": "myrole" }
```

Any additional "role dictionary" fields (other than "iden") may be specified.

Returns

The newly created role dictionary.

11.2.9 /api/v1/auth/delrole

Method

POST

This API endpoint allows the caller to delete a role from the system.

Input

This API expects the following JSON body:

```
{ "name": "myrole" }
```

Returns

null

11.2.10 /api/v1/auth/user/<id>

Method

POST

This API allows the caller to modify specified elements of a user dictionary.

Input

This API expects a JSON dictionary containing any updated values for the user.

Returns

The updated user dictionary.

Method
GET

This API allows the caller to retrieve a user dictionary.

Returns
A user dictionary.

11.2.11 /api/v1/auth/password/<id>

Method
POST

This API allows the caller to change a user's password. The authenticated user must either be an admin or the user whose password is being changed.

Input
This API expects a JSON dictionary containing the key `passwd` with the new password string.

Returns
The updated user dictionary.

11.2.12 /api/v1/auth/role/<id>

Method
POST

This API allows the caller to modify specified elements of a role dictionary.

Input
This API expects a dictionary containing any updated values for the role.

Returns
The updated role dictionary.

Method
GET

This API allows the caller to retrieve a role dictionary.

Returns
A role dictionary.

11.2.13 /api/v1/auth/grant

Method
POST

This API allows the caller to grant a role to a given user.

Input
This API expects the following JSON body:

```
{
    "user": "<id>",
    "role": "<id>"
}
```

Returns
The updated user dictionary.

11.2.14 /api/v1/auth/revoke

Method

POST

This API allows the caller to revoke a role which was previously granted to a user.

Input

This API expects the following JSON body:

```
{
    "user": "<id>",
    "role": "<id>"
}
```

Returns

The updated user dictionary.

11.3 Cortex

A Synapse Cortex implements an HTTP API for interacting with the hypergraph and data model. Some of the provided APIs are pure REST APIs for simple data model operations and single/simple node modification. However, many of the HTTP APIs provided by the Cortex are streaming APIs which use HTTP chunked encoding to deliver a stream of results as they become available.

The Cortex also implements the *Axon* HTTP API. Permissions are checked within the Cortex, and then the request is executed on the Axon.

11.3.1 /api/v1/feed

The Cortex feed API endpoint allows the caller to add nodes in bulk.

Method

POST

Input

The API expects the following JSON body:

```
{
    "items": [ <node>, ... ],
    # and optionally...
    "view": <iden>,
}
```

Each <node> is expected to be in packed tuple form:

```
[ [<formname>, <formvalu>], {...} ]
```

Returns

The API returns `{"status": "ok", "result": null}` on success and any failures are returned using the previously mentioned REST API convention.

11.3.2 /api/v1/storm

The Storm API endpoint allows the caller to execute a Storm query on the Cortex and stream back the messages generated during the Storm runtime execution. In addition to returning nodes, these messages include events for node edits, tool console output, etc. This streaming API has back-pressure, and will handle streaming millions of results as the reader consumes them. For more information about Storm APIs, including opts behavior, see *Storm API Guide*.

Method

GET

Input

The API expects the following JSON body:

```
{
    "query": "a storm query here",

    # optional
    "opts": {
       ...
    }

    # optional
    "stream": "jsonlines"
}
```

Returns

The API returns a series of messages generated by the Storm runtime. Each message is returned as an HTTP chunk, allowing readers to consume the resulting messages as a stream.

The `stream` argument to the body modifies how the results are streamed back. Currently this optional argument can be set to `jsonlines` to get newline separated JSON data.

Examples

The following two examples show querying the `api/v1/storm` endpoint and receiving multiple message types.

aiohttp example:

```
import json
import pprint

# Assumes sess is an aiohttp client session that has previously logged in

query = '.created $lib.print($node.repr(".created")) | limit 3'
data = {'query': query, 'opts': {'repr': True}}
url = 'https://localhost:4443/api/v1/storm'

async with sess.get(url, json=data) as resp:
    async for byts, x in resp.content.iter_chunks():

        if not byts:
            break

        mesg = json.loads(byts)
        pprint.pprint(mesg)
```

requests example:

```
import json
import pprint
# Assumes sess is an requests client session that has previously logged in

query = '.created $lib.print($node.repr(".created")) | limit 3'
data = {'query': query, 'opts': {'repr': True}}
url = 'https://localhost:4443/api/v1/storm'

resp = sess.get(url, json=data, stream=True)
for chunk in resp.iter_content(chunk_size=None, decode_unicode=True):
    mesg = json.loads(chunk)
    pprint.pprint(mesg)
```

When working with these APIs across proxies, we have experienced issues with NGINX interfering with the chunked encoding. This may require more careful message reconstruction. The following shows using aiohttp to do that message reconstruction.

```
import json
import pprint
# Assumes sess is an requests client session that has previously logged in

query = '.created $lib.print($node.repr(".created")) | limit 3'
data = {'query': query, 'opts': {'repr': True}}
url = 'https://localhost:4443/api/v1/storm'

async with sess.get(url, json=data) as resp:

    buf = b""

    async for byts, chunkend in resp.content.iter_chunks():

        if not byts:
            break

        buf += byts
        if not chunkend:
            continue

        mesg = json.loads(buf)
        buf = b""

        pprint.pprint(buf)
```

11.3.3 /api/v1/storm/call

The Storm Call API endpoint allows the caller to execute a Storm query on the Cortex and get a single return value back from the runtime. This is analogous to using the `callStorm()` Telepath API. This expects to return a value from the Storm query using the Storm `return( )` syntax. For more information about Storm APIs, including opts behavior, see *Storm API Guide*.

Method

GET

Input

The API expects the following JSON body:

```
{
    "query": "a storm query here",

    # optional
    "opts": {
        ...
    }
}
```

Returns

The API returns `{"status": "ok", "result": return_value}` on success and any failures are returned using the previously mentioned REST API convention.

Examples

The following two examples show querying the `api/v1/storm/call` endpoint and receiving a return value.

aiohttp example:

```
import pprint

# Assumes sess is an aiohttp client session that has previously logged in

query = '$valu = "world" $foo = `hello {$valu}` return ($foo)'
data = {'query': query}
url = 'https://localhost:4443/api/v1/storm/call'

async with sess.get(url, json=data) as resp:
    info = await resp.json()
    pprint.pprint(info)
```

requests example:

```
import pprint
# Assumes sess is an requests client session that has previously logged in

query = '$valu = "world" $foo = `hello {$valu}` return ($foo)'
data = {'query': query}
url = 'https://localhost:4443/api/v1/storm/call'

resp = sess.get(url, json=data)
info = resp.json()
pprint.pprint(info)
```

11.3.4 /api/v1/storm/nodes

Warning

This API is deprecated in Synapse `v2.110.0` and will be removed in a future version.

The Storm nodes API endpoint allows the caller to execute a Storm query on the Cortex and stream back the resulting nodes. This streaming API has back-pressure, and will handle streaming millions of results as the reader consumes

them.

Method

GET

Input

See /api/v1/storm for expected JSON body input.

Returns

The API returns the resulting nodes from the input Storm query. Each node is returned as an HTTP chunk, allowing readers to consume the resulting nodes as a stream.

Each serialized node will have the following structure:

```
[
    [<form>, <valu>],       # The [ typename, typevalue ] definition of the␣
↪node.
    {
        "iden": <hash>,     # A stable identifier for the node.
        "tags": {},         # The tags on the node.
        "props": {},        # The node's secondary properties.

        # optionally (if query opts included {"repr": True}
        "reprs": {}         # Presentation values for props which need it.
    }
]
```

The `stream` argument, documented in the /api/v1/storm endpoint, modifies how the nodes are streamed back. Currently this optional argument can be set to `jsonlines` to get newline separated JSON data.

11.3.5 /api/v1/storm/export

The Storm export API endpoint allows the caller to execute a Storm query on the Cortex and export the resulting nodes in msgpack format such that they can be directly ingested with the `syn.nodes` feed function.

Method

GET

Input

See /api/v1/storm for expected JSON body input.

Returns

The API returns the resulting nodes from the input Storm query. This API yields nodes after an initial complete lift in order to limit exported edges.

Each exported node will be in msgpack format.

There is no Content-Length header returned, since the API cannot predict the volume of data a given query may produce.

11.3.6 /api/v1/model

Method

GET

This API allows the caller to retrieve the current Cortex data model.

Input

The API takes no input.

Returns

The API returns the model in a dictionary, including the types, forms and tagprops. Secondary property information is also included for each form:

```
{
    "types": {
        ...  # dictionary of type definitions
    },
    "forms": {
        ...  # dictionary of form definitions, including secondary properties
    },
    "tagprops": {
        ...  # dictionary of tag property definitions
    }
}
```

11.3.7 /api/v1/model/norm

Method

GET, POST

This API allows the caller to normalize a value based on the Cortex data model. This may be called via a GET or POST requests.

Input

The API expects the following JSON body:

```
{
    "prop": "prop:name:here",
    "value": <value>,
}
```

Returns

The API returns the normalized value as well as any parsed subfields or type specific info:

```
{
    "norm": <value>,
    "info": {
        "subs": {},
        ...
    }
}
```

11.3.8 /api/v1/storm/vars/get

Method

GET

This API allows the caller to retrieve a storm global variable.

Input

The API expects the following JSON body:

```
{
    "name": "varnamehere",
```

(continues on next page)

(continued from previous page)

```
    "default": null,
}
```

Returns

The API returns the global variable value or the specified default using the REST API convention described earlier.

11.3.9 /api/v1/storm/vars/set

Method

POST

This API allows the caller to set a storm global variable.

Input

The API expects the following JSON body:

```
{
    "name": "varnamehere",
    "value": <value>,
}
```

Returns

The API returns *true* using the REST API convention described earlier.

11.3.10 /api/v1/storm/vars/pop

Method

POST

This API allows the caller to pop/delete a storm global variable.

Input

The API expects the following JSON body:

```
{
    "name": "varnamehere",
    "default": <value>,
}
```

Returns

The API returns the current value of the variable or default using the REST API convention described earlier.

11.3.11 /api/v1/core/info

Method

GET

This API allows the caller to retrieve the current Cortex version, data model definitions, and Storm information.

Input

The API takes no input.

Returns

The API returns the model in a dictionary, including the types, forms and tagprops. Secondary property information is also included for each form:

```
{
    "version": [ <major>, <minor>, <patch> ], # Version tuple
    "modeldict": {
        ...  # dictionary of model definitions
    },
    "stormdocs": {
        "libraries": [
            ... # list of information about Storm libraries.
        ],
        "types": [
            ... # list of information about Storm types.
        ]
    }
}
```

11.3.12 /api/ext/*

This API endpoint is used as the Base URL for Extended HTTP API endpoints which are user defined. See *Extended HTTP API* for additional information about this endpoint.

11.4 Aha

A Synapse Aha service implements an HTTP API for assisting with devops.

11.4.1 /api/v1/aha/provision/service

Method

POST

This API allows the caller to generate an AHA provisioning URL.

Input

The API expects the following JSON body:

```
{
    "name": " ... name of the service being provisioned",
    "provinfo": {
        "dmon:port": # optional integer, default Telepath listening port.
        "https:port": # optional integer, default HTTPS listening port.
        "mirror": # optional string, service to Mirror.
        "conf": {
            ... # optional, default service configuration values.
        }
    }
}
```

Returns

The API returns the following provisioning information. The data is returned using the REST API convention described earlier:

```
{
    "url": "< the AHA provisioning URL >",
}
```

11.4.2 /api/v1/aha/services

Method

GET

This API allows the caller to get a list of all the registered services.

Input

The API accepts the following **optional** JSON body:

```
{
    "network": " ... name of the aha network to list",
}
```

Returns

The API returns the following provisioning information. The data is returned using the REST API convention described earlier:

```
[
    {
        "name": "< the full service name >",
        "svcname": "< service name part >",
        "svcnetw": "< service network part >",
        "svcinfo": {
            "run": "< runtime service identifier >",
            "iden": "< persistent service identifier >",
            "leader": "< service leader name >",
            "urlinfo": {
                "scheme": "< listening scheme >",
                "port": listening port,
                "path": "< listening path >",
                "host": "< listening IP address >"
            },
            "ready": < boolean indicating the service is either an active␣
↪leader or in the realtime change event window >,
            "online": < runtime aha identifier if the service is connected >
        }
    },
    ...
]
```

11.5 Axon

A Synapse Axon implements an HTTP API for uploading and downloading files. The HTTP APIs use HTTP chunked encoding for handling large files.

11.5.1 /api/v1/axon/files/del

This API allows the caller to delete multiple files from the Axon by the SHA-256.

Method

POST

Input

The API expects the following JSON body:

```
{
    "sha256s": [<sha256>, ...],
}
```

Returns

The API returns an array of SHA-256 and boolean values representing whether each was found in the Axon and deleted. The array is returned using the REST API convention described earlier.

11.5.2 /api/v1/axon/files/put

This API allows the caller to upload and save a file to the Axon. This may be called via a PUT or POST request.

Method

PUT, POST

Input

The API expects a stream of byte chunks.

Returns

On successful upload, or if the file already existed, the API returns information about the file:

```
{
  "md5": "<the md5sum value of the uploaded bytes>",
  "sha1": "<the sha1 value of the uploaded bytes>",
  "sha256": "<the sha256 value of the uploaded bytes>",
  "sha512": "<the sha512 value of the uploaded bytes>",
  "size": <the size of the uploaded bytes>
}
```

11.5.3 /api/v1/axon/files/has/sha256/<SHA-256>

This API allows the caller to check if a file exists in the Axon as identified by the SHA-256.

Method

GET

Returns

True if the file exists; False if the file does not exist.

11.5.4 /api/v1/axon/files/by/sha256/<SHA-256>

This API allows the caller to retrieve or remove a file from the Axon as identified by the SHA-256. If the file does not exist a 404 will be returned.

Method

GET

Returns

If the file exists a stream of byte chunks will be returned to the caller. A `Range` header with a single `bytes` value can be provided to get a subset of a file.

Method

HEAD

Returns

If the file exists, the `Content-Length` header will be set for the size of the file. If a `Range` header with a single `bytes` value is provided, the `Content-Length` header will describe the size of the range, and the `Content-Range` header will also be set to describe the range of the requested bytes.

Method

DELETE

Returns

Boolean via the REST API convention described earlier. If the file is not found an error is returned.

CHAPTER

TWELVE

SYNAPSE DATA MODEL

This contains documentation for Synapse Data Model, including the data model deprecation policy.

The current sections are:

12.1 Synapse Data Model - Types

12.1.1 Base Types

Base types are defined via Python classes.

array

A typed array which indexes each field. It is implemented by the following class: `synapse.lib.types.Array`.

The base type `array` has the following default options set:

- type: `int`

bool

The base boolean type. It is implemented by the following class: `synapse.lib.types.Bool`.

comp

The base type for compound node fields. It is implemented by the following class: `synapse.lib.types.Comp`.

cvss:v2

A CVSS v2 vector string. It is implemented by the following class: `synapse.models.risk.CvssV2`.

An example of `cvss:v2`:

- `(AV:L/AC:L/Au:M/C:P/I:C/A:N)`

cvss:v3

A CVSS v3.x vector string. It is implemented by the following class: `synapse.models.risk.CvssV3`.

An example of `cvss:v3`:

- `AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L`

data

Arbitrary json compatible data. It is implemented by the following class: `synapse.lib.types.Data`.

duration

A duration value. It is implemented by the following class: `synapse.lib.types.Duration`.

The base type `duration` has the following default options set:

- signed: `False`

edge

An digraph edge base type. It is implemented by the following class: `synapse.lib.types.Edge`.

file:base

A file name with no path. It is implemented by the following class: `synapse.models.files.FileBase`.

An example of `file:base`:

- `woot.exe`

file:bytes

The file bytes type with SHA256 based primary property. It is implemented by the following class: `synapse.models.files.FileBytes`.

file:path

A normalized file path. It is implemented by the following class: `synapse.models.files.FilePath`.

An example of `file:path`:

- `c:/windows/system32/calc.exe`

float

The base floating point type. It is implemented by the following class: `synapse.lib.types.Float`.

The base type `float` has the following default options set:

- fmt: `%f`
- min: `None`
- minisvalid: `True`
- max: `None`
- maxisvalid: `True`

geo:area

A geographic area (base unit is square mm). It is implemented by the following class: `synapse.models.geospace.Area`.

An example of `geo:area`:

- `10 sq.km`

geo:dist

A geographic distance (base unit is mm). It is implemented by the following class: `synapse.models.geospace.Dist`.

An example of `geo:dist`:

- `10 km`

geo:latlong

A Lat/Long string specifying a point on Earth. It is implemented by the following class: `synapse.models.geospace.LatLong`.

An example of `geo:latlong`:

- `-12.45,56.78`

guid

The base GUID type. It is implemented by the following class: `synapse.lib.types.Guid`.

hex

The base hex type. It is implemented by the following class: `synapse.lib.types.Hex`.

The base type `hex` has the following default options set:

- size: `0`
- zeropad: `0`

hugenum

A potentially huge/tiny number. [x] <= 73075081866545145910184 2 with a fractional precision of 24 decimal digits. It is implemented by the following class: `synapse.lib.types.HugeNum`.

The base type `hugenum` has the following default options set:

- units: `None`
- modulo: `None`

inet:addr

A network layer URL-like format to represent tcp/udp/icmp clients and servers. It is implemented by the following class: `synapse.models.inet.Addr`.

An example of `inet:addr`:

- `tcp://1.2.3.4:80`

inet:cidr4

An IPv4 address block in Classless Inter-Domain Routing (CIDR) notation. It is implemented by the following class: `synapse.models.inet.Cidr4`.

An example of `inet:cidr4`:

- `1.2.3.0/24`

inet:cidr6

An IPv6 address block in Classless Inter-Domain Routing (CIDR) notation. It is implemented by the following class: synapse.models.inet.Cidr6.

An example of inet:cidr6:

- 2001:db8::/101

inet:dns:name

A DNS query name string. Likely an FQDN but not always. It is implemented by the following class: synapse.models.dns.DnsName.

An example of inet:dns:name:

- vertex.link

inet:email

An e-mail address. It is implemented by the following class: synapse.models.inet.Email.

inet:fqdn

A Fully Qualified Domain Name (FQDN). It is implemented by the following class: synapse.models.inet.Fqdn.

An example of inet:fqdn:

- vertex.link

inet:http:cookie

An individual HTTP cookie string. It is implemented by the following class: synapse.models.inet.HttpCookie.

An example of inet:http:cookie:

- PHPSESSID=el4ukv0kqbvoirg7nkp4dncpk3

inet:ipv4

An IPv4 address. It is implemented by the following class: synapse.models.inet.IPv4.

An example of inet:ipv4:

- 1.2.3.4

inet:ipv4range

An IPv4 address range. It is implemented by the following class: synapse.models.inet.IPv4Range.

An example of inet:ipv4range:

- 1.2.3.4-1.2.3.8

inet:ipv6

An IPv6 address. It is implemented by the following class: synapse.models.inet.IPv6.

An example of inet:ipv6:

- 2607:f8b0:4004:809::200e

inet:ipv6range

An IPv6 address range. It is implemented by the following class: `synapse.models.inet.IPv6Range`.

An example of `inet:ipv6range`:

- `(2607:f8b0:4004:809::200e, 2607:f8b0:4004:809::2011)`

inet:rfc2822:addr

An RFC 2822 Address field. It is implemented by the following class: `synapse.models.inet.Rfc2822Addr`.

An example of `inet:rfc2822:addr`:

- `"Visi Kenshoto" <visi@vertex.link>`

inet:url

A Universal Resource Locator (URL). It is implemented by the following class: `synapse.models.inet.Url`.

An example of `inet:url`:

- `http://www.woot.com/files/index.html`

int

The base 64 bit signed integer type. It is implemented by the following class: `synapse.lib.types.Int`.

The base type `int` has the following default options set:

- size: `8`
- signed: `True`
- enums:strict: `True`
- fmt: `%d`
- min: `None`
- max: `None`
- ismin: `False`
- ismax: `False`

it:sec:cpe

A NIST CPE 2.3 Formatted String. It is implemented by the following class: `synapse.models.infotech.Cpe23Str`.

The base type `it:sec:cpe` has the following default options set:

- lower: `True`

it:sec:cpe:v2_2

A NIST CPE 2.2 Formatted String. It is implemented by the following class: `synapse.models.infotech.Cpe22Str`.

The base type `it:sec:cpe:v2_2` has the following default options set:

- lower: `True`

it:semver

Semantic Version type. It is implemented by the following class: `synapse.models.infotech.SemVer`.

ival

A time window/interval. It is implemented by the following class: `synapse.lib.types.Ival`.

loc

The base geo political location type. It is implemented by the following class: `synapse.lib.types.Loc`.

ndef

The node definition type for a (form,valu) compound field. It is implemented by the following class: `synapse.lib.types.Ndef`.

nodeprop

The nodeprop type for a (prop,valu) compound field. It is implemented by the following class: `synapse.lib.types.NodeProp`.

range

A base range type. It is implemented by the following class: `synapse.lib.types.Range`.

The base type `range` has the following default options set:

- type: `('int', {})`

str

The base string type. It is implemented by the following class: `synapse.lib.types.Str`.

The base type `str` has the following default options set:

- enums: `None`
- regex: `None`
- lower: `False`
- strip: `False`
- replace: `()`
- onespace: `False`
- globsuffix: `False`

syn:role

A Synapse role. It is implemented by the following class: `synapse.models.syn.SynRole`.

syn:tag

The base type for a synapse tag. It is implemented by the following class: `synapse.lib.types.Tag`.

The base type `syn:tag` has the following default options set:

- enums: `None`
- regex: `None`

- lower: `False`
- strip: `False`
- replace: `()`
- onespace: `False`
- globsuffix: `False`

syn:tag:part

A tag component string. It is implemented by the following class: `synapse.lib.types.TagPart`.

The base type `syn:tag:part` has the following default options set:

- enums: `None`
- regex: `None`
- lower: `False`
- strip: `False`
- replace: `()`
- onespace: `False`
- globsuffix: `False`

syn:user

A Synapse user. It is implemented by the following class: `synapse.models.syn.SynUser`.

taxon

A component of a hierarchical taxonomy. It is implemented by the following class: `synapse.lib.types.Taxon`.

The base type `taxon` has the following default options set:

- enums: `None`
- regex: `None`
- lower: `False`
- strip: `False`
- replace: `()`
- onespace: `False`
- globsuffix: `False`

taxonomy

A hierarchical taxonomy. It is implemented by the following class: `synapse.lib.types.Taxonomy`.

The base type `taxonomy` has the following default options set:

- enums: `None`
- regex: `None`
- lower: `False`
- strip: `False`

- replace: ()
- onespace: False
- globsuffix: False

tel:mob:imei

An International Mobile Equipment Id. It is implemented by the following class: synapse.models.telco.Imei.

An example of tel:mob:imei:

- 490154203237518

tel:mob:imsi

An International Mobile Subscriber Id. It is implemented by the following class: synapse.models.telco.Imsi.

An example of tel:mob:imsi:

- 310150123456789

tel:phone

A phone number. It is implemented by the following class: synapse.models.telco.Phone.

An example of tel:phone:

- +15558675309

time

A date/time value. It is implemented by the following class: synapse.lib.types.Time.

The base type time has the following default options set:

- ismin: False
- ismax: False

timeedge

An digraph edge base type with a unique time. It is implemented by the following class: synapse.lib.types.TimeEdge.

velocity

A velocity with base units in mm/sec. It is implemented by the following class: synapse.lib.types.Velocity.

The base type velocity has the following default options set:

- relative: False

12.1.2 Types

Regular types are derived from BaseTypes.

auth:access

An instance of using creds to access a resource. The auth:access type is derived from the base type: guid.

auth:creds

A unique set of credentials used to access a resource. The `auth:creds` type is derived from the base type: `guid`.

belief:subscriber

A contact which subscribes to a belief system. The `belief:subscriber` type is derived from the base type: `guid`.

belief:system

A belief system such as an ideology, philosophy, or religion. The `belief:system` type is derived from the base type: `guid`.

belief:system:type:taxonomy

A hierarchical taxonomy of belief system types. The `belief:system:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

belief:tenet

A concrete tenet potentially shared by multiple belief systems. The `belief:tenet` type is derived from the base type: `guid`.

biz:bundle

A bundle allows construction of products which bundle instances of other products. The `biz:bundle` type is derived from the base type: `guid`.

biz:deal

A sales or procurement effort in pursuit of a purchase. The `biz:deal` type is derived from the base type: `guid`.

biz:dealstatus

A deal/rfp status taxonomy. The `biz:dealstatus` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`

- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

biz:dealtype

A deal type taxonomy. The `biz:dealtype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

biz:listing

A product or service being listed for sale at a given price by a specific seller. The `biz:listing` type is derived from the base type: `guid`.

biz:prodtype

A product type taxonomy. The `biz:prodtype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

biz:product

A product which is available for purchase. The `biz:product` type is derived from the base type: `guid`.

biz:rfp

An RFP (Request for Proposal) soliciting proposals. The `biz:rfp` type is derived from the base type: `guid`.

biz:service

A service which is performed by a specific organization. The `biz:service` type is derived from the base type: `guid`.

biz:service:type:taxonomy

A taxonomy of service offering types. The `biz:service:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

biz:stake

A stake or partial ownership in a company. The `biz:stake` type is derived from the base type: `guid`.

crypto:algorithm

A cryptographic algorithm name. The `crypto:algorithm` type is derived from the base type: `str`.

An example of `crypto:algorithm`:

- `aes256`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

crypto:currency:address

An individual crypto currency address. The `crypto:currency:address` type is derived from the base type: `comp`.

This type implements the following interfaces:

- `econ:pay:instrument`

An example of `crypto:currency:address`:

- btc/1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2

This type has the following options set:

- fields: (('coin', 'crypto:currency:coin'), ('iden', 'str'))
- sepr: /

crypto:currency:block

An individual crypto currency block record on the blockchain. The crypto:currency:block type is derived from the base type: comp.

This type has the following options set:

- fields: (('coin', 'crypto:currency:coin'), ('offset', 'int'))
- sepr: /

crypto:currency:client

A fused node representing a crypto currency address used by an Internet client. The crypto:currency:client type is derived from the base type: comp.

An example of crypto:currency:client:

- (1.2.3.4, (btc, 1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2))

This type has the following options set:

- fields: (('inetaddr', 'inet:client'), ('coinaddr', 'crypto:currency:address'))

crypto:currency:coin

An individual crypto currency type. The crypto:currency:coin type is derived from the base type: str.

An example of crypto:currency:coin:

- btc

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: False
- regex: None
- replace: ()
- strip: False

crypto:currency:transaction

An individual crypto currency transaction recorded on the blockchain. The crypto:currency:transaction type is derived from the base type: guid.

crypto:key

A cryptographic key and algorithm. The crypto:key type is derived from the base type: guid.

crypto:payment:input

A payment made into a transaction. The `crypto:payment:input` type is derived from the base type: `guid`.

crypto:payment:output

A payment received from a transaction. The `crypto:payment:output` type is derived from the base type: `guid`.

crypto:smart:contract

A smart contract. The `crypto:smart:contract` type is derived from the base type: `guid`.

crypto:smart:effect:burntoken

A smart contract effect which destroys a non-fungible token. The `crypto:smart:effect:burntoken` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:edittokensupply

A smart contract effect which increases or decreases the supply of a fungible token. The `crypto:smart:effect:edittokensupply` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:minttoken

A smart contract effect which creates a new non-fungible token. The `crypto:smart:effect:minttoken` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:proxytoken

A smart contract effect which grants a non-owner address the ability to manipulate a specific non-fungible token. The `crypto:smart:effect:proxytoken` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:proxytokenall

A smart contract effect which grants a non-owner address the ability to manipulate all non-fungible tokens of the owner. The `crypto:smart:effect:proxytokenall` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:proxytokens

A smart contract effect which grants a non-owner address the ability to manipulate fungible tokens. The `crypto:smart:effect:proxytokens` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:transfertoken

A smart contract effect which transfers ownership of a non-fungible token. The `crypto:smart:effect:transfertoken` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:effect:transfertokens

A smart contract effect which transfers fungible tokens. The `crypto:smart:effect:transfertokens` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `crypto:smart:effect`

crypto:smart:token

A token managed by a smart contract. The `crypto:smart:token` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('contract', 'crypto:smart:contract'), ('tokenid', 'hugenum'))`

crypto:x509:cert

A unique X.509 certificate. The `crypto:x509:cert` type is derived from the base type: `guid`.

crypto:x509:crl

A unique X.509 Certificate Revocation List. The `crypto:x509:crl` type is derived from the base type: `guid`.

crypto:x509:revoked

A revocation relationship between a CRL and an X.509 certificate. The `crypto:x509:revoked` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('crl', 'crypto:x509:crl'), ('cert', 'crypto:x509:cert'))`

crypto:x509:san

An X.509 Subject Alternative Name (SAN). The `crypto:x509:san` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('type', 'str'), ('value', 'str'))`

crypto:x509:signedfile

A digital signature relationship between an X.509 certificate and a file. The `crypto:x509:signedfile` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('cert', 'crypto:x509:cert'), ('file', 'file:bytes'))`

doc:policy

Guiding principles used to reach a set of goals. The `doc:policy` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `doc:document`

doc:policy:type:taxonomy

A taxonomy of policy types. The `doc:policy:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

doc:requirement

A single requirement, often defined by a standard. The `doc:requirement` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `doc:document`

doc:requirement:type:taxonomy

A taxonomy of requirement types. The `doc:requirement:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`

- strip: False

doc:resume

A CV/resume document. The doc:resume type is derived from the base type: guid.

This type implements the following interfaces:

- doc:document

doc:resume:type:taxonomy

A taxonomy of resume types. The doc:resume:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

doc:standard

A group of requirements which define how to implement a policy or goal. The doc:standard type is derived from the base type: guid.

This type implements the following interfaces:

- doc:document

doc:standard:type:taxonomy

A taxonomy of standard types. The doc:standard:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

econ:acct:balance

A snapshot of the balance of an account at a point in time. The `econ:acct:balance` type is derived from the base type: `guid`.

econ:acct:invoice

An invoice issued requesting payment. The `econ:acct:invoice` type is derived from the base type: `guid`.

econ:acct:payment

A payment or crypto currency transaction. The `econ:acct:payment` type is derived from the base type: `guid`.

econ:acct:receipt

A receipt issued as proof of payment. The `econ:acct:receipt` type is derived from the base type: `guid`.

econ:acquired

Deprecated. Please use econ:purchase -(acquired)> *. The `econ:acquired` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('purchase', 'econ:purchase'), ('item', 'ndef'))`

econ:bank:aba:rtn

An American Bank Association (ABA) routing transit number (RTN). The `econ:bank:aba:rtn` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `[0-9]{9}`
- replace: `()`
- strip: `False`

econ:bank:account

A bank account. The `econ:bank:account` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `econ:pay:instrument`

econ:bank:account:type:taxonomy

A bank account type taxonomy. The `econ:bank:account:type:taxonomy` type is derived from the base type: `taxonomy`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`

- regex: None
- replace: ()
- strip: False

econ:bank:balance

A balance contained by a bank account at a point in time. The econ:bank:balance type is derived from the base type: guid.

econ:bank:iban

An International Bank Account Number. The econ:bank:iban type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: [A-Z]{2}[0-9]{2}[a-zA-Z0-9]{1,30}
- replace: ()
- strip: False

econ:bank:statement

A statement of bank account payment activity over a period of time. The econ:bank:statement type is derived from the base type: guid.

econ:bank:swift:bic

A Society for Worldwide Interbank Financial Telecommunication (SWIFT) Business Identifier Code (BIC). The econ:bank:swift:bic type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: [A-Z]{6}[A-Z0-9]{5}
- replace: ()
- strip: False

econ:currency

The name of a system of money in general use. The econ:currency type is derived from the base type: str.

An example of econ:currency:

- usd

This type has the following options set:

- globsuffix: False
- lower: True

- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

econ:fin:bar

A sample of the open, close, high, low prices of a security in a specific time window. The `econ:fin:bar` type is derived from the base type: `guid`.

econ:fin:exchange

A financial exchange where securities are traded. The `econ:fin:exchange` type is derived from the base type: `guid`.

econ:fin:security

A financial security which is typically traded on an exchange. The `econ:fin:security` type is derived from the base type: `guid`.

econ:fin:tick

A sample of the price of a security at a single moment in time. The `econ:fin:tick` type is derived from the base type: `guid`.

econ:pay:card

A single payment card. The `econ:pay:card` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `econ:pay:instrument`

econ:pay:cvv

A Card Verification Value (CVV). The `econ:pay:cvv` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[0-9]{1,6}$`
- replace: `()`
- strip: `False`

econ:pay:iin

An Issuer Id Number (IIN). The `econ:pay:iin` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`

- ismin: False
- max: 999999
- min: 0
- signed: True
- size: 8

econ:pay:instrument

A node which may act as a payment instrument. The econ:pay:instrument type is derived from the base type: ndef.

This type has the following options set:

- interface: econ:pay:instrument

econ:pay:mii

A Major Industry Identifier (MII). The econ:pay:mii type is derived from the base type: int.

This type has the following options set:

- enums:strict: True
- fmt: %d
- ismax: False
- ismin: False
- max: 9
- min: 0
- signed: True
- size: 8

econ:pay:pan

A Primary Account Number (PAN) or card number. The econ:pay:pan type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: ^(?<iin>(?<mii>[0-9]{1})[0-9]{5})[0-9]{1,13}$
- replace: ()
- strip: False

econ:pay:pin

A Personal Identification Number (PIN). The econ:pay:pin type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False

- onespace: `False`
- regex: `^[0-9]{3,6}$`
- replace: `()`
- strip: `False`

econ:price

The amount of money expected, required, or given in payment for something. The `econ:price` type is derived from the base type: `hugenum`.

An example of `econ:price`:

- `2.20`

This type has the following options set:

- modulo: `None`
- norm: `False`
- units: `None`

econ:purchase

A purchase event. The `econ:purchase` type is derived from the base type: `guid`.

econ:receipt:item

A line item included as part of a purchase. The `econ:receipt:item` type is derived from the base type: `guid`.

edge:has

A digraph edge which records that N1 has N2. The `edge:has` type is derived from the base type: `edge`.

edge:refs

A digraph edge which records that N1 refers to or contains N2. The `edge:refs` type is derived from the base type: `edge`.

edge:wentto

A digraph edge which records that N1 went to N2 at a specific time. The `edge:wentto` type is derived from the base type: `timeedge`.

edu:class

An instance of an edu:course taught at a given time. The `edu:class` type is derived from the base type: `guid`.

edu:course

A course of study taught by an org. The `edu:course` type is derived from the base type: `guid`.

entity:actor

An entity which has initiative to act. The `entity:actor` type is derived from the base type: `ndef`.

This type has the following options set:

- forms: `('ou:org', 'ps:person', 'ps:contact', 'risk:threat')`

entity:name

A name used to refer to an entity. The `entity:name` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

entity:relationship

A directional relationship between two actor entities. The `entity:relationship` type is derived from the base type: `guid`.

entity:relationship:type:taxonomy

A hierarchical taxonomy of entity relationship types. The `entity:relationship:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

file:archive:entry

An archive entry representing a file and metadata within a parent archive file. The `file:archive:entry` type is derived from the base type: `guid`.

file:attachment

A file attachment. The `file:attachment` type is derived from the base type: `guid`.

file:filepath

The fused knowledge of the association of a file:bytes node and a file:path. The `file:filepath` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('path', 'file:path'))`

file:ismime

Records one, of potentially multiple, mime types for a given file. The `file:ismime` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('mime', 'file:mime'))`

file:mime

A file mime name string. The `file:mime` type is derived from the base type: `str`.

An example of `file:mime`:

- `text/plain`

This type has the following options set:

- globsuffix: `False`
- lower: `1`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

file:mime:gif

The GUID of a set of mime metadata for a .gif file. The `file:mime:gif` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:image`

file:mime:jpg

The GUID of a set of mime metadata for a .jpg file. The `file:mime:jpg` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:image`

file:mime:lnk

The GUID of the metadata pulled from a Windows shortcut or LNK file. The `file:mime:lnk` type is derived from the base type: `guid`.

file:mime:macho:loadcmd

A generic load command pulled from the Mach-O headers. The `file:mime:macho:loadcmd` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:macho:loadcmd`

file:mime:macho:section

A section inside a Mach-O binary denoting a named region of bytes inside a segment. The `file:mime:macho:section` type is derived from the base type: `guid`.

file:mime:macho:segment

A named region of bytes inside a Mach-O binary. The `file:mime:macho:segment` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:macho:loadcmd`

file:mime:macho:uuid

A specific load command denoting a UUID used to uniquely identify the Mach-O binary. The `file:mime:macho:uuid` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:macho:loadcmd`

file:mime:macho:version

A specific load command used to denote the version of the source used to build the Mach-O binary. The `file:mime:macho:version` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:macho:loadcmd`

file:mime:msdoc

The GUID of a set of mime metadata for a Microsoft Word file. The `file:mime:msdoc` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:msoffice`

file:mime:msppt

The GUID of a set of mime metadata for a Microsoft Powerpoint file. The `file:mime:msppt` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:msoffice`

file:mime:msxls

The GUID of a set of mime metadata for a Microsoft Excel file. The `file:mime:msxls` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:msoffice`

file:mime:pe:export

The fused knowledge of a file:bytes node containing a pe named export. The `file:mime:pe:export` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('name', 'str'))`

file:mime:pe:resource

The fused knowledge of a file:bytes node containing a pe resource. The `file:mime:pe:resource` type is derived from the base type: `comp`.

This type has the following options set:

- fields:

```
[
  [
    "file",
    "file:bytes"
  ],
  [
    "type",
    "pe:resource:type"
  ],
  [
    "langid",
    "pe:langid"
  ],
  [
    "resource",
    "file:bytes"
  ]
]
```

file:mime:pe:section

The fused knowledge a file:bytes node containing a pe section. The `file:mime:pe:section` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('name', 'str'), ('sha256', 'hash:sha256'))`

file:mime:pe:vsvers:info

knowledge of a file:bytes node containing vsvers info. The `file:mime:pe:vsvers:info` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('keyval', 'file:mime:pe:vsvers:keyval'))`

file:mime:pe:vsvers:keyval

A key value pair found in a PE vsversion info structure. The `file:mime:pe:vsvers:keyval` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('name', 'str'), ('value', 'str'))`

file:mime:png

The GUID of a set of mime metadata for a .png file. The `file:mime:png` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:image`

file:mime:rtf

The GUID of a set of mime metadata for a .rtf file. The `file:mime:rtf` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:meta`

file:mime:tif

The GUID of a set of mime metadata for a .tif file. The `file:mime:tif` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `file:mime:image`

file:string

Deprecated. Please use the edge -(refs)> it:dev:str. The `file:string` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('string', 'str'))`

file:subfile

A parent file that fully contains the specified child file. The `file:subfile` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('parent', 'file:bytes'), ('child', 'file:bytes'))`

geo:address

A street/mailing address string. The `geo:address` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

geo:altitude

A negative or positive offset from Mean Sea Level (6,371.0088km from Earths core). The `geo:altitude` type is derived from the base type: `geo:dist`.

An example of `geo:altitude`:

- `10 km`

This type has the following options set:

- baseoff: `6371008800`
- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

geo:bbox

A geospatial bounding box in (xmin, xmax, ymin, ymax) format. The `geo:bbox` type is derived from the base type: `comp`.

This type has the following options set:

- fields:

```
[
  [
    "xmin",
    "geo:longitude"
  ],
  [
    "xmax",
    "geo:longitude"
  ],
  [
    "ymin",
    "geo:latitude"
  ],
  [
    "ymax",
    "geo:latitude"
  ]
]
```

- sepr: `,`

geo:json

GeoJSON structured JSON data. The `geo:json` type is derived from the base type: `data`.

This type has the following options set:

- schema:


```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "definitions": {
    "BoundingBox": {
      "items": {
        "type": "number"
      },
      "minItems": 4,
      "type": "array"
    },
    "Feature": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "geometry": {
          "oneOf": [
            {
              "type": "null"
            },
            {
              "$ref": "#/definitions/Point"
            },
            {
              "$ref": "#/definitions/LineString"
            },
            {
              "$ref": "#/definitions/Polygon"
            },
            {
              "$ref": "#/definitions/MultiPoint"
            },
            {
              "$ref": "#/definitions/MultiLineString"
            },
            {
              "$ref": "#/definitions/MultiPolygon"
            },
            {
              "$ref": "#/definitions/GeometryCollection"
            }
          ]
        },
        "properties": {
          "oneOf": [
            {
              "type": "null"
```


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```
            },
            {
              "type": "object"
            }
          ]
        },
        "type": {
          "enum": [
            "Feature"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "properties",
        "geometry"
      ],
      "title": "GeoJSON Feature",
      "type": "object"
    },
    "FeatureCollection": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "features": {
          "items": {
            "$ref": "#/definitions/Feature"
          },
          "type": "array"
        },
        "type": {
          "enum": [
            "FeatureCollection"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "features"
      ],
      "title": "GeoJSON FeatureCollection",
      "type": "object"
    },
    "GeometryCollection": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "geometries": {
```

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```
          "items": {
            "oneOf": [
              {
                "$ref": "#/definitions/Point"
              },
              {
                "$ref": "#/definitions/LineString"
              },
              {
                "$ref": "#/definitions/Polygon"
              },
              {
                "$ref": "#/definitions/MultiPoint"
              },
              {
                "$ref": "#/definitions/MultiLineString"
              },
              {
                "$ref": "#/definitions/MultiPolygon"
              }
            ]
          },
          "type": "array"
        },
        "type": {
          "enum": [
            "GeometryCollection"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "geometries"
      ],
      "title": "GeoJSON GeometryCollection",
      "type": "object"
    },
    "LineString": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "coordinates": {
          "$ref": "#/definitions/LineStringCoordinates"
        },
        "type": {
          "enum": [
            "LineString"
          ],
          "type": "string"
        }
```

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```
      },
      "required": [
        "type",
        "coordinates"
      ],
      "title": "GeoJSON LineString",
      "type": "object"
    },
    "LineStringCoordinates": {
      "items": {
        "$ref": "#/definitions/PointCoordinates"
      },
      "minItems": 2,
      "type": "array"
    },
    "LinearRingCoordinates": {
      "items": {
        "$ref": "#/definitions/PointCoordinates"
      },
      "minItems": 4,
      "type": "array"
    },
    "MultiLineString": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "coordinates": {
          "items": {
            "$ref": "#/definitions/LineStringCoordinates"
          },
          "type": "array"
        },
        "type": {
          "enum": [
            "MultiLineString"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "coordinates"
      ],
      "title": "GeoJSON MultiLineString",
      "type": "object"
    },
    "MultiPoint": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
```

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```
      "coordinates": {
        "items": {
          "$ref": "#/definitions/PointCoordinates"
        },
        "type": "array"
      },
      "type": {
        "enum": [
          "MultiPoint"
        ],
        "type": "string"
      }
    },
    "required": [
      "type",
      "coordinates"
    ],
    "title": "GeoJSON MultiPoint",
    "type": "object"
  },
  "MultiPolygon": {
    "properties": {
      "bbox": {
        "$ref": "#/definitions/BoundingBox"
      },
      "coordinates": {
        "items": {
          "$ref": "#/definitions/PolygonCoordinates"
        },
        "type": "array"
      },
      "type": {
        "enum": [
          "MultiPolygon"
        ],
        "type": "string"
      }
    },
    "required": [
      "type",
      "coordinates"
    ],
    "title": "GeoJSON MultiPolygon",
    "type": "object"
  },
  "Point": {
    "properties": {
      "bbox": {
        "$ref": "#/definitions/BoundingBox"
      },
      "coordinates": {
        "$ref": "#/definitions/PointCoordinates"
```

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```
        },
        "type": {
          "enum": [
            "Point"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "coordinates"
      ],
      "title": "GeoJSON Point",
      "type": "object"
    },
    "PointCoordinates": {
      "items": {
        "type": "number"
      },
      "minItems": 2,
      "type": "array"
    },
    "Polygon": {
      "properties": {
        "bbox": {
          "$ref": "#/definitions/BoundingBox"
        },
        "coordinates": {
          "$ref": "#/definitions/PolygonCoordinates"
        },
        "type": {
          "enum": [
            "Polygon"
          ],
          "type": "string"
        }
      },
      "required": [
        "type",
        "coordinates"
      ],
      "title": "GeoJSON Polygon",
      "type": "object"
    },
    "PolygonCoordinates": {
      "items": {
        "$ref": "#/definitions/LinearRingCoordinates"
      },
      "type": "array"
    }
  },
  "oneOf": [
```

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```
    {
      "$ref": "#/definitions/Point"
    },
    {
      "$ref": "#/definitions/LineString"
    },
    {
      "$ref": "#/definitions/Polygon"
    },
    {
      "$ref": "#/definitions/MultiPoint"
    },
    {
      "$ref": "#/definitions/MultiLineString"
    },
    {
      "$ref": "#/definitions/MultiPolygon"
    },
    {
      "$ref": "#/definitions/GeometryCollection"
    },
    {
      "$ref": "#/definitions/Feature"
    },
    {
      "$ref": "#/definitions/FeatureCollection"
    }
  ]
}
```

geo:latitude

A latitude in floating point notation. The `geo:latitude` type is derived from the base type: `float`.

An example of `geo:latitude`:

- `31.337`

This type has the following options set:

- fmt: `%f`
- max: `90.0`
- maxisvalid: `True`
- min: `-90.0`
- minisvalid: `True`

geo:longitude

A longitude in floating point notation. The `geo:longitude` type is derived from the base type: `float`.

An example of `geo:longitude`:

- `31.337`

This type has the following options set:

- fmt: `%f`
- max: `180.0`
- maxisvalid: `True`
- min: `-180.0`
- minisvalid: `False`

geo:name

An unstructured place name or address. The `geo:name` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

geo:nloc

Records a node latitude/longitude in space-time. The `geo:nloc` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('ndef', 'ndef'), ('latlong', 'geo:latlong'), ('time', 'time'))`

geo:place

A GUID for a geographic place. The `geo:place` type is derived from the base type: `guid`.

geo:place:taxonomy

A taxonomy of place types. The `geo:place:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

geo:telem

The geospatial position and physical characteristics of a node at a given time. The `geo:telem` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `phys:object`
- `geo:locatable`

gov:cn:icp

A Chinese Internet Content Provider ID. The `gov:cn:icp` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

gov:cn:mucd

A Chinese PLA MUCD. The `gov:cn:mucd` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

gov:intl:un:m49

UN M49 Numeric Country Code. The `gov:intl:un:m49` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`

- max: 999
- min: 1
- signed: True
- size: 8

gov:us:cage

A Commercial and Government Entity (CAGE) code. The gov:us:cage type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: False
- regex: None
- replace: ()
- strip: False

gov:us:ssn

A US Social Security Number (SSN). The gov:us:ssn type is derived from the base type: int.

This type has the following options set:

- enums:strict: True
- fmt: %d
- ismax: False
- ismin: False
- max: None
- min: None
- signed: True
- size: 8

gov:us:zip

A US Postal Zip Code. The gov:us:zip type is derived from the base type: int.

This type has the following options set:

- enums:strict: True
- fmt: %d
- ismax: False
- ismin: False
- max: None
- min: None
- signed: True
- size: 8

graph:cluster

A generic node, used in conjunction with Edge types, to cluster arbitrary nodes to a single node in the model. The `graph:cluster` type is derived from the base type: `guid`.

graph:edge

A generic digraph edge to show relationships outside the model. The `graph:edge` type is derived from the base type: `edge`.

graph:event

A generic event node to represent events outside the model. The `graph:event` type is derived from the base type: `guid`.

graph:node

A generic node used to represent objects outside the model. The `graph:node` type is derived from the base type: `guid`.

graph:timeedge

A generic digraph time edge to show relationships outside the model. The `graph:timeedge` type is derived from the base type: `timeedge`.

hash:lm

A hex encoded Microsoft Windows LM password hash. The `hash:lm` type is derived from the base type: `hex`.

An example of `hash:lm`:

- `d41d8cd98f00b204e9800998ecf8427e`

This type has the following options set:

- size: `32`
- zeropad: `0`

hash:md5

A hex encoded MD5 hash. The `hash:md5` type is derived from the base type: `hex`.

An example of `hash:md5`:

- `d41d8cd98f00b204e9800998ecf8427e`

This type has the following options set:

- size: `32`
- zeropad: `0`

hash:ntlm

A hex encoded Microsoft Windows NTLM password hash. The `hash:ntlm` type is derived from the base type: `hex`.

An example of `hash:ntlm`:

- `d41d8cd98f00b204e9800998ecf8427e`

This type has the following options set:

- size: `32`

- zeropad: 0

hash:sha1

A hex encoded SHA1 hash. The hash:sha1 type is derived from the base type: hex.

An example of hash:sha1:

- da39a3ee5e6b4b0d3255bfef95601890afd80709

This type has the following options set:

- size: 40
- zeropad: 0

hash:sha256

A hex encoded SHA256 hash. The hash:sha256 type is derived from the base type: hex.

An example of hash:sha256:

- ad9f4fe922b61e674a09530831759843b1880381de686a43460a76864ca0340c

This type has the following options set:

- size: 64
- zeropad: 0

hash:sha384

A hex encoded SHA384 hash. The hash:sha384 type is derived from the base type: hex.

An example of hash:sha384:

- d425f1394e418ce01ed1579069a8bfaa1da8f32cf823982113ccbef531fa36bda9987f389c5af05b5e28035242efab6c

This type has the following options set:

- size: 96
- zeropad: 0

hash:sha512

A hex encoded SHA512 hash. The hash:sha512 type is derived from the base type: hex.

An example of hash:sha512:

- ca74fe2ff2d03b29339ad7d08ba21d192077fece1715291c7b43c20c9136cd132788239189f3441a87eb23ce2660aa243f3

This type has the following options set:

- size: 128
- zeropad: 0

inet:asn

An Autonomous System Number (ASN). The inet:asn type is derived from the base type: int.

This type has the following options set:

- enums:strict: True
- fmt: %d

- ismax: False
- ismin: False
- max: None
- min: None
- signed: True
- size: 8

inet:asnet4

An Autonomous System Number (ASN) and its associated IPv4 address range. The inet:asnet4 type is derived from the base type: comp.

An example of inet:asnet4:

- (54959, (1.2.3.4, 1.2.3.20))

This type has the following options set:

- fields: (('asn', 'inet:asn'), ('net4', 'inet:net4'))

inet:asnet6

An Autonomous System Number (ASN) and its associated IPv6 address range. The inet:asnet6 type is derived from the base type: comp.

An example of inet:asnet6:

- (54959, (ff::00, ff::02))

This type has the following options set:

- fields: (('asn', 'inet:asn'), ('net6', 'inet:net6'))

inet:banner

A network protocol banner string presented by a server. The inet:banner type is derived from the base type: comp.

This type has the following options set:

- fields: (('server', 'inet:server'), ('text', 'it:dev:str'))

inet:client

A network client address. The inet:client type is derived from the base type: inet:addr.

An example of inet:client:

- tcp://1.2.3.4:80

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

inet:dns:a

The result of a DNS A record lookup. The inet:dns:a type is derived from the base type: comp.

An example of inet:dns:a:

- (vertex.link,1.2.3.4)

This type has the following options set:

- fields: (('fqdn', 'inet:fqdn'), ('ipv4', 'inet:ipv4'))

inet:dns:aaaa

The result of a DNS AAAA record lookup. The inet:dns:aaaa type is derived from the base type: comp.

An example of inet:dns:aaaa:

- (vertex.link,2607:f8b0:4004:809::200e)

This type has the following options set:

- fields: (('fqdn', 'inet:fqdn'), ('ipv6', 'inet:ipv6'))

inet:dns:answer

A single answer from within a DNS reply. The inet:dns:answer type is derived from the base type: guid.

inet:dns:cname

The result of a DNS CNAME record lookup. The inet:dns:cname type is derived from the base type: comp.

An example of inet:dns:cname:

- (foo.vertex.link,vertex.link)

This type has the following options set:

- fields: (('fqdn', 'inet:fqdn'), ('cname', 'inet:fqdn'))

inet:dns:dynreg

A dynamic DNS registration. The inet:dns:dynreg type is derived from the base type: guid.

inet:dns:mx

The result of a DNS MX record lookup. The inet:dns:mx type is derived from the base type: comp.

An example of inet:dns:mx:

- (vertex.link,mail.vertex.link)

This type has the following options set:

- fields: (('fqdn', 'inet:fqdn'), ('mx', 'inet:fqdn'))

inet:dns:ns

The result of a DNS NS record lookup. The inet:dns:ns type is derived from the base type: comp.

An example of inet:dns:ns:

- (vertex.link,ns.dnshost.com)

This type has the following options set:

- fields: `(('zone', 'inet:fqdn'), ('ns', 'inet:fqdn'))`

inet:dns:query

A DNS query unique to a given client. The `inet:dns:query` type is derived from the base type: `comp`.

An example of `inet:dns:query`:

- `(1.2.3.4, woot.com, 1)`

This type has the following options set:

- fields: `(('client', 'inet:client'), ('name', 'inet:dns:name'), ('type', 'int'))`

inet:dns:request

A single instance of a DNS resolver request and optional reply info. The `inet:dns:request` type is derived from the base type: `guid`.

inet:dns:rev

The transformed result of a DNS PTR record lookup. The `inet:dns:rev` type is derived from the base type: `comp`.

An example of `inet:dns:rev`:

- `(1.2.3.4,vertex.link)`

This type has the following options set:

- fields: `(('ipv4', 'inet:ipv4'), ('fqdn', 'inet:fqdn'))`

inet:dns:rev6

The transformed result of a DNS PTR record for an IPv6 address. The `inet:dns:rev6` type is derived from the base type: `comp`.

An example of `inet:dns:rev6`:

- `(2607:f8b0:4004:809::200e,vertex.link)`

This type has the following options set:

- fields: `(('ipv6', 'inet:ipv6'), ('fqdn', 'inet:fqdn'))`

inet:dns:soa

The result of a DNS SOA record lookup. The `inet:dns:soa` type is derived from the base type: `guid`.

inet:dns:txt

The result of a DNS TXT record lookup. The `inet:dns:txt` type is derived from the base type: `comp`.

An example of `inet:dns:txt`:

- `(hehe.vertex.link,"fancy TXT record")`

This type has the following options set:

- fields: `(('fqdn', 'inet:fqdn'), ('txt', 'str'))`

inet:dns:type

A DNS query/answer type integer. The `inet:dns:type` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

inet:dns:wild:a

A DNS A wild card record and the IPv4 it resolves to. The `inet:dns:wild:a` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('fqdn', 'inet:fqdn'), ('ipv4', 'inet:ipv4'))`

inet:dns:wild:aaaa

A DNS AAAA wild card record and the IPv6 it resolves to. The `inet:dns:wild:aaaa` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('fqdn', 'inet:fqdn'), ('ipv6', 'inet:ipv6'))`

inet:download

An instance of a file downloaded from a server. The `inet:download` type is derived from the base type: `guid`.

inet:egress

A host using a specific network egress client address. The `inet:egress` type is derived from the base type: `guid`.

inet:email:header

A unique email message header. The `inet:email:header` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('name', 'inet:email:header:name'), ('value', 'str'))`

inet:email:header:name

An email header name. The `inet:email:header:name` type is derived from the base type: `str`.

An example of `inet:email:header:name`:

- `subject`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:email:message

An individual email message delivered to an inbox. The `inet:email:message` type is derived from the base type: `guid`.

inet:email:message:attachment

A file which was attached to an email message. The `inet:email:message:attachment` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('message', 'inet:email:message'), ('file', 'file:bytes'))`

inet:email:message:link

A url/link embedded in an email message. The `inet:email:message:link` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('message', 'inet:email:message'), ('url', 'inet:url'))`

inet:flow

An individual network connection between a given source and destination. The `inet:flow` type is derived from the base type: `guid`.

inet:group

A group name string. The `inet:group` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:http:header

An HTTP protocol header key/value. The `inet:http:header` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('name', 'inet:http:header:name'), ('value', 'str'))`

inet:http:header:name

The base string type. The `inet:http:header:name` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:http:param

An HTTP request path query parameter. The `inet:http:param` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('name', 'str'), ('value', 'str'))`

inet:http:request

A single HTTP request. The `inet:http:request` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:proto:request`

inet:http:request:header

An HTTP request header. The `inet:http:request:header` type is derived from the base type: `inet:http:header`.

This type has the following options set:

- fields: `(('name', 'inet:http:header:name'), ('value', 'str'))`

inet:http:response:header

An HTTP response header. The `inet:http:response:header` type is derived from the base type: `inet:http:header`.

This type has the following options set:

- fields: `(('name', 'inet:http:header:name'), ('value', 'str'))`

inet:http:session

An HTTP session. The `inet:http:session` type is derived from the base type: `guid`.

inet:iface

A network interface with a set of associated protocol addresses. The `inet:iface` type is derived from the base type: `guid`.

inet:mac

A 48-bit Media Access Control (MAC) address. The `inet:mac` type is derived from the base type: `str`.

An example of `inet:mac`:

- `aa:bb:cc:dd:ee:ff`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^([0-9a-f]{2}[:]){5}([0-9a-f]{2})$`
- replace: `()`
- strip: `False`

inet:net4

An IPv4 address range. The `inet:net4` type is derived from the base type: `inet:ipv4range`.

An example of `inet:net4`:

- `(1.2.3.4, 1.2.3.20)`

This type has the following options set:

- type: `('inet:ipv4', {})`

inet:net6

An IPv6 address range. The `inet:net6` type is derived from the base type: `inet:ipv6range`.

An example of `inet:net6`:

- `('ff::00', 'ff::30')`

This type has the following options set:

- type: `('inet:ipv6', {})`

inet:passwd

A password string. The `inet:passwd` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:port

A network port. The `inet:port` type is derived from the base type: `int`.

An example of `inet:port`:

- `80`

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `65535`
- min: `0`
- signed: `True`
- size: `8`

inet:proto

A network protocol name. The `inet:proto` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z0-9+-]+$`
- replace: `()`
- strip: `False`

inet:search:query

An instance of a search query issued to a search engine. The `inet:search:query` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:action`

inet:search:result

A single result from a web search. The `inet:search:result` type is derived from the base type: `guid`.

inet:server

A network server address. The `inet:server` type is derived from the base type: `inet:addr`.

An example of `inet:server`:

- `tcp://1.2.3.4:80`

This type has the following options set:

- globsuffix: `False`

- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:servfile

A file hosted on a server for access over a network protocol. The `inet:servfile` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('server', 'inet:server'), ('file', 'file:bytes'))`

inet:service:access

Represents a user access request to a service resource. The `inet:service:access` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:action`

inet:service:access:action:taxonomy

A hierarchical taxonomy of service actions. The `inet:service:access:action:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:account

An account within a service platform. Accounts may be instance specific. The `inet:service:account` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:subscriber`

inet:service:app

A platform specific application. The `inet:service:app` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:bucket

A file/blob storage object within a service architecture. The `inet:service:bucket` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:bucket:item

An individual file stored within a bucket. The `inet:service:bucket:item` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:channel

A channel used to distribute messages. The `inet:service:channel` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:channel:member

Represents a service account being a member of a channel. The `inet:service:channel:member` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:emote

An emote or reaction by an account. The `inet:service:emote` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:group

A group or role which contains member accounts. The `inet:service:group` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:group:member

Represents a service account being a member of a group. The `inet:service:group:member` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:instance

An instance of the platform such as Slack or Discord instances. The `inet:service:instance` type is derived from the base type: `guid`.

inet:service:login

A login event for a service account. The `inet:service:login` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:action`

inet:service:login:method:taxonomy

A taxonomy of inet service login methods. The `inet:service:login:method:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:message

A message or post created by an account. The `inet:service:message` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:action`

inet:service:message:attachment

A file attachment included within a message. The `inet:service:message:attachment` type is derived from the base type: `guid`.

inet:service:message:link

A URL link included within a message. The `inet:service:message:link` type is derived from the base type: `guid`.

inet:service:message:type:taxonomy

A message type taxonomy. The `inet:service:message:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:object

An ndef type including all forms which implement the inet:service:object interface. The `inet:service:object` type is derived from the base type: `ndef`.

This type has the following options set:

- interfaces: `('inet:service:object',)`

inet:service:object:status

An object status enumeration. The `inet:service:object:status` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
10	draft
30	available
40	offline
50	removed

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

inet:service:permission

A permission which may be granted to a service account or role. The `inet:service:permission` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:permission:type:taxonomy

A permission type taxonomy. The `inet:service:permission:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:platform

A network platform which provides services. The `inet:service:platform` type is derived from the base type: `guid`.

inet:service:relationship

A relationship between two service objects. The `inet:service:relationship` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:relationship:type:taxonomy

A service object relationship type taxonomy. The `inet:service:relationship:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:resource

A generic resource provided by the service architecture. The `inet:service:resource` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:resource:type:taxonomy

A taxonomy of inet service resource types. The `inet:service:resource:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:rule

A rule which grants or denies a permission to a service account or role. The `inet:service:rule` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:session

An authenticated session. The `inet:service:session` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:subscriber

A node which may subscribe to a service subscription. The `inet:service:subscriber` type is derived from the base type: `ndef`.

This type has the following options set:

- interface: `inet:service:subscriber`

inet:service:subscription

A subscription to a service platform or instance. The `inet:service:subscription` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:service:subscription:level:taxonomy

A taxonomy of platform specific subscription levels. The `inet:service:subscription:level:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:service:tenant

A tenant which groups accounts and instances. The `inet:service:tenant` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:subscriber`

inet:service:thread

A message thread. The `inet:service:thread` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

inet:ssl:cert

Deprecated. Please use inet:tls:servercert or inet:tls:clientcert. The `inet:ssl:cert` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('server', 'inet:server'), ('file', 'file:bytes'))`

inet:ssl:jarmhash

A TLS JARM fingerprint hash. The `inet:ssl:jarmhash` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^(?<ciphers>[0-9a-f]{30})(?<extensions>[0-9a-f]{32})$`
- replace: `()`
- strip: `True`

inet:ssl:jarmsample

A JARM hash sample taken from a server. The `inet:ssl:jarmsample` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('server', 'inet:server'), ('jarmhash', 'inet:ssl:jarmhash'))`

inet:tls:clientcert

An x509 certificate sent by a client for TLS. The `inet:tls:clientcert` type is derived from the base type: `comp`.

An example of `inet:tls:clientcert`:

- `(1.2.3.4:443, 3fdf364e081c14997b291852d1f23868)`

This type has the following options set:

- fields: `(('client', 'inet:client'), ('cert', 'crypto:x509:cert'))`

inet:tls:handshake

An instance of a TLS handshake between a server and client. The `inet:tls:handshake` type is derived from the base type: `guid`.

inet:tls:ja3:sample

A JA3 sample taken from a client. The `inet:tls:ja3:sample` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('client', 'inet:client'), ('ja3', 'hash:md5'))`

inet:tls:ja3s:sample

A JA3 sample taken from a server. The `inet:tls:ja3s:sample` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('server', 'inet:server'), ('ja3s', 'hash:md5'))`

inet:tls:ja4

A JA4 TLS client fingerprint. The `inet:tls:ja4` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^([tqd])([sd\d]\d)([di])(\d{2})(\d{2})([a-zA-Z0-9]{2})_([0-9a-f]{12})_([0-9a-f]{12})$`
- replace: `()`
- strip: `True`

inet:tls:ja4:sample

A JA4 TLS client fingerprint used by a client. The `inet:tls:ja4:sample` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('client', 'inet:client'), ('ja4', 'inet:tls:ja4'))`

inet:tls:ja4s

A JA4S TLS server fingerprint. The `inet:tls:ja4s` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^([tq])([sd\d]\d)(\d{2})([a-zA-Z0-9]{2})_([0-9a-f]{4})_([0-9a-f]{12})$`
- replace: `()`
- strip: `True`

inet:tls:ja4s:sample

A JA4S TLS server fingerprint used by a server. The `inet:tls:ja4s:sample` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('server', 'inet:server'), ('ja4s', 'inet:tls:ja4s'))`

inet:tls:servercert

An x509 certificate sent by a server for TLS. The `inet:tls:servercert` type is derived from the base type: `comp`.

An example of `inet:tls:servercert`:

- `(1.2.3.4:443, c7437790af01ae1bb2f8f3b684c70bf8)`

This type has the following options set:

- fields: `(('server', 'inet:server'), ('cert', 'crypto:x509:cert'))`

inet:tunnel

A specific sequence of hosts forwarding connections such as a VPN or proxy. The `inet:tunnel` type is derived from the base type: `guid`.

inet:tunnel:type:taxonomy

A taxonomy of network tunnel types. The `inet:tunnel:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:url:mirror

A URL mirror site. The `inet:url:mirror` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('of', 'inet:url'), ('at', 'inet:url'))`

inet:urlfile

A file hosted at a specific Universal Resource Locator (URL). The `inet:urlfile` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('url', 'inet:url'), ('file', 'file:bytes'))`

inet:urlredir

A URL that redirects to another URL, such as via a URL shortening service or an HTTP 302 response. The `inet:urlredir` type is derived from the base type: `comp`.

An example of `inet:urlredir`:

- `(http://foo.com/,http://bar.com/)`

This type has the following options set:

- fields: `(('src', 'inet:url'), ('dst', 'inet:url'))`

inet:user

A username string. The `inet:user` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:web:acct

An account with a given Internet-based site or service. The `inet:web:acct` type is derived from the base type: `comp`.

An example of `inet:web:acct`:

- `twitter.com/invisig0th`

This type has the following options set:

- fields: `(('site', 'inet:fqdn'), ('user', 'inet:user'))`
- sepr: `/`

inet:web:action

An instance of an account performing an action at an Internet-based site or service. The `inet:web:action` type is derived from the base type: `guid`.

inet:web:attachment

An instance of a file being sent to a web service by an account. The `inet:web:attachment` type is derived from the base type: `guid`.

inet:web:channel

A channel within a web service or instance such as slack or discord. The `inet:web:channel` type is derived from the base type: `guid`.

inet:web:chprofile

A change to a web account. Used to capture historical properties associated with an account, as opposed to current data in the inet:web:acct node. The `inet:web:chprofile` type is derived from the base type: `guid`.

inet:web:file

A file posted by a web account. The `inet:web:file` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('acct', 'inet:web:acct'), ('file', 'file:bytes'))`

inet:web:follows

A web account follows or is connected to another web account. The `inet:web:follows` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('follower', 'inet:web:acct'), ('followee', 'inet:web:acct'))`

inet:web:group

A group hosted within or registered with a given Internet-based site or service. The `inet:web:group` type is derived from the base type: `comp`.

An example of `inet:web:group`:

- `somesite.com/mycoolgroup`

This type has the following options set:

- fields: `(('site', 'inet:fqdn'), ('id', 'inet:group'))`
- sepr: `/`

inet:web:hashtag

A hashtag used in a web post. The `inet:web:hashtag` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`

- regex: ^#[^\p{Z}#]+$
- replace: ()
- strip: True

inet:web:instance

An instance of a web service such as slack or discord. The inet:web:instance type is derived from the base type: guid.

inet:web:logon

An instance of an account authenticating to an Internet-based site or service. The inet:web:logon type is derived from the base type: guid.

inet:web:memb

Deprecated. Please use inet:web:member. The inet:web:memb type is derived from the base type: comp.

This type has the following options set:

- fields: (('acct', 'inet:web:acct'), ('group', 'inet:web:group'))

inet:web:member

Represents a web account membership in a channel or group. The inet:web:member type is derived from the base type: guid.

inet:web:mesg

A message sent from one web account to another web account or channel. The inet:web:mesg type is derived from the base type: comp.

An example of inet:web:mesg:

- ((twitter.com, invisig0th), (twitter.com, gobbles), 20041012130220)

This type has the following options set:

- fields: (('from', 'inet:web:acct'), ('to', 'inet:web:acct'), ('time', 'time'))

inet:web:post

A post made by a web account. The inet:web:post type is derived from the base type: guid.

inet:web:post:link

A link contained within post text. The inet:web:post:link type is derived from the base type: guid.

inet:whois:contact

An individual contact from a domain whois record. The inet:whois:contact type is derived from the base type: comp.

This type has the following options set:

- fields: (('rec', 'inet:whois:rec'), ('type', ('str', {'lower': True})))

inet:whois:email

An email address associated with an FQDN via whois registration text. The `inet:whois:email` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('fqdn', 'inet:fqdn'), ('email', 'inet:email'))`

inet:whois:ipcontact

An individual contact from an IP block record. The `inet:whois:ipcontact` type is derived from the base type: `guid`.

inet:whois:ipquery

Query details used to retrieve an IP record. The `inet:whois:ipquery` type is derived from the base type: `guid`.

inet:whois:iprec

An IPv4/IPv6 block registration record. The `inet:whois:iprec` type is derived from the base type: `guid`.

inet:whois:rar

A domain registrar. The `inet:whois:rar` type is derived from the base type: `str`.

An example of `inet:whois:rar`:

- `godaddy, inc.`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:whois:rec

A domain whois record. The `inet:whois:rec` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('fqdn', 'inet:fqdn'), ('asof', 'time'))`

inet:whois:recns

A nameserver associated with a domain whois record. The `inet:whois:recns` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('ns', 'inet:fqdn'), ('rec', 'inet:whois:rec'))`

inet:whois:reg

A domain registrant. The `inet:whois:reg` type is derived from the base type: `str`.

An example of `inet:whois:reg`:

- `woot hostmaster`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:whois:regid

The registry unique identifier of the registration record. The `inet:whois:regid` type is derived from the base type: `str`.

An example of `inet:whois:regid`:

- `NET-10-0-0-0-1`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

inet:wifi:ap

An SSID/MAC address combination for a wireless access point. The `inet:wifi:ap` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('ssid', 'inet:wifi:ssid'), ('bssid', 'inet:mac'))`

inet:wifi:ssid

A WiFi service set identifier (SSID) name. The `inet:wifi:ssid` type is derived from the base type: `str`.

An example of `inet:wifi:ssid`:

- `The Vertex Project`

This type has the following options set:

- globsuffix: `False`
- lower: `False`

- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

iso:3166:cc

An ISO 3166 2 digit country code. The `iso:3166:cc` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z]{2}$`
- replace: `()`
- strip: `False`

iso:oid

An ISO Object Identifier string. The `iso:oid` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^([0-2])((\.0)|(\.[1-9][0-9]*))*$`
- replace: `()`
- strip: `False`

it:account

A GUID that represents an account on a host or network. The `it:account` type is derived from the base type: `guid`.

it:adid

An advertising identification string. The `it:adid` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

it:app:snort:hit

An instance of a snort rule hit. The `it:app:snort:hit` type is derived from the base type: `guid`.

it:app:snort:rule

A snort rule. The `it:app:snort:rule` type is derived from the base type: `guid`.

it:app:yara:match

A YARA rule match to a file. The `it:app:yara:match` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('rule', 'it:app:yara:rule'), ('file', 'file:bytes'))`

it:app:yara:netmatch

An instance of a YARA rule network hunting match. The `it:app:yara:netmatch` type is derived from the base type: `guid`.

it:app:yara:procmatch

An instance of a YARA rule match to a process. The `it:app:yara:procmatch` type is derived from the base type: `guid`.

it:app:yara:rule

A YARA rule unique identifier. The `it:app:yara:rule` type is derived from the base type: `guid`.

it:auth:passwdhash

An instance of a password hash. The `it:auth:passwdhash` type is derived from the base type: `guid`.

it:av:filehit

Deprecated. Please use it:av:scan:result. The `it:av:filehit` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('sig', 'it:av:sig'))`

it:av:prochit

Deprecated. Please use it:av:scan:result. The `it:av:prochit` type is derived from the base type: `guid`.

it:av:scan:result

The result of running an antivirus scanner. The `it:av:scan:result` type is derived from the base type: `guid`.

it:av:sig

Deprecated. Please use it:av:scan:result. The `it:av:sig` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('soft', 'it:prod:soft'), ('name', 'it:av:signame'))`

it:av:signame

An antivirus signature name. The `it:av:signame` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:cmd

A unique command-line string. The `it:cmd` type is derived from the base type: `str`.

An example of `it:cmd`:

- `foo.exe --dostuff bar`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

it:cmd:history

A single command executed within a session. The `it:cmd:history` type is derived from the base type: `guid`.

it:cmd:session

A command line session with multiple commands run over time. The `it:cmd:session` type is derived from the base type: `guid`.

it:dev:int

A developer selected integer constant. The `it:dev:int` type is derived from the base type: `int`.

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`

- size: 8

it:dev:mutex

A string representing a mutex. The `it:dev:mutex` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:dev:pipe

A string representing a named pipe. The `it:dev:pipe` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:dev:regkey

A Windows registry key. The `it:dev:regkey` type is derived from the base type: `str`.

An example of `it:dev:regkey`:

- `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:dev:regval

A Windows registry key/value pair. The `it:dev:regval` type is derived from the base type: `guid`.

it:dev:repo

A version control system instance. The `it:dev:repo` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:branch

A branch in a version control system instance. The `it:dev:repo:branch` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:commit

A commit to a repository. The `it:dev:repo:commit` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:diff

A diff of a file being applied in a single commit. The `it:dev:repo:diff` type is derived from the base type: `guid`.

it:dev:repo:diff:comment

A comment on a diff in a repository. The `it:dev:repo:diff:comment` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:issue

An issue raised in a repository. The `it:dev:repo:issue` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:issue:comment

A comment on an issue in a repository. The `it:dev:repo:issue:comment` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:issue:label

A label applied to a repository issue. The `it:dev:repo:issue:label` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:dev:repo:label

A developer selected label. The `it:dev:repo:label` type is derived from the base type: `guid`.

it:dev:repo:remote

A remote repo that is tracked for changes/branches/etc. The `it:dev:repo:remote` type is derived from the base type: `guid`.

it:dev:repo:type:taxonomy

A version control system type taxonomy. The `it:dev:repo:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:dev:str

A developer selected string. The `it:dev:str` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:domain

A logical boundary of authentication and configuration such as a windows domain. The `it:domain` type is derived from the base type: `guid`.

it:exec:bind

An instance of a host binding a listening port. The `it:exec:bind` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:file:add

An instance of a host adding a file to a filesystem. The `it:exec:file:add` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:file:del

An instance of a host deleting a file from a filesystem. The `it:exec:file:del` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:file:read

An instance of a host reading a file from a filesystem. The `it:exec:file:read` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:file:write

An instance of a host writing a file to a filesystem. The `it:exec:file:write` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:loadlib

A library load event in a process. The `it:exec:loadlib` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:mmap

A memory mapped segment located in a process. The `it:exec:mmap` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:mutex

A mutex created by a process at runtime. The `it:exec:mutex` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:pipe

A named pipe created by a process at runtime. The `it:exec:pipe` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:proc

A process executing on a host. May be an actual (e.g., endpoint) or virtual (e.g., malware sandbox) host. The `it:exec:proc` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:query

An instance of an executed query. The `it:exec:query` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:reg:del

An instance of a host deleting a registry key. The `it:exec:reg:del` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:reg:get

An instance of a host getting a registry key. The `it:exec:reg:get` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:reg:set

An instance of a host creating or setting a registry key. The `it:exec:reg:set` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:thread

A thread executing in a process. The `it:exec:thread` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:exec:url

An instance of a host requesting a URL using any protocol scheme. The `it:exec:url` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:fs:file

A file on a host. The `it:fs:file` type is derived from the base type: `guid`.

it:group

A GUID that represents a group on a host or network. The `it:group` type is derived from the base type: `guid`.

it:host

A GUID that represents a host or system. The `it:host` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`
- `phys:object`

it:host:tenancy

A time window where a host was a tenant run by another host. The `it:host:tenancy` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:hostname

The name of a host or system. The `it:hostname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

it:hostsoft

A version of a software product which is present on a given host. The `it:hostsoft` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('host', 'it:host'), ('softver', 'it:prod:softver'))`

it:hosturl

A url hosted on or served by a host or system. The `it:hosturl` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('host', 'it:host'), ('url', 'inet:url'))`

it:log:event

A GUID representing an individual log event. The `it:log:event` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:log:event:type:taxonomy

A taxonomy of log event types. The `it:log:event:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:logon

A GUID that represents an individual logon/logoff event. The `it:logon` type is derived from the base type: `guid`.

it:mitre:attack:campaign

A MITRE ATT&CK Campaign ID. The `it:mitre:attack:campaign` type is derived from the base type: `str`.

An example of `it:mitre:attack:campaign`:

- `C0028`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^C[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:data:component

A MITRE ATT&CK data component. The `it:mitre:attack:data:component` type is derived from the base type: `guid`.

it:mitre:attack:datasource

A MITRE ATT&CK Datasource ID. The `it:mitre:attack:datasource` type is derived from the base type: `str`.

An example of `it:mitre:attack:datasource`:

- `DS0026`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^DS[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:flow

A MITRE ATT&CK Flow diagram. The `it:mitre:attack:flow` type is derived from the base type: `guid`.

it:mitre:attack:group

A MITRE ATT&CK Group ID. The `it:mitre:attack:group` type is derived from the base type: `str`.

An example of `it:mitre:attack:group`:

- `G0100`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^G[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:matrix

An enumeration of ATT&CK matrix values. The `it:mitre:attack:matrix` type is derived from the base type: `str`.

An example of `it:mitre:attack:matrix`:

- `enterprise`

This type has the following options set:

- enums:

valu
enterprise
mobile
ics

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:mitre:attack:mitigation

A MITRE ATT&CK Mitigation ID. The `it:mitre:attack:mitigation` type is derived from the base type: `str`.

An example of `it:mitre:attack:mitigation`:

- `M1036`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^M[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:software

A MITRE ATT&CK Software ID. The `it:mitre:attack:software` type is derived from the base type: `str`.

An example of `it:mitre:attack:software`:

- `S0154`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^S[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:status

A MITRE ATT&CK element status. The `it:mitre:attack:status` type is derived from the base type: `str`.

An example of `it:mitre:attack:status`:

- `current`

This type has the following options set:

- enums:

valu
current
deprecated
withdrawn

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:mitre:attack:tactic

A MITRE ATT&CK Tactic ID. The `it:mitre:attack:tactic` type is derived from the base type: `str`.

An example of `it:mitre:attack:tactic`:

- `TA0040`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^TA[0-9]{4}$`
- replace: `()`
- strip: `False`

it:mitre:attack:technique

A MITRE ATT&CK Technique ID. The `it:mitre:attack:technique` type is derived from the base type: `str`.

An example of `it:mitre:attack:technique`:

- `T1548`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^T[0-9]{4}(.[0-9]{3})?$`
- replace: `()`
- strip: `False`

it:network

A GUID that represents a logical network. The `it:network` type is derived from the base type: `guid`.

it:network:type:taxonomy

A taxonomy of network types. The `it:network:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:os:android:aaid

Deprecated. Please use it:adid. The `it:os:android:aaid` type is derived from the base type: `it:adid`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

it:os:android:ibroadcast

The given software broadcasts the given Android intent. The `it:os:android:ibroadcast` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('app', 'it:prod:soft'), ('intent', 'it:os:android:intent'))`

it:os:android:ilisten

The given software listens for an android intent. The `it:os:android:ilisten` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('app', 'it:prod:soft'), ('intent', 'it:os:android:intent'))`

it:os:android:intent

An android intent string. The `it:os:android:intent` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:os:android:perm

An android permission string. The `it:os:android:perm` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:os:android:reqperm

The given software requests the android permission. The `it:os:android:reqperm` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('app', 'it:prod:soft'), ('perm', 'it:os:android:perm'))`

it:os:ios:idfa

Deprecated. Please use it:adid. The `it:os:ios:idfa` type is derived from the base type: `it:adid`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`

- replace: ()
- strip: True

it:os:windows:service

A Microsoft Windows service configuration on a host. The it:os:windows:service type is derived from the base type: guid.

it:os:windows:sid

A Microsoft Windows Security Identifier. The it:os:windows:sid type is derived from the base type: str.

An example of it:os:windows:sid:

- S-1-5-21-1220945662-1202665555-839525555-5555

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: ^S-1-(?:\d{1,10}|0x[0-9a-fA-F]{12})(?:-(?:\d+|0x[0-9a-fA-F]{2,}))*$
- replace: ()
- strip: False

it:prod:component

A specific instance of an it:prod:hardware most often as part of an it:host. The it:prod:component type is derived from the base type: guid.

it:prod:hardware

A specification for a piece of IT hardware. The it:prod:hardware type is derived from the base type: guid.

it:prod:hardwaretype

An IT hardware type taxonomy. The it:prod:hardwaretype type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

it:prod:soft

A software product. The `it:prod:soft` type is derived from the base type: `guid`.

it:prod:soft:taxonomy

A software type taxonomy. The `it:prod:soft:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:prod:softfile

A file is distributed by a specific software version. The `it:prod:softfile` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('soft', 'it:prod:softver'), ('file', 'file:bytes'))`

it:prod:softid

An identifier issued to a given host by a specific software application. The `it:prod:softid` type is derived from the base type: `guid`.

it:prod:softlib

A software version contains a library software version. The `it:prod:softlib` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('soft', 'it:prod:softver'), ('lib', 'it:prod:softver'))`

it:prod:softname

A software product name. The `it:prod:softname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

it:prod:softos

The software version is known to be compatible with the given os software version. The `it:prod:softos` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('soft', 'it:prod:softver'), ('os', 'it:prod:softver'))`

it:prod:softreg

A registry entry is created by a specific software version. The `it:prod:softreg` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('softver', 'it:prod:softver'), ('regval', 'it:dev:regval'))`

it:prod:softver

A specific version of a software product. The `it:prod:softver` type is derived from the base type: `guid`.

it:query

A unique query string. The `it:query` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

it:reveng:filefunc

An instance of a function in an executable. The `it:reveng:filefunc` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('file', 'file:bytes'), ('function', 'it:reveng:function'))`

it:reveng:funcstr

A reference to a string inside a function. The `it:reveng:funcstr` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('function', 'it:reveng:function'), ('string', 'str'))`

it:reveng:function

A function inside an executable. The `it:reveng:function` type is derived from the base type: `guid`.

it:reveng:impfunc

A function from an imported library. The `it:reveng:impfunc` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `1`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:screenshot

A screenshot of a host. The `it:screenshot` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `it:host:activity`

it:sec:c2:config

An extracted C2 config from an executable. The `it:sec:c2:config` type is derived from the base type: `guid`.

it:sec:cve

A vulnerability as designated by a Common Vulnerabilities and Exposures (CVE) number. The `it:sec:cve` type is derived from the base type: `str`.

An example of `it:sec:cve`:

- `cve-2012-0158`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `(?i)^CVE-[0-9]{4}-[0-9]{4,}$`
- replace: `(('-', '-'), ('-', '-'), ('-', '-'), ('-', '-'))`
- strip: `False`

it:sec:cwe

NIST NVD Common Weaknesses Enumeration Specification. The `it:sec:cwe` type is derived from the base type: `str`.

An example of `it:sec:cwe`:

- `CWE-120`

This type has the following options set:

- globsuffix: `False`
- lower: `False`

- onespace: `False`
- regex: `^CWE-[0-9]{1,8}$`
- replace: `()`
- strip: `False`

it:sec:metrics

A node used to track metrics of an organization's infosec program. The `it:sec:metrics` type is derived from the base type: `guid`.

it:sec:stix:bundle

A STIX bundle. The `it:sec:stix:bundle` type is derived from the base type: `guid`.

it:sec:stix:indicator

A STIX indicator pattern. The `it:sec:stix:indicator` type is derived from the base type: `guid`.

it:sec:tlp

The US CISA Traffic-Light-Protocol used to designate information sharing boundaries. The `it:sec:tlp` type is derived from the base type: `int`.

An example of `it:sec:tlp`:

- `green`

This type has the following options set:

- enums:

int	valu
10	clear
20	green
30	amber
40	amber-strict
50	red

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

it:sec:vuln:scan

An instance of running a vulnerability scan. The `it:sec:vuln:scan` type is derived from the base type: `guid`.

it:sec:vuln:scan:result

A vulnerability scan result for an asset. The `it:sec:vuln:scan:result` type is derived from the base type: `guid`.

it:software:image

The base image used to create a container or OS. The `it:software:image` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `inet:service:object`

it:software:image:type:taxonomy

A taxonomy of software image types. The `it:software:image:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

it:storage:mount

A storage volume that has been attached to an image. The `it:storage:mount` type is derived from the base type: `guid`.

it:storage:volume

A physical or logical storage volume that can be attached to a physical/virtual machine or container. The `it:storage:volume` type is derived from the base type: `guid`.

it:storage:volume:type:taxonomy

A taxonomy of storage volume types. The `it:storage:volume:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

An example of `it:storage:volume:type:taxonomy`:

- `network.smb`

This type has the following options set:

- globsuffix: `False`

- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

lang:code

An optionally 2 part language code. The `lang:code` type is derived from the base type: `str`.

An example of `lang:code`:

- `pt.br`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z]{2}(.[a-z]{2})?$`
- replace: `()`
- strip: `False`

lang:idiom

Deprecated. Please use lang:translation. The `lang:idiom` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

lang:language

A specific written or spoken language. The `lang:language` type is derived from the base type: `guid`.

lang:name

A name used to refer to a language. The `lang:name` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`

- replace: ()
- strip: False

lang:phrase

A small group of words which stand together as a concept. The lang:phrase type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: True
- regex: None
- replace: ()
- strip: False

lang:trans

Deprecated. Please use lang:translation. The lang:trans type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

lang:translation

A translation of text from one language to another. The lang:translation type is derived from the base type: guid.

markdown

A markdown string. The markdown type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

mass

A mass which converts to grams as a base unit. The `mass` type is derived from the base type: `hugenum`.

This type has the following options set:

- modulo: `None`
- units: `{'µg': '0.000001', 'microgram': '0.000001', 'micrograms': '0.000001', 'mg': '0.001', 'milligram': '0.001', 'milligrams': '0.001', 'g': '1', 'grams': '1', 'kg': '1000', 'kilogram': '1000', 'kilograms': '1000', 'lb': '453.592', 'lbs': '453.592', 'pound': '453.592', 'pounds': '453.592', 'stone': '6350.29'}`

mat:item

A GUID assigned to a material object. The `mat:item` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `phys:object`
- `geo:locatable`

mat:itemimage

The base type for compound node fields. The `mat:itemimage` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('item', 'mat:item'), ('file', 'file:bytes'))`

mat:spec

A GUID assigned to a material specification. The `mat:spec` type is derived from the base type: `guid`.

mat:specimage

The base type for compound node fields. The `mat:specimage` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('spec', 'mat:spec'), ('file', 'file:bytes'))`

mat:type

A taxonomy of material item/specification types. The `mat:type` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

math:algorithm

A mathematical algorithm. The `math:algorithm` type is derived from the base type: `guid`.

math:algorithm:type:taxonomy

A hierarchical taxonomy of algorithm types. The `math:algorithm:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

media:news

A GUID for a news article or report. The `media:news` type is derived from the base type: `guid`.

media:news:taxonomy

A taxonomy of types or sources of news. The `media:news:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

media:topic

A topic string. The `media:topic` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`

- strip: `False`

meta:activity

A generic activity level enumeration. The `meta:activity` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
0	none
10	lowest
20	low
30	medium
40	high
50	highest

- enums:strict: `False`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

meta:aggregate

A node which represents an aggregate count of a specific type. The `meta:aggregate` type is derived from the base type: `guid`.

meta:aggregate:type:taxonomy

A type of item being counted in aggregate. The `meta:aggregate:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

meta:event

An analytically relevant event in a curated timeline. The `meta:event` type is derived from the base type: `guid`.

meta:event:taxonomy

A taxonomy of event types for meta:event nodes. The `meta:event:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

meta:feed

A data feed provided by a specific source. The `meta:feed` type is derived from the base type: `guid`.

meta:feed:type:taxonomy

A data feed type taxonomy. The `meta:feed:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

meta:note

An analyst note about nodes linked with -(about)> edges. The `meta:note` type is derived from the base type: `guid`.

meta:note:type:taxonomy

An analyst note type taxonomy. The `meta:note:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

meta:priority

A generic priority enumeration. The `meta:priority` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
0	none
10	lowest
20	low
30	medium
40	high
50	highest

- enums:strict: `False`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

meta:rule

A generic rule linked to matches with -(matches)> edges. The `meta:rule` type is derived from the base type: `guid`.

meta:rule:type:taxonomy

A taxonomy for meta:rule types. The `meta:rule:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`

- regex: None
- replace: ()
- strip: False

meta:ruleset

A set of rules linked with -(has)> edges. The meta:ruleset type is derived from the base type: guid.

meta:ruleset:type:taxonomy

A taxonomy for meta:ruleset types. The meta:ruleset:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

meta:seen

Annotates that the data in a node was obtained from or observed by a given source. The meta:seen type is derived from the base type: comp.

This type has the following options set:

- fields: (('source', 'meta:source'), ('node', 'ndef'))

meta:severity

A generic severity enumeration. The meta:severity type is derived from the base type: int.

This type has the following options set:

- enums:

int	valu
0	none
10	lowest
20	low
30	medium
40	high
50	highest

- enums:strict: False
- fmt: %d

- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

meta:sophistication

A sophistication score with named values: very low, low, medium, high, and very high. The `meta:sophistication` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
10	very low
20	low
30	medium
40	high
50	very high

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

meta:source

A data source unique identifier. The `meta:source` type is derived from the base type: `guid`.

meta:timeline

A curated timeline of analytically relevant events. The `meta:timeline` type is derived from the base type: `guid`.

meta:timeline:taxonomy

A taxonomy of timeline types for meta:timeline nodes. The `meta:timeline:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:alias

Deprecated. Please use ou:name. The `ou:alias` type is derived from the base type: `str`.

An example of `ou:alias`:

- `vertexproject`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[\w0-9_]+$`
- replace: `()`
- strip: `False`

ou:asset

A node for tracking assets which belong to an organization. The `ou:asset` type is derived from the base type: `guid`.

ou:asset:status:taxonomy

An asset status taxonomy. The `ou:asset:status:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:asset:type:taxonomy

An asset type taxonomy. The `ou:asset:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:attendee

A node representing a person attending a meeting, conference, or event. The `ou:attendee` type is derived from the base type: `guid`.

ou:award

An award issued by an organization. The `ou:award` type is derived from the base type: `guid`.

ou:campaign

Represents an org's activity in pursuit of a goal. The `ou:campaign` type is derived from the base type: `guid`.

ou:campname

A campaign name. The `ou:campname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

ou:camptype

An campaign type taxonomy. The `ou:camptype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:candidate

A candidate being considered for a role within an organization. The `ou:candidate` type is derived from the base type: `guid`.

ou:candidate:method:taxonomy

A taxonomy of methods by which a candidate came under consideration. The `ou:candidate:method:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:conference

A conference with a name and sponsoring org. The `ou:conference` type is derived from the base type: `guid`.

ou:conference:attendee

Deprecated. Please use ou:attendee. The `ou:conference:attendee` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('conference', 'ou:conference'), ('person', 'ps:person'))`

ou:conference:event

A conference event with a name and associated conference. The `ou:conference:event` type is derived from the base type: `guid`.

ou:conference:event:attendee

Deprecated. Please use ou:attendee. The `ou:conference:event:attendee` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('conference', 'ou:conference:event'), ('person', 'ps:person'))`

ou:conflict

Represents a conflict where two or more campaigns have mutually exclusive goals. The `ou:conflict` type is derived from the base type: `guid`.

ou:contest

A competitive event resulting in a ranked set of participants. The ou:contest type is derived from the base type: guid.

ou:contest:result

The results from a single contest participant. The ou:contest:result type is derived from the base type: comp.

This type has the following options set:

- fields: (('contest', 'ou:contest'), ('participant', 'ps:contact'))

ou:contract

An contract between multiple entities. The ou:contract type is derived from the base type: guid.

ou:contract:type

A pre-defined set of contract types. The ou:contract:type type is derived from the base type: str.

This type has the following options set:

- enum: ('nda', 'other', 'grant', 'treaty', 'purchase', 'indemnity', 'partnership')
- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

ou:contribution

Represents a specific instance of contributing material support to a campaign. The ou:contribution type is derived from the base type: guid.

ou:conttype

A contract type taxonomy. The ou:conttype type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

ou:employment

An employment type taxonomy. The `ou:employment` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

An example of `ou:employment`:

- `fulltime.salary`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:enacted

An organization enacting a document. The `ou:enacted` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `proj:task`

ou:enacted:status:taxonomy

A taxonomy of enacted statuses. The `ou:enacted:status:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:goal

An assessed or stated goal which may be abstract or org specific. The `ou:goal` type is derived from the base type: `guid`.

ou:goal:type:taxonomy

A taxonomy of goal types. The `ou:goal:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:goalname

A goal name. The `ou:goalname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

ou:hasalias

The knowledge that an organization has an alias. The `ou:hasalias` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('alias', 'ou:alias'))`

ou:hasgoal

Deprecated. Please use ou:org:goals. The `ou:hasgoal` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('goal', 'ou:goal'))`

ou:id:number

A unique id number issued by a specific organization. The `ou:id:number` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('type', 'ou:id:type'), ('value', 'ou:id:value'))`

ou:id:type

A type of id number issued by an org. The `ou:id:type` type is derived from the base type: `guid`.

ou:id:update

A status update to an org:id:number. The `ou:id:update` type is derived from the base type: `guid`.

ou:id:value

The value of an org:id:number. The `ou:id:value` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

ou:industry

An industry classification type. The `ou:industry` type is derived from the base type: `guid`.

ou:industry:type:taxonomy

An industry type taxonomy. The `ou:industry:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:industryname

The name of an industry. The `ou:industryname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`

- strip: `False`

ou:isic

An International Standard Industrial Classification of All Economic Activities (ISIC) code. The `ou:isic` type is derived from the base type: `str`.

An example of `ou:isic`:

- `C1393`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[A-Z]([0-9]{2}[0-9]{0,2})?$`
- replace: `()`
- strip: `False`

ou:jobtitle

A title for a position within an org. The `ou:jobtitle` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

ou:jobtype

A taxonomy of job types. The `ou:jobtype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

An example of `ou:jobtype`:

- `it.dev.python`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:meet

An informal meeting of people which has no title or sponsor. See also: ou:conference. The `ou:meet` type is derived from the base type: `guid`.

ou:meet:attendee

Deprecated. Please use ou:attendee. The `ou:meet:attendee` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('meet', 'ou:meet'), ('person', 'ps:person'))`

ou:member

Deprecated. Please use ou:position. The `ou:member` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('person', 'ps:person'))`

ou:naics

North American Industry Classification System codes and prefixes. The `ou:naics` type is derived from the base type: `str`.

An example of `ou:naics`:

- `541715`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[1-9][0-9]{1,5}?$`
- replace: `()`
- strip: `True`

ou:name

The name of an organization. This may be a formal name or informal name of the organization. The `ou:name` type is derived from the base type: `str`.

An example of `ou:name`:

- `acme corporation`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

ou:opening

A job/work opening within an org. The `ou:opening` type is derived from the base type: `guid`.

ou:org

A GUID for a human organization such as a company or military unit. The `ou:org` type is derived from the base type: `guid`.

ou:org:has

An org owns, controls, or has exclusive use of an object or resource, potentially during a specific period of time. The `ou:org:has` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('node', 'ndef'))`

ou:orgnet4

An organization's IPv4 netblock. The `ou:orgnet4` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('net', 'inet:net4'))`

ou:orgnet6

An organization's IPv6 netblock. The `ou:orgnet6` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('net', 'inet:net6'))`

ou:orgtype

An org type taxonomy. The `ou:orgtype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:position

A position within an org. May be organized into an org chart. The `ou:position` type is derived from the base type: `guid`.

ou:preso

A webinar, conference talk, or other type of presentation. The ou:preso type is derived from the base type: guid.

ou:requirement

A specific requirement. The ou:requirement type is derived from the base type: guid.

ou:requirement:type:taxonomy

A taxonomy of requirement types. The ou:requirement:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

ou:role

A named role when participating in an event. The ou:role type is derived from the base type: str.

An example of ou:role:

- staff

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: False
- regex: ^\w+$
- replace: ()
- strip: False

ou:sic

The four digit Standard Industrial Classification Code. The ou:sic type is derived from the base type: str.

An example of ou:sic:

- 0111

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False

- regex: `^[0-9]{4}$`
- replace: `()`
- strip: `False`

ou:suborg

Any parent/child relationship between two orgs. May represent ownership, organizational structure, etc. The `ou:suborg` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('sub', 'ou:org'))`

ou:team

A GUID for a team within an organization. The `ou:team` type is derived from the base type: `guid`.

ou:technique

A specific technique used to achieve a goal. The `ou:technique` type is derived from the base type: `guid`.

ou:technique:taxonomy

An analyst defined taxonomy to classify techniques in different disciplines. The `ou:technique:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ou:user

A user name within an organization. The `ou:user` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('org', 'ou:org'), ('user', 'inet:user'))`

ou:vitals

Vital statistics about an org for a given time period. The `ou:vitals` type is derived from the base type: `guid`.

pe:langid

The PE language id. The `pe:langid` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
0	neutral
1	ar
2	bg
3	ca
4	zh-Hans
5	cs
6	da
7	de
8	el
9	en
10	es
11	fi
12	fr
13	he
14	hu
15	is
16	it
17	ja
18	ko
19	nl
20	no
21	pl
22	pt
23	rm
24	ro
25	ru
26	hr
27	sk
28	sq
29	sv
30	th
31	tr
32	ur
33	id
34	uk
35	be
36	sl
37	et
38	lv
39	lt
40	tg
41	fa
42	vi
43	hy
44	az

continues on next page

Table 1 – continued from previous page

int	valu
45	eu
46	hsb
47	mk
48	st
49	ts
50	tn
51	ve
52	xh
53	zu
54	af
55	ka
56	fo
57	hi
58	mt
59	se
60	ga
61	yi
62	ms
63	kk
64	ky
65	sw
66	tk
67	uz
68	tt
69	bn
70	pa
71	gu
72	or
73	ta
74	te
75	kn
76	ml
77	as
78	mr
79	sa
80	mn
81	bo
82	cy
83	km
84	lo
85	my
86	gl
87	kok
88	mni
89	sd
90	syr
91	si
92	chr
93	iu
94	am

continues on next page

Table 1 – continued from previous page

int	valu
95	tzm
96	ks
97	ne
98	fy
99	ps
100	fil
101	dv
102	bin
103	ff
104	ha
105	ibb
106	yo
107	quz
108	nso
109	ba
110	lb
111	kl
112	ig
113	kr
114	om
115	ti
116	gn
117	haw
118	la
119	so
120	ii
121	pap
122	arn
123	undefined and unreserved 0x007B
124	moh
125	undefined and unreserved 0x007D
126	br
127	invariant
128	ug
129	mi
130	oc
131	co
132	gsw
133	sah
134	quc
135	rw
136	wo
137	undefined and unreserved 0x0089
138	undefined and unreserved 0x008A
139	undefined and unreserved 0x008B
140	prs
141	undefined and unreserved 0x008D
142	undefined and unreserved 0x008E
143	undefined and unreserved 0x008F
144	undefined and unreserved 0x0090

continues on next page

Table 1 – continued from previous page

int	valu
145	gd
146	ku
147	quc, reserved
1024	default
1025	ar-SA
1026	bg-BG
1027	ca-ES
1028	zh-TW
1029	cs-CZ
1030	da-DK
1031	de-DE
1032	el-GR
1033	en-US
1034	es-ES_tradnl
1035	fi-FI
1036	fr-FR
1037	he-IL
1038	hu-HU
1039	is-IS
1040	it-IT
1041	ja-JP
1042	ko-KR
1043	nl-NL
1044	nb-NO
1045	pl-PL
1046	pt-BR
1047	rm-CH
1048	ro-RO
1049	ru-RU
1050	hr-HR
1051	sk-SK
1052	sq-AL
1053	sv-SE
1054	th-TH
1055	tr-TR
1056	ur-PK
1057	id-ID
1058	uk-UA
1059	be-BY
1060	sl-SI
1061	et-EE
1062	lv-LV
1063	lt-LT
1064	tg-Cyrl-TJ
1065	fa-IR
1066	vi-VN
1067	hy-AM
1068	az-Latn-AZ
1069	eu-ES
1070	hsb-DE

continues on next page

Table 1 – continued from previous page

int	valu
1071	mk-MK
1072	st-ZA
1073	ts-ZA
1074	tn-ZA
1075	ve-ZA
1076	xh-ZA
1077	zu-ZA
1078	af-ZA
1079	ka-GE
1080	fo-FO
1081	hi-IN
1082	mt-MT
1083	se-NO
1085	yi-001
1086	ms-MY
1087	kk-KZ
1088	ky-KG
1089	sw-KE
1090	tk-TM
1091	uz-Latn-UZ
1092	tt-RU
1093	bn-IN
1094	pa-IN
1095	gu-IN
1096	or-IN
1097	ta-IN
1098	te-IN
1099	kn-IN
1100	ml-IN
1101	as-IN
1102	mr-IN
1103	sa-IN
1104	mn-MN
1105	bo-CN
1106	cy-GB
1107	km-KH
1108	lo-LA
1109	my-MM
1110	gl-ES
1111	kok-IN
1112	mni-IN
1113	sd-Deva-IN
1114	syr-SY
1115	si-LK
1116	chr-Cher-US
1117	iu-Cans-CA
1118	am-ET
1119	tzm-Arab-MA
1120	ks-Arab
1121	ne-NP

continues on next page

Table 1 – continued from previous page

int	valu
1122	fy-NL
1123	ps-AF
1124	fil-PH
1125	dv-MV
1126	bin-NG
1127	ff-NG
1128	ha-Latn-NG
1129	ibb-NG
1130	yo-NG
1131	quz-BO
1132	nso-ZA
1133	ba-RU
1134	lb-LU
1135	kl-GL
1136	ig-NG
1137	kr-Latn-NG
1138	om-ET
1139	ti-ET
1140	gn-PY
1141	haw-US
1142	la-VA
1143	so-SO
1144	ii-CN
1145	pap-029
1146	arn-CL
1148	moh-CA
1150	br-FR
1152	ug-CN
1153	mi-NZ
1154	oc-FR
1155	co-FR
1156	gsw-FR
1157	sah-RU
1158	quc-Latn-GT
1159	rw-RW
1160	wo-SN
1164	prs-AF
1165	plt-MG
1166	zh-yue-HK
1167	tdd-Tale-CN
1168	khb-Talu-CN
1169	gd-GB
1170	ku-Arab-IQ
1171	quc-CO, reserved
1281	qps-ploc
1534	qps-ploca
2048	sys default
2049	ar-IQ
2051	ca-ES-Valencia
2052	zh-CN

continues on next page

Table 1 – continued from previous page

int	valu
2055	de-CH
2057	en-GB
2058	es-MX
2060	fr-BE
2064	it-CH
2065	ja-Ploc-JP
2067	nl-BE
2068	nn-NO
2070	pt-PT
2072	ro-MD
2073	ru-MD
2074	sr-Latn-CS
2077	sv-FI
2080	ur-IN
2087	undefined and unreserved 0x0827
2092	az-Cyrl-AZ
2094	dsb-DE
2098	tn-BW
2107	se-SE
2108	ga-IE
2110	ms-BN
2111	kk-Latn-KZ
2115	uz-Cyrl-UZ
2117	bn-BD
2118	pa-Arab-PK
2121	ta-LK
2128	mn-Mong-CN
2129	bo-BT
2137	sd-Arab-PK
2141	iu-Latn-CA
2143	tzm-Latn-DZ
2144	ks-Deva-IN
2145	ne-IN
2151	ff-Latn-SN
2155	quz-EC
2163	ti-ER
2559	qps-plocm
3072	custom default
3073	ar-EG
3076	zh-HK
3079	de-AT
3081	en-AU
3082	es-ES
3084	fr-CA
3098	sr-Cyrl-CS
3131	se-FI
3152	mn-Mong-MN
3153	dz-BT
3167	tzm-MA
3179	quz-PE

continues on next page

Table 1 – continued from previous page

int	valu
4096	custom unspecified
4097	ar-LY
4100	zh-SG
4103	de-LU
4105	en-CA
4106	es-GT
4108	fr-CH
4122	hr-BA
4155	smj-NO
4191	tzm-Tfng-MA
5120	ui_custom_default
5121	ar-DZ
5124	zh-MO
5127	de-LI
5129	en-NZ
5130	es-CR
5132	fr-LU
5146	bs-Latn-BA
5179	smj-SE
6145	ar-MA
6153	en-IE
6154	es-PA
6156	fr-MC
6170	sr-Latn-BA
6203	sma-NO
7169	ar-TN
7177	en-ZA
7178	es-DO
7180	fr-029
7194	sr-Cyrl-BA
7227	sma-SE
8192	custom transient 0x2000
8193	ar-OM
8200	undefined and unreserved 0x2008
8201	en-JM
8202	es-VE
8204	fr-RE
8218	bs-Cyrl-BA
8251	sms-FI
9216	custom transient 0x2400
9217	ar-YE
9225	en-029
9226	es-CO
9228	fr-CD
9242	sr-Latn-RS
9275	smn-FI
10240	custom transient 0x2800
10241	ar-SY
10249	en-BZ
10250	es-PE

continues on next page

Table 1 – continued from previous page

int	valu
10252	fr-SN
10266	sr-Cyrl-RS
11264	custom transient 0x2C00
11265	ar-JO
11273	en-TT
11274	es-AR
11276	fr-CM
11290	sr-Latn-ME
12288	custom transient 0x3000
12289	ar-LB
12297	en-ZW
12298	es-EC
12300	fr-CI
12314	sr-Cyrl-ME
13312	custom transient 0x3400
13313	ar-KW
13321	en-PH
13322	es-CL
13324	fr-ML
14336	custom transient 0x3800
14337	ar-AE
14345	en-ID
14346	es-UY
14348	fr-MA
15360	custom transient 0x3C00
15361	ar-BH
15369	en-HK
15370	es-PY
15372	fr-HT
16384	custom transient 0x4000
16385	ar-QA
16393	en-IN
16394	es-BO
17408	custom transient 0x4400
17409	ar-Ploc-SA
17417	en-MY
17418	es-SV
18432	custom transient 0x4800
18433	ar-145
18441	en-SG
18442	es-HN
19456	custom transient 0x4C00
19465	en-AE
19466	es-NI
20489	en-BH
20490	es-PR
21513	en-EG
21514	es-US
22537	en-JO
22538	es-419

continues on next page

Table 1 – continued from previous page

int	valu
23561	en-KW
23562	es-CU
24585	en-TR
25609	en-YE
25626	bs-Cyrl
26650	bs-Latn
27674	sr-Cyrl
28698	sr-Latn
28731	smn
29740	az-Cyrl
29755	sms
30724	zh
30740	nn
30746	bs
30764	az-Latn
30779	sma
30783	kk-Cyrl
30787	uz-Cyrl
30800	mn-Cyrl
30813	iu-Cans
30815	tzm-Tfng
31748	zh-Hant
31764	nb
31770	sr
31784	tg-Cyrl
31790	dsb
31803	smj
31807	kk-Latn
31811	uz-Latn
31814	pa-Arab
31824	mn-Mong
31833	sd-Arab
31836	chr-Cher
31837	iu-Latn
31839	tzm-Latn
31847	ff-Latn
31848	ha-Latn
31890	ku-Arab
58380	fr-015
61166	reserved 0xEEEE
62190	reserved 0xF2EE

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`

- min: `None`
- signed: `True`
- size: `8`

pe:resource:type

The typecode for the resource. The `pe:resource:type` type is derived from the base type: `int`.

This type has the following options set:

- enums:

int	valu
1	RT_CURSOR
2	RT_BITMAP
3	RT_ICON
4	RT_MENU
5	RT_DIALOG
6	RT_STRING
7	RT_FONTDIR
8	RT_FONT
9	RT_ACCELERATOR
10	RT_RCDATA
11	RT_MESSAGETABLE
12	RT_GROUP_CURSOR
14	RT_GROUP_ICON
16	RT_VERSION
17	RT_DLGINCLUDE
19	RT_PLUGPLAY
20	RT_VXD
21	RT_ANICURSOR
22	RT_ANIICON
23	RT_HTML
24	RT_MANIFEST

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

phys:contained

A node which represents a physical object containing another physical object. The `phys:contained` type is derived from the base type: `guid`.

phys:contained:type:taxonomy

A taxonomy for types of contained relationships. The `phys:contained:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

phys:object

A node which represents a physical object. The `phys:object` type is derived from the base type: `ndef`.

This type has the following options set:

- interface: `phys:object`

plan:phase

A phase within a planning system which may be used to group steps within a procedure. The `plan:phase` type is derived from the base type: `guid`.

plan:procedure

A procedure consisting of steps. The `plan:procedure` type is derived from the base type: `guid`.

plan:procedure:link

A link between steps in a procedure. The `plan:procedure:link` type is derived from the base type: `guid`.

plan:procedure:step

A step within a procedure. The `plan:procedure:step` type is derived from the base type: `guid`.

plan:procedure:type:taxonomy

A taxonomy of procedure types. The `plan:procedure:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`

- regex: None
- replace: ()
- strip: False

plan:procedure:variable

A variable used by a procedure. The plan:procedure:variable type is derived from the base type: guid.

plan:system

A planning or behavioral analysis system that defines phases and procedures. The plan:system type is derived from the base type: guid.

pol:candidate

A candidate for office in a specific race. The pol:candidate type is derived from the base type: guid.

pol:country

A GUID for a country. The pol:country type is derived from the base type: guid.

pol:election

An election involving one or more races for office. The pol:election type is derived from the base type: guid.

pol:immigration:status

A node which tracks the immigration status of a contact. The pol:immigration:status type is derived from the base type: guid.

pol:immigration:status:type:taxonomy

A taxonomy of immigration types. The pol:immigration:status:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

pol:iso2

The 2 digit ISO 3166 country code. The pol:iso2 type is derived from the base type: str.

An example of pol:iso2:

- us

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z0-9]{2}$`
- replace: `()`
- strip: `False`

pol:iso3

The 3 digit ISO 3166 country code. The `pol:iso3` type is derived from the base type: `str`.

An example of `pol:iso3`:

- `usa`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z0-9]{3}$`
- replace: `()`
- strip: `False`

pol:isonum

The ISO integer country code. The `pol:isonum` type is derived from the base type: `int`.

An example of `pol:isonum`:

- `840`

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

pol:office

An elected or appointed office. The `pol:office` type is derived from the base type: `guid`.

pol:pollingplace

An official place where ballots may be cast for a specific election. The `pol:pollingplace` type is derived from the base type: `guid`.

pol:race

An individual race for office. The `pol:race` type is derived from the base type: `guid`.

pol:term

A term in office held by a specific individual. The `pol:term` type is derived from the base type: `guid`.

pol:vitals

A set of vital statistics about a country. The `pol:vitals` type is derived from the base type: `guid`.

proj:attachment

A file attachment added to a ticket or comment. The `proj:attachment` type is derived from the base type: `guid`.

proj:comment

A user comment on a ticket. The `proj:comment` type is derived from the base type: `guid`.

proj:epic

A collection of tickets related to a topic. The `proj:epic` type is derived from the base type: `guid`.

proj:project

A project in a ticketing system. The `proj:project` type is derived from the base type: `guid`.

proj:project:type:taxonomy

A type taxonomy for projects. The `proj:project:type:taxonomy` type is derived from the base type: `taxonomy`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

proj:sprint

A timeboxed period to complete a set amount of work. The `proj:sprint` type is derived from the base type: `guid`.

proj:ticket

A ticket in a ticketing system. The `proj:ticket` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `proj:task`

ps:achievement

An instance of an individual receiving an award. The `ps:achievement` type is derived from the base type: `guid`.

ps:contact

A GUID for a contact info record. The `ps:contact` type is derived from the base type: `guid`.

ps:contact:type:taxonomy

A taxonomy of contact types. The `ps:contact:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ps:contactlist

A GUID for a list of associated contacts. The `ps:contactlist` type is derived from the base type: `guid`.

ps:education

A period of education for an individual. The `ps:education` type is derived from the base type: `guid`.

ps:name

An arbitrary, lower spaced string with normalized whitespace. The `ps:name` type is derived from the base type: `str`.

An example of `ps:name`:

- `robert grey`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

ps:person

A GUID for a person. The `ps:person` type is derived from the base type: `guid`.

ps:person:has

Deprecated. Please use ps:person -(has)>. The `ps:person:has` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('person', 'ps:person'), ('node', 'ndef'))`

ps:persona

Deprecated. Please use ps:contact. The `ps:persona` type is derived from the base type: `guid`.

ps:persona:has

Deprecated. Please use ps:contact -(has)>. The `ps:persona:has` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('persona', 'ps:persona'), ('node', 'ndef'))`

ps:proficiency

The assessment that a given contact possesses a specific skill. The `ps:proficiency` type is derived from the base type: `guid`.

ps:skill

A specific skill which a person or organization may have. The `ps:skill` type is derived from the base type: `guid`.

ps:skill:type:taxonomy

A taxonomy of skill types. The `ps:skill:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

ps:tokn

A single name element (potentially given or sur). The `ps:tokn` type is derived from the base type: `str`.

An example of `ps:tokn`:

- `robert`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

ps:vitals

Statistics and demographic data about a person or contact. The `ps:vitals` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `phys:object`

ps:workhist

An entry in a contact's work history. The `ps:workhist` type is derived from the base type: `guid`.

risk:alert

An instance of an alert which indicates the presence of a risk. The `risk:alert` type is derived from the base type: `guid`.

risk:alert:taxonomy

A taxonomy of alert types. The `risk:alert:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:alert:verdict:taxonomy

A taxonomy of verdicts for the origin and validity of the alert. The `risk:alert:verdict:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`

- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:attack

An instance of an actor attacking a target. The `risk:attack` type is derived from the base type: `guid`.

risk:attacktype

A taxonomy of attack types. The `risk:attacktype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:availability

A taxonomy of availability status values. The `risk:availability` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:compromise

A compromise and its aggregate impact. The compromise is the result of a successful attack. The `risk:compromise` type is derived from the base type: `guid`.

risk:compromisetype

A taxonomy of compromise types. The `risk:compromisetype` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

An example of `risk:compromisetype`:

- `cno.breach`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:extortion

An event where an attacker attempted to extort a victim. The `risk:extortion` type is derived from the base type: `guid`.

risk:extortion:type:taxonomy

A taxonomy of extortion event types. The `risk:extortion:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:hasvuln

Deprecated. Please use risk:vulnerable. The `risk:hasvuln` type is derived from the base type: `guid`.

risk:leak

An event where information was disclosed without permission. The `risk:leak` type is derived from the base type: `guid`.

risk:leak:type:taxonomy

A taxonomy of leak event types. The `risk:leak:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:mitigation

A mitigation for a specific risk:vuln. The `risk:mitigation` type is derived from the base type: `guid`.

risk:mitigation:type:taxonomy

A taxonomy of mitigation types. The `risk:mitigation:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:outage

An outage event which affected resource availability. The `risk:outage` type is derived from the base type: `guid`.

risk:outage:cause:taxonomy

An outage cause taxonomy. The `risk:outage:cause:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`

- regex: None
- replace: ()
- strip: False

risk:outage:type:taxonomy

An outage type taxonomy. The risk:outage:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

risk:technique:masquerade

Represents the assessment that a node is designed to resemble another in order to mislead. The risk:technique:masquerade type is derived from the base type: guid.

risk:threat

A threat cluster or subgraph of threat activity, as reported by a specific organization. The risk:threat type is derived from the base type: guid.

risk:threat:type:taxonomy

A taxonomy of threat types. The risk:threat:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

risk:tool:software

A software tool used in threat activity, as reported by a specific organization. The risk:tool:software type is derived from the base type: guid.

risk:tool:software:taxonomy

A taxonomy of software / tool types. The `risk:tool:software:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:vuln

A unique vulnerability. The `risk:vuln` type is derived from the base type: `guid`.

risk:vuln:soft:range

A contiguous range of software versions which contain a vulnerability. The `risk:vuln:soft:range` type is derived from the base type: `guid`.

risk:vuln:type:taxonomy

A taxonomy of vulnerability types. The `risk:vuln:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

risk:vulnerable

Indicates that a node is susceptible to a vulnerability. The `risk:vulnerable` type is derived from the base type: `guid`.

risk:vulnname

A vulnerability name such as log4j or rowhammer. The `risk:vulnname` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`

- lower: `True`
- onespace: `True`
- regex: `None`
- replace: `()`
- strip: `False`

rsa:key

An RSA keypair modulus and public exponent. The `rsa:key` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('mod', 'hex'), ('pub:exp', 'int'))`

sci:evidence

An assessment of how an observation supports or refutes a hypothesis. The `sci:evidence` type is derived from the base type: `guid`.

sci:experiment

An instance of running an experiment. The `sci:experiment` type is derived from the base type: `guid`.

sci:experiment:type:taxonomy

A taxonomy of experiment types. The `sci:experiment:type:taxonomy` type is derived from the base type: `taxonomy`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

sci:hypothesis

A hypothesis or theory. The `sci:hypothesis` type is derived from the base type: `guid`.

sci:hypothesis:type:taxonomy

A taxonomy of hypothesis types. The `sci:hypothesis:type:taxonomy` type is derived from the base type: `taxonomy`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`

- replace: ()
- strip: False

sci:observation

An observation which may have resulted from an experiment. The sci:observation type is derived from the base type: guid.

syn:cmd

A Synapse storm command. The syn:cmd type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: True

syn:cron

A Cortex cron job. The syn:cron type is derived from the base type: guid.

syn:form

A Synapse form used for representing nodes in the graph. The syn:form type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: True

syn:nodedata

A nodedata key and the form it may be present on. The syn:nodedata type is derived from the base type: comp.

This type has the following options set:

- fields: (('key', 'str'), ('form', 'syn:form'))

syn:prop

A Synapse property. The syn:prop type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: False

- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

syn:tagprop

A user defined tag property. The `syn:tagprop` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

syn:trigger

A Cortex trigger. The `syn:trigger` type is derived from the base type: `guid`.

syn:type

A Synapse type used for normalizing nodes and properties. The `syn:type` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `True`

tel:call

A guid for a telephone call record. The `tel:call` type is derived from the base type: `guid`.

tel:mob:carrier

The fusion of a MCC/MNC. The `tel:mob:carrier` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('mcc', 'tel:mob:mcc'), ('mnc', 'tel:mob:mnc'))`

tel:mob:cell

A mobile cell site which a phone may connect to. The `tel:mob:cell` type is derived from the base type: `comp`.

This type has the following options set:

- fields: `(('carrier', 'tel:mob:carrier'), ('lac', ('int', {})), ('cid', ('int', {})))`

tel:mob:imid

Fused knowledge of an IMEI/IMSI used together. The `tel:mob:imid` type is derived from the base type: `comp`.

An example of `tel:mob:imid`:

- `(490154203237518, 310150123456789)`

This type has the following options set:

- fields: `(('imei', 'tel:mob:imei'), ('imsi', 'tel:mob:imsi'))`

tel:mob:imsiphone

Fused knowledge of an IMSI assigned phone number. The `tel:mob:imsiphone` type is derived from the base type: `comp`.

An example of `tel:mob:imsiphone`:

- `(310150123456789, "+7(495) 124-59-83")`

This type has the following options set:

- fields: `(('imsi', 'tel:mob:imsi'), ('phone', 'tel:phone'))`

tel:mob:mcc

ITU Mobile Country Code. The `tel:mob:mcc` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[0-9]{3}$`
- replace: `()`
- strip: `1`

tel:mob:mnc

ITU Mobile Network Code. The `tel:mob:mnc` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[0-9]{2,3}$`
- replace: `()`
- strip: `1`

tel:mob:tac

A mobile Type Allocation Code. The `tel:mob:tac` type is derived from the base type: `int`.

An example of `tel:mob:tac`:

- `49015420`

This type has the following options set:

- enums:strict: `True`
- fmt: `%d`
- ismax: `False`
- ismin: `False`
- max: `None`
- min: `None`
- signed: `True`
- size: `8`

tel:mob:tadig

A Transferred Account Data Interchange Group number issued to a GSM carrier. The `tel:mob:tadig` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `^[A-Z0-9]{5}$`
- replace: `()`
- strip: `True`

tel:mob:telem

A single mobile telemetry measurement. The `tel:mob:telem` type is derived from the base type: `guid`.

tel:phone:type:taxonomy

A taxonomy of phone number types. The `tel:phone:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`

- strip: False

tel:txtmesg

A guid for an individual text message. The tel:txtmesg type is derived from the base type: guid.

transport:air:craft

An individual aircraft. The transport:air:craft type is derived from the base type: guid.

This type implements the following interfaces:

- transport:vehicle

transport:air:flight

An individual instance of a flight. The transport:air:flight type is derived from the base type: guid.

This type implements the following interfaces:

- transport:trip

transport:air:flightnum

A commercial flight designator including airline and serial. The transport:air:flightnum type is derived from the base type: str.

An example of transport:air:flightnum:

- ua2437

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: False
- regex: ^[a-z0-9]{3,6}$
- replace: ((' ', ''),)
- strip: True

transport:air:occupant

Deprecated. Please use transport:occupant. The transport:air:occupant type is derived from the base type: guid.

transport:air:port

An IATA assigned airport code. The transport:air:port type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: False
- regex: None
- replace: ()
- strip: False

transport:air:tailnum

An aircraft registration number or military aircraft serial number. The `transport:air:tailnum` type is derived from the base type: `str`.

An example of `transport:air:tailnum`:

- `ff023`

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^[a-z0-9-]{2,}$`
- replace: `()`
- strip: `True`

transport:air:telem

A telemetry sample from an aircraft in transit. The `transport:air:telem` type is derived from the base type: `guid`.

transport:cargo

Cargo being carried by a vehicle on a trip. The `transport:cargo` type is derived from the base type: `guid`.

transport:container

A container capable of transporting cargo or personnel. The `transport:container` type is derived from the base type: `ndef`.

This type has the following options set:

- interface: `transport:container`

transport:direction

A direction measured in degrees with 0.0 being true North. The `transport:direction` type is derived from the base type: `hugenum`.

This type has the following options set:

- modulo: `360`
- units: `None`

transport:land:drive

A drive taken by a land vehicle. The `transport:land:drive` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:trip`

transport:land:license

A license to operate a land vehicle issued to a contact. The `transport:land:license` type is derived from the base type: `guid`.

transport:land:registration

Registration issued to a contact for a land vehicle. The `transport:land:registration` type is derived from the base type: `guid`.

transport:land:vehicle

An individual land based vehicle. The `transport:land:vehicle` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:vehicle`

transport:land:vehicle:type:taxonomy

A type taxonomy for land vehicles. The `transport:land:vehicle:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

transport:occupant

An occupant of a vehicle on a trip. The `transport:occupant` type is derived from the base type: `guid`.

transport:occupant:role:taxonomy

A taxonomy of transportation occupant roles. The `transport:occupant:role:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`

- strip: False

transport:point

A departure/arrival point such as an airport gate or train platform. The transport:point type is derived from the base type: str.

This type has the following options set:

- globsuffix: False
- lower: True
- onespace: True
- regex: None
- replace: ()
- strip: False

transport:rail:car

An individual train car. The transport:rail:car type is derived from the base type: guid.

This type implements the following interfaces:

- transport:container

transport:rail:car:type:taxonomy

A hierarchical taxonomy of rail car types. The transport:rail:car:type:taxonomy type is derived from the base type: taxonomy.

This type implements the following interfaces:

- meta:taxonomy

An example of transport:rail:car:type:taxonomy:

- engine.diesel

This type has the following options set:

- globsuffix: False
- lower: False
- onespace: False
- regex: None
- replace: ()
- strip: False

transport:rail:consist

A group of rail cars and locomotives connected together. The transport:rail:consist type is derived from the base type: guid.

This type implements the following interfaces:

- transport:vehicle

transport:rail:train

An individual instance of a consist of train cars running a route. The `transport:rail:train` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:trip`

transport:sea:imo

An International Maritime Organization registration number. The `transport:sea:imo` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `True`
- onespace: `False`
- regex: `^imo[0-9]{7}$`
- replace: `((' ', ''),)`
- strip: `True`

transport:sea:mmsi

A Maritime Mobile Service Identifier. The `transport:sea:mmsi` type is derived from the base type: `str`.

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `[0-9]{9}`
- replace: `()`
- strip: `False`

transport:sea:telem

A telemetry sample from a vessel in transit. The `transport:sea:telem` type is derived from the base type: `guid`.

transport:sea:vessel

An individual sea vessel. The `transport:sea:vessel` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:vehicle`

transport:sea:vessel:type:taxonomy

A hierarchical taxonomy of sea vessel types. The `transport:sea:vessel:type:taxonomy` type is derived from the base type: `taxonomy`.

This type implements the following interfaces:

- `meta:taxonomy`

This type has the following options set:

- globsuffix: `False`
- lower: `False`
- onespace: `False`
- regex: `None`
- replace: `()`
- strip: `False`

transport:shipping:container

An individual shipping container. The `transport:shipping:container` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:container`

transport:stop

A stop made by a vehicle on a trip. The `transport:stop` type is derived from the base type: `guid`.

This type implements the following interfaces:

- `transport:schedule`

transport:trip

A trip such as a flight or train ride. The `transport:trip` type is derived from the base type: `ndef`.

This type has the following options set:

- interface: `transport:trip`

transport:vehicle

A vehicle such as an aircraft or sea vessel. The `transport:vehicle` type is derived from the base type: `ndef`.

This type has the following options set:

- interface: `transport:vehicle`

12.2 Synapse Data Model - Forms

12.2.1 Forms

Forms are derived from types, or base types. Forms represent node types in the graph.

auth:access

An instance of using creds to access a resource.

The base type for the form can be found at *auth:access*.

Properties:

name	type	doc
:creds	*auth:creds*	The credentials used to attempt access.
:time	*time*	The time of the access attempt.
:success	*bool*	Set to true if the access was successful.
:person	*ps:person*	The person who attempted access.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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Table 2 – continued from previous page

source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

auth:creds

A unique set of credentials used to access a resource.

The base type for the form can be found at *auth:creds*.

Properties:

name	type	doc	opts
:email	*inet:email*	The email address used to identify the user.	
:user	*inet:user*	The user name used to identify the user.	
:phone	*tel:phone*	The phone number used to identify the user.	
:passwd	*inet:passwd*	The password used to authenticate.	
:passwdhash	*it:auth:passwdh*	The password hash used to authenticate.	
:account	*it:account*	The account that the creds allow access to.	
:website	*inet:url*	The base URL of the website that the credentials allow access to.	
:host	*it:host*	The host that the credentials allow access to.	
:wifi:ssid	*inet:wifi:ssid*	The WiFi SSID that the credentials allow access to.	
:web:acct	*inet:web:acct*	Deprecated. Use :service:account.	Deprecated: True
:service:acc	*inet:service:acc*	The service account that the credentials allow access to.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 3 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

belief:subscriber

A contact which subscribes to a belief system.

The base type for the form can be found at *belief:subscriber*.

Properties:

name	type	doc
:contact	*ps:contact*	The contact which subscribes to the belief system.
:system	*belief:system*	The belief system to which the contact subscribes.
:began	*time*	The time that the contact began to be a subscriber to the belief system.
:ended	*time*	The time when the contact ceased to be a subscriber to the belief system.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirem	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)	geo:telem	Deprecated. Please use geo:telem:node.
belief:subscr	-(follows	belief:tene	The subscriber is assessed to generally adhere to the specific tenet.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

belief:system

A belief system such as an ideology, philosophy, or religion.

The base type for the form can be found at *belief:system*.

Properties:

name	type	doc	opts
:name	*str* onespace: True lower: True	The name of the belief system.	
:desc	*str*	A description of the belief system.	Display: {'hint': 'text'}
:type	*belief:system:type:taxono*	A taxonometric type for the belief system.	
:began	*time*	The time that the belief system was first observed.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
belief:syste	-(has)>	belief:tenet	The belief system includes the tenet.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 5 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

belief:system:type:taxonomy

A hierarchical taxonomy of belief system types.

The base type for the form can be found at *belief:system:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*belief:system:type:taxono*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

belief:tenet

A concrete tenet potentially shared by multiple belief systems.

The base type for the form can be found at *belief:tenet*.

Properties:

name	type	doc	opts
:name	*str* onespace: True lower: True	The name of the tenet.	
:desc	*str*	A description of the tenet.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
belief:subscriber	-(follows)>	belief:tenet	The subscriber is assessed to generally adhere to the spe
belief:system	-(has)>	belief:tenet	The belief system includes the tenet.
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the targ
it:exec:query	-(found)>	*	The target node was returned as a result of running the
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targ
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target no
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the c

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Table 7 – continued from previous page

source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target node
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes

biz:bundle

A bundle allows construction of products which bundle instances of other products.

The base type for the form can be found at *biz:bundle*.

Properties:

name	type	doc	opts
:count	*int*	The number of instances of the product or service included in the bundle.	
:price	*econ:price*	The price of the bundle.	
:product	*biz:product*	The product included in the bundle.	
:service	*biz:service*	The service included in the bundle.	
:deal	*biz:deal*	Deprecated. Please use econ:receipt:item for instances of bundles being sold.	Deprecated: True
:purchas	*econ:purcha*	Deprecated. Please use econ:receipt:item for instances of bundles being sold.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 8 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:deal

A sales or procurement effort in pursuit of a purchase.

The base type for the form can be found at *biz:deal*.

Properties:

name	type	doc	opts
:id	*str* strip: True	An identifier for the deal.	
:title	*str*	A title for the deal.	
:type	*biz:dealtype*	The type of deal.	Display: {'hint': 'taxonomy'}
:status	*biz:dealstatus*	The status of the deal.	Display: {'hint': 'taxonomy'}
:updated	*time*	The last time the deal had a significant update.	
:contacted	*time*	The last time the contacts communicated about the deal.	
:rfp	*biz:rfp*	The RFP that the deal is in response to.	
:buyer	*ps:contact*	The primary contact information for the buyer.	
:buyer:org	*ou:org*	The buyer org.	
:buyer:orgname	*ou:name*	The reported ou:name of the buyer org.	
:buyer:orgfqdn	*inet:fqdn*	The reported inet:fqdn of the buyer org.	
:seller	*ps:contact*	The primary contact information for the seller.	
:seller:org	*ou:org*	The seller org.	
:seller:orgname	*ou:name*	The reported ou:name of the seller org.	
:seller:orgfqdn	*inet:fqdn*	The reported inet:fqdn of the seller org.	
:currency	*econ:currency*	The currency of econ:price values associated with the deal.	
:buyer:budget	*econ:price*	The buyers budget for the eventual purchase.	
:buyer:deadline	*time*	When the buyer intends to make a decision.	
:offer:price	*econ:price*	The total price of the offered products.	
:offer:expires	*time*	When the offer expires.	
:purchase	*econ:purchase*	Records a purchase resulting from the deal.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:dealstatus

A deal/rfp status taxonomy.

The base type for the form can be found at *biz:dealstatus*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*biz:dealstatus*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:dealtype

A deal type taxonomy.

The base type for the form can be found at *biz:dealtype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*biz:dealtype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:listing

A product or service being listed for sale at a given price by a specific seller.

The base type for the form can be found at *biz:listing*.

Properties:

name	type	doc
:seller	*ps:contact*	The contact information for the seller.
:product	*biz:product*	The product being offered.
:service	*biz:service*	The service being offered.
:current	*bool*	Set to true if the offer is still current.
:time	*time*	The first known offering of this product/service by the organization for the asking price.
:expires	*time*	Set if the offer has a known expiration date.
:price	*econ:price*	The asking price of the product or service.
:currency	*econ:currency*	The currency of the asking price.
:count:total	*int* min: 0	The number of instances for sale.
:count:remaining	*int* min: 0	The current remaining number of instances for sale.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:prodtype

A product type taxonomy.

The base type for the form can be found at *biz:prodtype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*biz:prodtype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:product

A product which is available for purchase.

The base type for the form can be found at *biz:product*.

Properties:

name	type	doc	opts
:name	*str*	The name of the product.	
:type	*biz:prodtype*	The type of product.	Display: {'hint': 'taxonomy'}
:summary	*str*	A brief summary of the product.	Display: {'hint': 'text'}
:maker	*ps:contact*	A contact for the maker of the product.	
:madeby:org	*ou:org*	Deprecated. Please use biz:product:maker.	Deprecated: True
:madeby:orgname	*ou:name*	Deprecated. Please use biz:product:maker.	Deprecated: True
:madeby:orgfqdn	*inet:fqdn*	Deprecated. Please use biz:product:maker.	Deprecated: True
:price:retail	*econ:price*	The MSRP price of the product.	
:price:bottom	*econ:price*	The minimum offered or observed price of the product.	
:price:currency	*econ:currency*	The currency of the retail and bottom price properties.	
:bundles	*array* type: *biz:bundle* uniq: True sorted: True	An array of bundles included with the product.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:rfp

An RFP (Request for Proposal) soliciting proposals.

The base type for the form can be found at *biz:rfp*.

Properties:

name	type	doc	opts
:ext:id	*str*	An externally specified identifier for the RFP.	
:title	*str*	The title of the RFP.	
:summary	*str*	A brief summary of the RFP.	Display: {'hint': 'text'}
:status	*biz:dealstatus*	The status of the RFP.	Display: {'hint': 'enum'}
:url	*inet:url*	The official URL for the RFP.	
:file	*file:bytes*	The RFP document.	
:posted	*time*	The date/time that the RFP was posted.	
:quesdue	*time*	The date/time that questions are due.	
:propdue	*time*	The date/time that proposals are due.	
:contact	*ps:contact*	The contact information given for the org requesting offers.	
:purchases	*array* type: *econ:purchase* uniq: True sorted: True	Any known purchases that resulted from the RFP.	
:requirements	*array* type: *ou:goal* uniq: True sorted: True	A typed array which indexes each field.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:service

A service which is performed by a specific organization.

The base type for the form can be found at *biz:service*.

Properties:

name	type	doc	opts
:provider	*ps:contact*	The contact info of the entity which performs the service.	
:name	*str* lower: True onespace: True	The name of the service being performed.	
:summary	*str*	A brief summary of the service.	Display: {'hint': 'text'}
:type	*biz:service:type:taxono*	A taxonomy of service types.	
:launched	*time*	The time when the operator first made the service available.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 16 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

biz:stake

A stake or partial ownership in a company.

The base type for the form can be found at *biz:stake*.

Properties:

name	type	doc
:vitals	*ou:vitals*	The ou:vitals snapshot this stake is part of.
:org	*ou:org*	The resolved org.
:orgname	*ou:name*	The org name as reported by the source of the vitals.
:orgfqdn	*inet:fqdn*	The org FQDN as reported by the source of the vitals.
:name	*str*	An arbitrary name for this stake. Can be non-contact like “pool”.
:asof	*time*	The time the stake is being measured. Likely as part of an ou:vitals.
:shares	*int*	The number of shares represented by the stake.
:invested	*econ:price*	The amount of money invested in the cap table iteration.
:value	*econ:price*	The monetary value of the stake.
:percent	*hugenum*	The percentage ownership represented by this stake.
:owner	*ps:contact*	Contact information of the owner of the stake.
:purchase	*econ:purchase*	The purchase event for the stake.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:algorithm

A cryptographic algorithm name.

The base type for the form can be found at *crypto:algorithm*.

An example of crypto:algorithm:

- aes256

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:currency:address

An individual crypto currency address.

The base type for the form can be found at *crypto:currency:address*.

An example of `crypto:currency:address`:

- `btc/1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2`

Properties:

name	type	doc	opts
:coin	*crypto:currenc*	The crypto coin to which the address belongs.	Read Only: True
:seed	*crypto:key*	The cryptographic key and or password used to generate the address.	
:iden	*str*	The coin specific address identifier.	Read Only: True
:desc	*str*	A free-form description of the address.	
:conta	*ps:contact*	The primary contact for the crypto currency address.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe

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Table 19 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:currency:block

An individual crypto currency block record on the blockchain.

The base type for the form can be found at *crypto:currency:block*.

Properties:

name	type	doc	opts
:coin	*crypto:currency:coin*	The coin/blockchain this block resides on.	Read Only: True
:offset	*int*	The index of this block.	Read Only: True
:hash	*hex*	The unique hash for the block.	
:minedby	*crypto:currency:addr*	The address which mined the block.	
:time	*time*	Time timestamp embedded in the block by the miner.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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Table 20 – continued from previous page

source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:currency:client

A fused node representing a crypto currency address used by an Internet client.

The base type for the form can be found at *crypto:currency:client*.

An example of `crypto:currency:client`:

- `(1.2.3.4, (btc, 1BvBMSEYstWetqTFn5Au4m4GFg7xJaNVN2))`

Properties:

name	type	doc	opts
:inetad	*inet:client*	The Internet client address observed using the crypto currency address.	Read Only: True
:coinad	*crypto:currency:*	The crypto currency address observed in use by the Internet client.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:currency:coin

An individual crypto currency type.

The base type for the form can be found at *crypto:currency:coin*.

An example of `crypto:currency:coin`:

- btc

Properties:

name	type	doc
:name	*str*	The full name of the crypto coin.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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Table 22 – continued from previous page

source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:currency:transaction

An individual crypto currency transaction recorded on the blockchain.

The base type for the form can be found at *crypto:currency:transaction*.

Properties:

name	type	doc	opts
:hash	*hex*	The unique transaction hash for the transaction.	
:desc	*str*	An analyst specified description of the transaction.	
:block	*crypto:currency:block*	The block which records the transaction.	
:block:coin	*crypto:currency:coin*	The coin/blockchain of the block which records this transaction.	
:block:offset	*int*	The offset of the block which records this transaction.	
:success	*bool*	Set to true if the transaction was successfully executed and recorded.	
:status:code	*int*	A coin specific status code which may represent an error reason.	
:status:message	*str*	A coin specific status message which may contain an error reason.	
:to	*crypto:currency:addres*	The destination address of the transaction.	
:from	*crypto:currency:addres*	The source address of the transaction.	
:inputs	*array* type: *crypto:payment:input* sorted: True uniq: True	Deprecated. Please use crypto:payment:input:t	Deprecated: True
:outputs	*array* type: *crypto:payment:output* sorted: True uniq: True	Deprecated. Please use crypto:payment:output:	Deprecated: True
:fee	*econ:price*	The total fee paid to execute the transaction.	
:value	*econ:price*	The total value of the transaction.	
:time	*time*	The time this transaction was initiated.	
:eth:gasused	*int*	The amount of gas used to execute this transaction.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:key

A cryptographic key and algorithm.

The base type for the form can be found at *crypto:key*.

Properties:

name	type	doc	opts
:algorithm	*crypto:algorithm*	The cryptographic algorithm which uses the key material.	Example: aes256
:mode	*str* lower: True onespace: True	The algorithm specific mode in use.	
:iv	*hex*	The hex encoded initialization vector.	
:iv:text	*it:dev:str*	Set only if the :iv property decodes to ASCII.	
:public	*hex*	The hex encoded public key material if the algorithm has a public/private key pair.	
:public:text	*it:dev:str*	Set only if the :public property decodes to ASCII.	
:public:md5	*hash:md5*	The MD5 hash of the public key in raw binary form.	
:public:sha1	*hash:sha1*	The SHA1 hash of the public key in raw binary form.	
:public:sha256	*hash:sha256*	The SHA256 hash of the public key in raw binary form.	
:private	*hex*	The hex encoded private key material. All symmetric keys are private.	
:private:text	*it:dev:str*	Set only if the :private property decodes to ASCII.	
:private:md5	*hash:md5*	The MD5 hash of the private key in raw binary form.	
:private:sha1	*hash:sha1*	The SHA1 hash of the private key in raw binary form.	
:private:sha256	*hash:sha256*	The SHA256 hash of the private key in raw binary form.	
:seed:passwd	*inet:passwd*	The seed password used to generate the key material.	
:seed:algorithm	*crypto:algorithm*	The algorithm used to generate the key from the seed password.	Example: pbkdf2

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:payment:input

A payment made into a transaction.

The base type for the form can be found at *crypto:payment:input*.

Properties:

name	type	doc
:transaction	*crypto:currency:transaction*	The transaction the payment was input to.
:address	*crypto:currency:address*	The address which paid into the transaction.
:value	*econ:price*	The value of the currency paid into the transaction.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:payment:output

A payment received from a transaction.

The base type for the form can be found at *crypto:payment:output*.

Properties:

name	type	doc
:transaction	*crypto:currency:transactic*	The transaction the payment was output from.
:address	*crypto:currency:address*	The address which received payment from the transaction.
:value	*econ:price*	The value of the currency received from the transaction.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:contract

A smart contract.

The base type for the form can be found at *crypto:smart:contract*.

Properties:

name	type	doc
:transaction	*crypto:currency:transactior*	The transaction which created the contract.
:address	*crypto:currency:address*	The address of the contract.
:bytecode	*file:bytes*	The bytecode which implements the contract.
:token:name	*str*	The ERC-20 token name.
:token:symbol	*str*	The ERC-20 token symbol.
:token:totalsupply	*hugenum*	The ERC-20 totalSupply value.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:burntoken

A smart contract effect which destroys a non-fungible token.

The base type for the form can be found at *crypto:smart:effect:burntoken*.

Properties:

name	type	doc
:token	*crypto:smart:token*	The non-fungible token that was destroyed.
:index	*int*	The order of the effect within the effects of one transaction.
:transactior	*crypto:currency:transacti*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:edittokensupply

A smart contract effect which increases or decreases the supply of a fungible token.

The base type for the form can be found at *crypto:smart:effect:edittokensupply*.

Properties:

name	type	doc
:contract	*crypto:smart:contract*	The contract which defines the tokens.
:amount	*hugenum*	The number of tokens added or removed if negative.
:totalsupply	*hugenum*	The total supply of tokens after this modification.
:index	*int*	The order of the effect within the effects of one transaction.
:transactior	*crypto:currency:transacti*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.

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source	verb	target	doc
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:minttoken

A smart contract effect which creates a new non-fungible token.

The base type for the form can be found at *crypto:smart:effect:minttoken*.

Properties:

name	type	doc
:token	*crypto:smart:token*	The non-fungible token that was created.
:index	*int*	The order of the effect within the effects of one transaction.
:transactior	*crypto:currency:transacti*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.

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source	verb	target	doc
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:proxytoken

A smart contract effect which grants a non-owner address the ability to manipulate a specific non-fungible token.

The base type for the form can be found at *crypto:smart:effect:proxytoken*.

Properties:

name	type	doc
:owner	*crypto:currency:addres*	The address granting proxy authority to manipulate non-fungible tokens.
:proxy	*crypto:currency:addres*	The address granted proxy authority to manipulate non-fungible tokens.
:token	*crypto:smart:token*	The specific token being granted access to.
:index	*int*	The order of the effect within the effects of one transaction.
:transactic	*crypto:currency:transa*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:proxytokenall

A smart contract effect which grants a non-owner address the ability to manipulate all non-fungible tokens of the owner.

The base type for the form can be found at *crypto:smart:effect:proxytokenall*.

Properties:

name	type	doc
:contract	*crypto:smart:contra*	The contract which defines the tokens.
:owner	*crypto:currency:ad*	The address granting/denying proxy authority to manipulate all non-fungible tokens of the owner.
:proxy	*crypto:currency:ad*	The address granted/denied proxy authority to manipulate all non-fungible tokens of the owner.
:approval	*bool*	The approval status.
:index	*int*	The order of the effect within the effects of one transaction.
:transact	*crypto:currency:tra*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 32 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:proxytokens

A smart contract effect which grants a non-owner address the ability to manipulate fungible tokens.

The base type for the form can be found at *crypto:smart:effect:proxytokens*.

Properties:

name	type	doc
:contract	*crypto:smart:contract*	The contract which defines the tokens.
:owner	*crypto:currency:addres*	The address granting proxy authority to manipulate fungible tokens.
:proxy	*crypto:currency:addres*	The address granted proxy authority to manipulate fungible tokens.
:amount	*hex*	The hex encoded amount of tokens the proxy is allowed to manipulate.
:index	*int*	The order of the effect within the effects of one transaction.
:transactic	*crypto:currency:transac*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 33 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:transfertoken

A smart contract effect which transfers ownership of a non-fungible token.

The base type for the form can be found at *crypto:smart:effect:transfertoken*.

Properties:

name	type	doc
:token	*crypto:smart:token*	The non-fungible token that was transferred.
:from	*crypto:currency:address*	The address the NFT was transferred from.
:to	*crypto:currency:address*	The address the NFT was transferred to.
:index	*int*	The order of the effect within the effects of one transaction.
:transactior	*crypto:currency:transacti*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:effect:transfertokens

A smart contract effect which transfers fungible tokens.

The base type for the form can be found at *crypto:smart:effect:transfertokens*.

Properties:

name	type	doc
:contract	*crypto:smart:contract*	The contract which defines the tokens.
:from	*crypto:currency:address*	The address the tokens were transferred from.
:to	*crypto:currency:address*	The address the tokens were transferred to.
:amount	*hugenum*	The number of tokens transferred.
:index	*int*	The order of the effect within the effects of one transaction.
:transactior	*crypto:currency:transactio*	The transaction where the smart contract was called.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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Table 35 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:smart:token

A token managed by a smart contract.

The base type for the form can be found at *crypto:smart:token*.

Properties:

name	type	doc	opts
:contract	*crypto:smart:cor*	The smart contract which defines and manages the token.	Read Only: True
:tokenid	*hugenum*	The token ID.	Read Only: True
:owner	*crypto:currency:*	The address which currently owns the token.	
:nft:url	*inet:url*	The URL which hosts the NFT metadata.	
:nft:meta	*data*	The raw NFT metadata.	
:nft:meta:name	*str*	The name field from the NFT metadata.	
:nft:meta:desc	*str*	The description field from the NFT metadata.	Display: {'hint': 'text'}
:nft:meta:imag	*inet:url*	The image URL from the NFT metadata.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 36 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:x509:cert

A unique X.509 certificate.

The base type for the form can be found at *crypto:x509:cert*.

Properties:

name	type	doc
:file	*file:bytes*	The file that the certificate metadata was parsed from.
:subject	*str*	The subject identifier, commonly in X.500/LDAP format, to which the certificate was issued.
:issuer	*str*	The Distinguished Name (DN) of the Certificate Authority (CA) which issued the certificate.
:issuer:cert	*crypto:x509:cert*	The certificate used by the issuer to sign this certificate.
:serial	*hex* zeropad: 40	The certificate serial number as a big endian hex value.
:version	*int* enums: ((0, 'v1'), (2, 'v3'))	The version integer in the certificate. (ex. 2 == v3).
:validity:notbefore	*time*	The timestamp for the beginning of the certificate validity period.
:validity:notafter	*time*	The timestamp for the end of the certificate validity period.
:md5	*hash:md5*	The MD5 fingerprint for the certificate.
:sha1	*hash:sha1*	The SHA1 fingerprint for the certificate.
:sha256	*hash:sha256*	The SHA256 fingerprint for the certificate.
:rsa:key	*rsa:key*	The optional RSA public key associated with the certificate.
:algo	*iso:oid*	The X.509 signature algorithm OID.
:signature	*hex*	The hexadecimal representation of the digital signature.
:ext:sans	*array* type: *crypto:x509:san* uniq: True sorted: True	The Subject Alternate Names (SANs) listed in the certificate.
:ext:crls	*array* type: *crypto:x509:san* uniq: True sorted: True	A list of Subject Alternate Names (SANs) for Distribution Points.
:identities:fqdns	*array* type: *inet:fqdn* uniq: True	The fused list of FQDNs identified by the cert CN and SANs.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:x509:crl

A unique X.509 Certificate Revocation List.

The base type for the form can be found at *crypto:x509:crl*.

Properties:

name	type	doc
:file	*file:bytes*	The file containing the CRL.
:url	*inet:url*	The URL where the CRL was published.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 38 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:x509:revoked

A revocation relationship between a CRL and an X.509 certificate.

The base type for the form can be found at *crypto:x509:revoked*.

Properties:

name	type	doc	opts
:crl	*crypto:x509:crl*	The CRL which revoked the certificate.	Read Only: True
:cert	*crypto:x509:cert*	The certificate revoked by the CRL.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 39 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

crypto:x509:signedfile

A digital signature relationship between an X.509 certificate and a file.

The base type for the form can be found at *crypto:x509:signedfile*.

Properties:

name	type	doc	opts
:cert	*crypto:x509:cert*	The certificate for the key which signed the file.	Read Only: True
:file	*file:bytes*	The file which was signed by the certificates key.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 40 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:policy

Guiding principles used to reach a set of goals.

The base type for the form can be found at *doc:policy*.

Properties:

name	type	doc
:id	*str* strip: True	The policy ID.
:name	*str* lower: True onespace: True	The policy name.
:type	*doc:policy:type:taxonomy*	The type of policy.
:text	*str*	The text of the policy.
:file	*file:bytes*	The file which contains the policy.
:created	*time*	The time that the policy was created.
:updated	*time*	The time that the policy was last updated.
:author	*ps:contact*	The contact information of the primary author.
:contributors	*array* type: *ps:contact* sorted: True uniq: True	An array of contacts which contributed to the policy.
:version	*it:semver*	The version of the policy.
:supersedes	*array* type: *doc:policy* sorted: True uniq: True	An array of policies which are superseded by this policy.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:policy:type:taxonomy

A taxonomy of policy types.

The base type for the form can be found at *doc:policy:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*doc:policy:type:taxono*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:requirement

A single requirement, often defined by a standard.

The base type for the form can be found at *doc:requirement*.

Properties:

name	type	doc	opts
:summary	*str*	A summary of the requirement definition.	Display: {'hint': 'text'}
:optional	*bool*	Set to true if the requirement is optional as defined by the standard.	
:priority	*meta:priority*	The priority of the requirement as defined by the standard.	
:standard	*doc:standard*	The standard which defined the requirement.	
:id	*str* strip: True	The requirement ID.	
:name	*str* lower: True onespace: True	The requirement name.	
:type	*doc:requirement:type:t*	The type of requirement.	
:text	*str*	The text of the requirement.	
:file	*file:bytes*	The file which contains the requirement.	
:created	*time*	The time that the requirement was created.	
:updated	*time*	The time that the requirement was last updated.	
:author	*ps:contact*	The contact information of the primary author.	
:contributors	*array* type: *ps:contact* sorted: True uniq: True	An array of contacts which contributed to the requirement.	
:version	*it:semver*	The version of the requirement.	
:supersedes	*array* type: *doc:requirement* sorted: True uniq: True	An array of requirements which are superseded by this requirement.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:requirement:type:taxonomy

A taxonomy of requirement types.

The base type for the form can be found at *doc:requirement:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*doc:requirement:type:t*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:resume

A CV/resume document.

The base type for the form can be found at *doc:resume*.

Properties:

name	type	doc	opts
:contact	*ps:contact*	Contact information for subject of the resume.	
:summary	*str*	The summary of qualifications from the resume.	Display: {'hint': 'text'}
:workhist	*array* type: *ps:workhist* sorted: True uniq: True	Work history described in the resume.	
:education	*array* type: *ps:education* sorted: True uniq: True	Education experience described in the resume.	
:achievements	*array* type: *ps:achievement* sorted: True uniq: True	Achievements described in the resume.	
:id	*str* strip: True	The resume ID.	
:name	*str* lower: True onespace: True	The resume name.	
:type	*doc:resume:type:taxon*	The type of resume.	
:text	*str*	The text of the resume.	
:file	*file:bytes*	The file which contains the resume.	
:created	*time*	The time that the resume was created.	
:updated	*time*	The time that the resume was last updated.	
:author	*ps:contact*	The contact information of the primary author.	
:contributors	*array* type: *ps:contact* sorted: True uniq: True	An array of contacts which contributed to the resume.	
:version	*it:semver*	The version of the re-	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:resume:type:taxonomy

A taxonomy of resume types.

The base type for the form can be found at *doc:resume:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*doc:resume:type:taxon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:standard

A group of requirements which define how to implement a policy or goal.

The base type for the form can be found at *doc:standard*.

Properties:

name	type	doc
:policy	*doc:policy*	The policy which was used to derive the standard.
:id	*str* strip: True	The standard ID.
:name	*str* lower: True onespace: True	The standard name.
:type	*doc:standard:type:taxonomy*	The type of standard.
:text	*str*	The text of the standard.
:file	*file:bytes*	The file which contains the standard.
:created	*time*	The time that the standard was created.
:updated	*time*	The time that the standard was last updated.
:author	*ps:contact*	The contact information of the primary author.
:contributors	*array* type: *ps:contact* sorted: True uniq: True	An array of contacts which contributed to the standard.
:version	*it:semver*	The version of the standard.
:supersedes	*array* type: *doc:standard* sorted: True uniq: True	An array of standards which are superseded by this standard.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

doc:standard:type:taxonomy

A taxonomy of standard types.

The base type for the form can be found at *doc:standard:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*doc:standard:type:taxo*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:acct:balance

A snapshot of the balance of an account at a point in time.

The base type for the form can be found at *econ:acct:balance*.

Properties:

name	type	doc	opts
:time	*time*	The time the balance was recorded.	
:instrument	*econ:pay:instrumen*	The financial instrument holding the balance.	
:pay:card	*econ:pay:card*	Deprecated. Please use :instrument.	Deprecated: True
:crypto:addre	*crypto:currency:ad*	Deprecated. Please use :instrument.	Deprecated: True
:amount	*econ:price*	The account balance at the time.	
:currency	*econ:currency*	The currency of the balance amount.	
:delta	*econ:price*	The change since last regular sample.	
:total:receiv	*econ:price*	The total amount of currency received by the account.	
:total:sent	*econ:price*	The total amount of currency sent from the account.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:acct:invoice

An invoice issued requesting payment.

The base type for the form can be found at *econ:acct:invoice*.

Properties:

name	type	doc
:issued	*time*	The time that the invoice was issued to the recipient.
:issuer	*ps:contact*	The contact information for the entity who issued the invoice.
:purchase	*econ:purchase*	The purchase that the invoice is requesting payment for.
:recipient	*ps:contact*	The contact information for the intended recipient of the invoice.
:due	*time*	The time by which the payment is due.
:paid	*bool*	Set to true if the invoice has been paid in full.
:amount	*econ:price*	The balance due.
:currency	*econ:currency*	The currency that the invoice specifies for payment.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:acct:payment

A payment or crypto currency transaction.

The base type for the form can be found at *econ:acct:payment*.

Properties:

name	type	doc	opts
:txnid	*str* strip: True	A payment processor specific transaction id.	
:fee	*econ:price*	The transaction fee paid by the recipient to the payment processor.	
:from:cash	*bool*	Set to true if the payment input was in cash.	
:to:instrument	*econ:pay:instrument*	The payment instrument which received funds from the payment.	
:from:instrument	*econ:pay:instrument*	The payment instrument used to make the payment.	
:from:account	*econ:bank:account*	Deprecated. Please use :from:instrument.	Deprecated: True
:from:pay:card	*econ:pay:card*	Deprecated. Please use :from:instrument.	Deprecated: True
:from:contract	*ou:contract*	A contract used as an aggregate payment source.	
:from:coinaddr	*crypto:currency:addres*	Deprecated. Please use :from:instrument.	Deprecated: True
:from:contact	*ps:contact*	Contact information for the entity making the payment.	
:to:cash	*bool*	Set to true if the payment output was in cash.	
:to:account	*econ:bank:account*	Deprecated. Please use :to:instrument.	Deprecated: True
:to:coinaddr	*crypto:currency:addres*	Deprecated. Please use :to:instrument.	Deprecated: True
:to:contact	*ps:contact*	Contact information for the person/org being paid.	
:to:contract	*ou:contract*	A contract used as an aggregate payment destination.	
:time	*time*	The time the payment was processed.	
:purchase	*econ:purchase*	The purchase which the payment was paying for.	
:amount	*econ:price*	The amount of money transferred in the payment.	
:currency	*econ:currency*	The currency of the payment.	
:memo	*str*	A small note specified by the payer common in financial transactions.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:bank:statement	-(has)>	econ:acct:payment	The bank statement includes the payment.
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting th
it:exec:query	-(found)>	*	The target node was returned as a result of runnin
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of th
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the ta
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target
ps:contact	-(has)>	*	The contact is or was in possession of the target n
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target n
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the at
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result o
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access
risk:leak	-(leaked)>	*	The leak included the disclosure of the target nod
risk:outage	-(impacted)>	*	The outage event impacted the availability of the
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the targ
sci:experiment	-(uses)>	*	The experiment used the target nodes when it wa
sci:observation	-(has)>	*	The observations are summarized from the target

econ:acct:receipt

A receipt issued as proof of payment.

The base type for the form can be found at *econ:acct:receipt*.

Properties:

name	type	doc
:issued	*time*	The time the receipt was issued.
:purchase	*econ:purchase*	The purchase that the receipt confirms payment for.
:issuer	*ps:contact*	The contact information for the entity who issued the receipt.
:recipient	*ps:contact*	The contact information for the entity who received the receipt.
:currency	*econ:currency*	The currency that the receipt uses to specify the price.
:amount	*econ:price*	The price that the receipt confirms was paid.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.

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Table 52 – continued from previous page

source	verb	target	doc
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:acquired

Deprecated. Please use econ:purchase -(acquired)> *.

The base type for the form can be found at *econ:acquired*.

Properties:

name	type	doc	opts
:purchase	*econ:purchase*	The purchase event which acquired an item.	Read Only: True
:item	*ndef*	A reference to the item that was acquired.	Read Only: True
:item:form	*str*	The form of item purchased.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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Table 53 – continued from previous page

source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:aba:rtn

An American Bank Association (ABA) routing transit number (RTN).

The base type for the form can be found at *econ:bank:aba:rtn*.

Properties:

name	type	doc
:bank	*ou:org*	The bank which was issued the ABA RTN.
:bank:name	*ou:name*	The name which is registered for this ABA RTN.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:account

A bank account.

The base type for the form can be found at *econ:bank:account*.

Properties:

name	type	doc
:type	*econ:bank:account:type:taxono*	The type of bank account.
:aba:rtn	*econ:bank:aba:rtn*	The ABA routing transit number for the bank which issued the account.
:number	*str* regex: [0-9]+	The account number.
:iban	*econ:bank:iban*	The IBAN for the account.
:issuer	*ou:org*	The bank which issued the account.
:issuer:name	*ou:name*	The name of the bank which issued the account.
:currency	*econ:currency*	The currency of the account balance.
:balance	*econ:bank:balance*	The most recently known bank balance information.
:contact	*ps:contact*	The primary contact for the bank account.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 55 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:account:type:taxonomy

A bank account type taxonomy.

The base type for the form can be found at *econ:bank:account:type:taxonomy*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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Table 56 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:balance

A balance contained by a bank account at a point in time.

The base type for the form can be found at *econ:bank:balance*.

Properties:

name	type	doc
:time	*time*	The time that the account balance was observed.
:amount	*econ:price*	The amount of currency available at the time.
:account	*econ:bank:account*	The bank account which contained the balance amount.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:iban

An International Bank Account Number.

The base type for the form can be found at *econ:bank:iban*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:statement

A statement of bank account payment activity over a period of time.

The base type for the form can be found at *econ:bank:statement*.

Properties:

name	type	doc
:account	*econ:bank:accoun*	The bank account used to compute the statement.
:period	*ival*	The period that the statement includes.
:starting:balanc	*econ:price*	The account balance at the beginning of the statement period.
:ending:balance	*econ:price*	The account balance at the end of the statement period.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)	geo:telem	Deprecated. Please use geo:telem:node.
econ:bank:stater	-(has)>	econ:acct:paym	The bank statement includes the payment.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:bank:swift:bic

A Society for Worldwide Interbank Financial Telecommunication (SWIFT) Business Identifier Code (BIC).

The base type for the form can be found at *econ:bank:swift:bic*.

Properties:

name	type	doc
:business	*ou:org*	The business which is the registered owner of the SWIFT BIC.
:office	*ps:contact*	The branch or office which is specified in the last 3 digits of the SWIFT BIC.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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Table 60 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:currency

The name of a system of money in general use.

The base type for the form can be found at *econ:currency*.

An example of econ:currency:

- usd

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 61 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:fin:bar

A sample of the open, close, high, low prices of a security in a specific time window.

The base type for the form can be found at *econ:fin:bar*.

Properties:

name	type	doc
:security	*econ:fin:security*	The security measured by the bar.
:ival	*ival*	The interval of measurement.
:price:open	*econ:price*	The opening price of the security.
:price:close	*econ:price*	The closing price of the security.
:price:low	*econ:price*	The low price of the security.
:price:high	*econ:price*	The high price of the security.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 62 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:fin:exchange

A financial exchange where securities are traded.

The base type for the form can be found at *econ:fin:exchange*.

Properties:

name	type	doc	opts
:name	*str* lower: True strip: True	A simple name for the exchange.	Example: nasdaq
:org	*ou:org*	The organization that operates the exchange.	
:currency	*econ:currency*	The currency used for all transactions in the exchange.	Example: usd

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.

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Table 63 – continued from previous page

source	verb	target	doc
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:fin:security

A financial security which is typically traded on an exchange.

The base type for the form can be found at *econ:fin:security*.

Properties:

name	type	doc
:exchange	*econ:fin:exchange*	The exchange on which the security is traded.
:ticker	*str* lower: True strip: True	The identifier for this security within the exchange.
:type	*str* lower: True strip: True	A user defined type such as stock, bond, option, future, or forex.
:price	*econ:price*	The last known/available price of the security.
:time	*time*	The time of the last know price sample.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:fin:tick

A sample of the price of a security at a single moment in time.

The base type for the form can be found at *econ:fin:tick*.

Properties:

name	type	doc
:security	*econ:fin:security*	The security measured by the tick.
:time	*time*	The time the price was sampled.
:price	*econ:price*	The price of the security at the time.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:pay:card

A single payment card.

The base type for the form can be found at *econ:pay:card*.

Properties:

name	type	doc
:pan	*econ:pay:pan*	The payment card number.
:pan:mii	*econ:pay:mii*	The payment card MII.
:pan:iin	*econ:pay:iin*	The payment card IIN.
:name	*ps:name*	The name as it appears on the card.
:expr	*time*	The expiration date for the card.
:cvv	*econ:pay:cvv*	The Card Verification Value on the card.
:pin	*econ:pay:pin*	The Personal Identification Number on the card.
:account	*econ:bank:account*	A bank account associated with the payment card.
:contact	*ps:contact*	The primary contact for the payment card.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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Table 66 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:pay:iin

An Issuer Id Number (IIN).

The base type for the form can be found at *econ:pay:iin*.

Properties:

name	type	doc
:org	*ou:org*	The issuer organization.
:name	*str* lower: True	The registered name of the issuer.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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Table 67 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:purchase

A purchase event.

The base type for the form can be found at *econ:purchase*.

Properties:

name	type	doc
:by:contact	*ps:contact*	The contact information used to make the purchase.
:from:contact	*ps:contact*	The contact information used to sell the item.
:time	*time*	The time of the purchase.
:place	*geo:place*	The place where the purchase took place.
:paid	*bool*	Set to True if the purchase has been paid in full.
:paid:time	*time*	The point in time where the purchase was paid in full.
:settled	*time*	The point in time where the purchase was settled.
:campaign	*ou:campaign*	The campaign that the purchase was in support of.
:price	*econ:price*	The econ:price of the purchase.
:currency	*econ:currency*	The econ:price of the purchase.
:listing	*biz:listing*	The purchase was made based on the given listing.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
econ:purchas	-(acquired)	*	The purchase was used to acquire the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

econ:receipt:item

A line item included as part of a purchase.

The base type for the form can be found at *econ:receipt:item*.

Properties:

name	type	doc
:purchase	*econ:purchase*	The purchase that contains this line item.
:count	*int* min: 1	The number of items included in this line item.
:price	*econ:price*	The total cost of this receipt line item.
:product	*biz:product*	The product being being purchased in this line item.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

edge:has

A digraph edge which records that N1 has N2.

The base type for the form can be found at *edge:has*.

Properties:

name	type	doc	opts
:n1	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n1:form	*str*	The base string type.	Read Only: True
:n2	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n2:form	*str*	The base string type.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None

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Table 70 – continued from previous page

source	verb	target	doc
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

edge:refs

A digraph edge which records that N1 refers to or contains N2.

The base type for the form can be found at *edge:refs*.

Properties:

name	type	doc	opts
:n1	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n1:form	*str*	The base string type.	Read Only: True
:n2	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n2:form	*str*	The base string type.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

edge:wentto

A digraph edge which records that N1 went to N2 at a specific time.

The base type for the form can be found at *edge:wentto*.

Properties:

name	type	doc	opts
:n1	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n1:form	*str*	The base string type.	Read Only: True
:n2	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n2:form	*str*	The base string type.	Read Only: True
:time	*time*	A date/time value.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 72 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

edu:class

An instance of an edu:course taught at a given time.

The base type for the form can be found at *edu:class*.

Properties:

name	type	doc
:course	*edu:course*	The course being taught in the class.
:instructor	*ps:contact*	The primary instructor for the class.
:assistants	*array* type: *ps:contact* uniq: True sorted: True	An array of assistant/co-instructor contacts.
:date:first	*time*	The date of the first day of class.
:date:last	*time*	The date of the last day of class.
:isvirtual	*bool*	Set if the class is known to be virtual.
:virtual:url	*inet:url*	The URL a student would use to attend the virtual class.
:virtual:provider	*ps:contact*	Contact info for the virtual infrastructure provider.
:place	*geo:place*	The place that the class is held.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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Table 73 – continued from previous page

source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

edu:course

A course of study taught by an org.

The base type for the form can be found at *edu:course*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the course.	Example: organic chemistry for beginners
:desc	*str*	A brief course description.	
:code	*str* lower: True strip: True	The course catalog number or designator.	Example: chem101
:institution	*ps:contact*	The org or department which teaches the course.	
:prereqs	*array* type: *edu:course* uniq: True sorted: True	The pre-requisite courses for taking this course.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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Table 74 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

entity:name

A name used to refer to an entity.

The base type for the form can be found at *entity:name*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

entity:relationship

A directional relationship between two actor entities.

The base type for the form can be found at *entity:relationship*.

Properties:

name	type	doc
:type	*entity:relationship:type:taxonomy*	The type of relationship.
:period	*ival*	The time period when the relationship existed.
:source	*entity:actor*	The source entity in the relationship.
:target	*entity:actor*	The target entity in the relationship.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

entity:relationship:type:taxonomy

A hierarchical taxonomy of entity relationship types.

The base type for the form can be found at *entity:relationship:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*entity:relationship:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:archive:entry

An archive entry representing a file and metadata within a parent archive file.

The base type for the form can be found at *file:archive:entry*.

Properties:

name	type	doc
:parent	*file:bytes*	The parent archive file.
:file	*file:bytes*	The file contained within the archive.
:path	*file:path*	The file path of the archived file.
:user	*inet:user*	The name of the user who owns the archived file.
:added	*time*	The time that the file was added to the archive.
:created	*time*	The created time of the archived file.
:modified	*time*	The modified time of the archived file.
:comment	*str*	The comment field for the file entry within the archive.
:posix:uid	*int*	The POSIX UID of the user who owns the archived file.
:posix:gid	*int*	The POSIX GID of the group who owns the archived file.
:posix:perms	*int*	The POSIX permissions mask of the archived file.
:archived:size	*int*	The encoded or compressed size of the archived file within the parent.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:attachment

A file attachment.

The base type for the form can be found at *file:attachment*.

Properties:

name	type	doc
:name	*file:path*	The name of the attached file.
:text	*str*	Any text associated with the file such as alt-text for images.
:file	*file:bytes*	The file which was attached.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:base

A file name with no path.

The base type for the form can be found at *file:base*.

An example of `file:base`:

- `woot.exe`

Properties:

name	type	doc	opts
`:ext`	*str*	The file extension (if any).	Read Only: `True`

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:bytes

The file bytes type with SHA256 based primary property.

The base type for the form can be found at *file:bytes*.

Properties:

name	type	doc
:size	*int*	The file size in bytes.
:md5	*hash:md5*	The md5 hash of the file.
:sha1	*hash:sha1*	The sha1 hash of the file.
:sha256	*hash:sha25*	The sha256 hash of the file.
:sha512	*hash:sha51*	The sha512 hash of the file.
:name	*file:base*	The best known base name for the file.
:mime	*file:mime*	The “best” mime type name for the file.
:mime:x509:cn	*str*	The Common Name (CN) attribute of the x509 Subject.
:mime:pe:size	*int*	The size of the executable file according to the PE file header.
:mime:pe:imphash	*hash:md5*	The PE import hash of the file as calculated by pefile; https://github.com/erocarrera/pefile .
:mime:pe:compiled	*time*	The compile time of the file according to the PE header.
:mime:pe:pdbpath	*file:path*	The PDB string according to the PE.
:mime:pe:exports:	*time*	The export time of the file according to the PE.
:mime:pe:exports:	*str*	The export library name according to the PE.
:mime:pe:richhdr	*hash:sha25*	The sha256 hash of the rich header bytes.
:exe:compiler	*it:prod:soft*	The software used to compile the file.
:exe:packer	*it:prod:soft*	The packer software used to encode the file.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
file:bytes	-(refs)>	it:dev:str	The source file contains the target string.
file:bytes	-(uses)>	math:algorithm	The file uses the algorithm.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:filepath

The fused knowledge of the association of a file:bytes node and a file:path.

The base type for the form can be found at *file:filepath*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file seen at a path.	Read Only: True
:path	*file:path*	The path a file was seen at.	Read Only: True
:path:dir	*file:path*	The parent directory.	Read Only: True
:path:base	*file:base*	The name of the file.	Read Only: True
:path:base:ext	*str*	The extension of the file name.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:ismime

Records one, of potentially multiple, mime types for a given file.

The base type for the form can be found at *file:ismime*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file node that is an instance of the named mime type.	Read Only: True
:mime	*file:mime*	The mime type of the file.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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Table 83 – continued from previous page

source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime

A file mime name string.

The base type for the form can be found at *file:mime*.

An example of file:mime:

- text/plain

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 84 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:gif

The GUID of a set of mime metadata for a .gif file.

The base type for the form can be found at *file:mime:gif*.

Properties:

name	type	doc
:desc	*str*	MIME specific description field extracted from metadata.
:comment	*str*	MIME specific comment field extracted from metadata.
:created	*time*	MIME specific creation timestamp extracted from metadata.
:imageid	*str*	MIME specific unique identifier extracted from metadata.
:author	*ps:contact*	MIME specific contact information extracted from metadata.
:latlong	*geo:latlong*	MIME specific lat/long information extracted from metadata.
:altitude	*geo:altitude*	MIME specific altitude information extracted from metadata.
:text	*str* lower: True onespace: True	The text contained within the image.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:jpg

The GUID of a set of mime metadata for a .jpg file.

The base type for the form can be found at *file:mime:jpg*.

Properties:

name	type	doc
:desc	*str*	MIME specific description field extracted from metadata.
:comment	*str*	MIME specific comment field extracted from metadata.
:created	*time*	MIME specific creation timestamp extracted from metadata.
:imageid	*str*	MIME specific unique identifier extracted from metadata.
:author	*ps:contact*	MIME specific contact information extracted from metadata.
:latlong	*geo:latlong*	MIME specific lat/long information extracted from metadata.
:altitude	*geo:altitude*	MIME specific altitude information extracted from metadata.
:text	*str* lower: True onespace: True	The text contained within the image.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:lnk

The GUID of the metadata pulled from a Windows shortcut or LNK file.

The base type for the form can be found at *file:mime:lnk*.

Properties:

name	type	doc	opts
:flags	*int*	The flags specified by the LNK header that control the structure of the LNK file.	
:entry:primary	*file:path*	The primary file path contained within the FileEntry structure of the LNK file.	
:entry:secondary	*file:path*	The secondary file path contained within the FileEntry structure of the LNK file.	
:entry:extended	*file:path*	The extended file path contained within the extended FileEntry structure of the LNK file.	
:entry:localized	*file:path*	The localized file path reconstructed from references within the extended FileEntry structure of the LNK file.	
:entry:icon	*file:path*	The icon file path contained within the StringData structure of the LNK file.	
:environment:path	*file:path*	The target file path contained within the EnvironmentVariableDataBlock structure of the LNK file.	
:environment:icon	*file:path*	The icon file path contained within the IconEnvironmentDataBlock structure of the LNK file.	
:iconindex	*int*	A resource index for an icon within an icon location.	
:working	*file:path*	The working directory used when activating the link target.	
:relative	*str* strip: True	The relative target path string contained within the StringData structure of the LNK file.	
:arguments	*it:cmd*	The command line arguments passed to the target file when the LNK file is activated.	
:desc	*str*	The description of the LNK file contained within the StringData section of the LNK file.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:macho:loadcmd

A generic load command pulled from the Mach-O headers.

The base type for the form can be found at *file:mime:macho:loadcmd*.

Properties:

name	type	doc
:file	*file:bytes*	The Mach-O file containing the load command.
:type	*int* enums: ((1, 'segment'), (2, 'symbol table'), (3, 'gdb symbol table'), (4, 'thread'), (5, 'unix thread'), (6, 'fixed VM shared library'), (7, 'fixed VM shared library identification'), (8, 'object identification'), (9, 'fixed VM file inclusion'), (10, 'prepage'), (11, 'dynamic link-edit symbol table'), (12, 'load dynamically linked shared library'), (13, 'dynamically linked shared library identifier'), (14, 'load dynamic linker'), (15, 'dynamic linker identification'), (16, 'prebound dynamically linked shared library'), (17, 'image routines'), (18, 'sub framework'), (19, 'sub umbrella'), (20, 'sub client'), (21, 'sub library'), (22, 'two level namespace lookup hints'), (23, 'prebind checksum'), (24, 'weak import dynamically linked shared library'), (25, '64bit segment'), (26, '64bit image routines'), (27, 'uuid'), (28, 'runpath additions'), (29, 'code signature'), (30, 'split segment info'), (31, 'load and re-export dynamic library'), (32, 'delay load of dynamic library'), (33, 'encrypted segment	The type of the load command.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:macho:section

A section inside a Mach-O binary denoting a named region of bytes inside a segment.

The base type for the form can be found at *file:mime:macho:section*.

Properties:

name	type	doc
:segment	*file:mime:macho:segment*	The Mach-O segment that contains this section.
:name	*str*	Name of the section.
:size	*int*	Size of the section in bytes.
:type	*int* enums: ((0, 'regular'), (1, 'zero fill on demand'), (2, 'only literal C strings'), (3, 'only 4 byte literals'), (4, 'only 8 byte literals'), (5, 'only pointers to literals'), (6, 'only non-lazy symbol pointers'), (7, 'only lazy symbol pointers'), (8, 'only symbol stubs'), (9, 'only function pointers for init'), (10, 'only function pointers for fini'), (11, 'contains symbols to be coalesced'), (12, 'zero fill on deman (greater than 4gb)'), (13, 'only pairs of function pointers for interposing'), (14, 'only 16 byte literals'), (15, 'dtrace object format'), (16, 'only lazy symbols pointers to lazy dynamic libraries'))	The type of the section.
:sha256	*hash:sha256*	The sha256 hash of the bytes of the Mach-O section.
:offset	*int*	The file offset to the beginning of the section.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:macho:segment

A named region of bytes inside a Mach-O binary.

The base type for the form can be found at *file:mime:macho:segment*.

Properties:

name	type	doc
:name	*str*	The name of the Mach-O segment.
:memsize	*int*	The size of the segment in bytes, when resident in memory, according to the load command structure.
:disksize	*int*	The size of the segment in bytes, when on disk, according to the load command structure.
:sha256	*hash:sha256*	The sha256 hash of the bytes of the segment.
:offset	*int*	The file offset to the beginning of the segment.
:file	*file:bytes*	The Mach-O file containing the load command.
:type	*int* enums: ((1, 'segment'), (2, 'symbol table'), (3, 'gdb symbol table'), (4, 'thread'), (5, 'unix thread'), (6, 'fixed VM shared library'), (7, 'fixed VM shared library identification'), (8, 'object identification'), (9, 'fixed VM file inclusion'), (10, 'prepage'), (11, 'dynamic link-edit symbol table'), (12, 'load dynamically linked shared library'), (13, 'dynamically linked shared library identifier'), (14, 'load dynamic linker'), (15, 'dynamic linker identification'), (16, 'prebound dynamically linked shared library'), (17, 'image routines'), (18, 'sub framework'), (19, 'sub umbrella'), (20, 'sub client'), (21, 'sub library'), (22, 'two level namespace lookup hints'), (23, 'prebind checksum'), (24, 'weak import dynamically	The type of the load command.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:macho:uuid

A specific load command denoting a UUID used to uniquely identify the Mach-O binary.

The base type for the form can be found at *file:mime:macho:uuid*.

Properties:

name	type	doc
:uuid	*guid*	The UUID of the Mach-O application (as defined in an LC_UUID load command).
:file	*file:bytes*	The Mach-O file containing the load command.
:type	*int* enums: ((1, 'segment'), (2, 'symbol table'), (3, 'gdb symbol table'), (4, 'thread'), (5, 'unix thread'), (6, 'fixed VM shared library'), (7, 'fixed VM shared library identification'), (8, 'object identification'), (9, 'fixed VM file inclusion'), (10, 'prepage'), (11, 'dynamic link-edit symbol table'), (12, 'load dynamically linked shared library'), (13, 'dynamically linked shared library identifier'), (14, 'load dynamic linker'), (15, 'dynamic linker identification'), (16, 'prebound dynamically linked shared library'), (17, 'image routines'), (18, 'sub framework'), (19, 'sub umbrella'), (20, 'sub client'), (21, 'sub library'), (22, 'two level namespace lookup hints'), (23, 'prebind checksum'), (24, 'weak import dynamically linked shared library'), (25, '64bit segment'), (26, '64bit image routines'), (27, 'uuid'), (28, 'runpath additions'), (29, 'code signature'), (30, 'split segment info'), (31, 'load and re-export dynamic library'), (32, 'delay	The type of the load command.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:macho:version

A specific load command used to denote the version of the source used to build the Mach-O binary.

The base type for the form can be found at *file:mime:macho:version*.

Properties:

name	type	doc
:version	*str*	The version of the Mach-O file encoded in an LC_VERSION load command.
:file	*file:bytes*	The Mach-O file containing the load command.
:type	*int* enums: ((1, 'segment'), (2, 'symbol table'), (3, 'gdb symbol table'), (4, 'thread'), (5, 'unix thread'), (6, 'fixed VM shared library'), (7, 'fixed VM shared library identification'), (8, 'object identification'), (9, 'fixed VM file inclusion'), (10, 'prepage'), (11, 'dynamic link-edit symbol table'), (12, 'load dynamically linked shared library'), (13, 'dynamically linked shared library identifier'), (14, 'load dynamic linker'), (15, 'dynamic linker identification'), (16, 'prebound dynamically linked shared library'), (17, 'image routines'), (18, 'sub framework'), (19, 'sub umbrella'), (20, 'sub client'), (21, 'sub library'), (22, 'two level namespace lookup hints'), (23, 'prebind checksum'), (24, 'weak import dynamically linked shared library'), (25, '64bit segment'), (26, '64bit image routines'), (27, 'uuid'), (28, 'runpath additions'), (29, 'code signature'), (30, 'split segment info'), (31, 'load and re-export dynamic library'), (32, 'delay	The type of the load command.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:msdoc

The GUID of a set of mime metadata for a Microsoft Word file.

The base type for the form can be found at *file:mime:msdoc*.

Properties:

name	type	doc
:title	*str*	The title extracted from Microsoft Office metadata.
:author	*str*	The author extracted from Microsoft Office metadata.
:subject	*str*	The subject extracted from Microsoft Office metadata.
:application	*str*	The creating_application extracted from Microsoft Office metadata.
:created	*time*	The create_time extracted from Microsoft Office metadata.
:lastsaved	*time*	The last_saved_time extracted from Microsoft Office metadata.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:msppt

The GUID of a set of mime metadata for a Microsoft Powerpoint file.

The base type for the form can be found at *file:mime:msppt*.

Properties:

name	type	doc
:title	*str*	The title extracted from Microsoft Office metadata.
:author	*str*	The author extracted from Microsoft Office metadata.
:subject	*str*	The subject extracted from Microsoft Office metadata.
:application	*str*	The creating_application extracted from Microsoft Office metadata.
:created	*time*	The create_time extracted from Microsoft Office metadata.
:lastsaved	*time*	The last_saved_time extracted from Microsoft Office metadata.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:msxls

The GUID of a set of mime metadata for a Microsoft Excel file.

The base type for the form can be found at *file:mime:msxls*.

Properties:

name	type	doc
:title	*str*	The title extracted from Microsoft Office metadata.
:author	*str*	The author extracted from Microsoft Office metadata.
:subject	*str*	The subject extracted from Microsoft Office metadata.
:application	*str*	The creating_application extracted from Microsoft Office metadata.
:created	*time*	The create_time extracted from Microsoft Office metadata.
:lastsaved	*time*	The last_saved_time extracted from Microsoft Office metadata.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:pe:export

The fused knowledge of a file:bytes node containing a pe named export.

The base type for the form can be found at *file:mime:pe:export*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file containing the export.	Read Only: True
:name	*str*	The name of the export in the file.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:pe:resource

The fused knowledge of a file:bytes node containing a pe resource.

The base type for the form can be found at *file:mime:pe:resource*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file containing the resource.	Read Only: True
:type	*pe:resource:type*	The typecode for the resource.	Read Only: True
:langid	*pe:langid*	The language code for the resource.	Read Only: True
:resource	*file:bytes*	The sha256 hash of the resource bytes.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:pe:section

The fused knowledge a file:bytes node containing a pe section.

The base type for the form can be found at *file:mime:pe:section*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file containing the section.	Read Only: True
:name	*str*	The textual name of the section.	Read Only: True
:sha25(	*hash:sha25*	The sha256 hash of the section. Relocations must be zeroed before hashing.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:pe:vsvers:info

knowledge of a file:bytes node containing vsvers info.

The base type for the form can be found at *file:mime:pe:vsvers:info*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file containing the vsversion keyval pair.	Read Only: True
:keyval	*file:mime:pe:vsvers:keyv*	The vsversion info keyval in this file:bytes node.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:pe:vsvers:keyval

A key value pair found in a PE vsversion info structure.

The base type for the form can be found at *file:mime:pe:vsvers:keyval*.

Properties:

name	type	doc	opts
:name	*str*	The key for the vsversion keyval pair.	Read Only: True
:value	*str*	The value for the vsversion keyval pair.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:png

The GUID of a set of mime metadata for a .png file.

The base type for the form can be found at *file:mime:png*.

Properties:

name	type	doc
:desc	*str*	MIME specific description field extracted from metadata.
:comment	*str*	MIME specific comment field extracted from metadata.
:created	*time*	MIME specific creation timestamp extracted from metadata.
:imageid	*str*	MIME specific unique identifier extracted from metadata.
:author	*ps:contact*	MIME specific contact information extracted from metadata.
:latlong	*geo:latlong*	MIME specific lat/long information extracted from metadata.
:altitude	*geo:altitude*	MIME specific altitude information extracted from metadata.
:text	*str* lower: True onespace: True	The text contained within the image.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:rtf

The GUID of a set of mime metadata for a .rtf file.

The base type for the form can be found at *file:mime:rtf*.

Properties:

name	type	doc
:guid	*guid*	The parsed GUID embedded in the .rtf file.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:mime:tif

The GUID of a set of mime metadata for a .tif file.

The base type for the form can be found at *file:mime:tif*.

Properties:

name	type	doc
:desc	*str*	MIME specific description field extracted from metadata.
:comment	*str*	MIME specific comment field extracted from metadata.
:created	*time*	MIME specific creation timestamp extracted from metadata.
:imageid	*str*	MIME specific unique identifier extracted from metadata.
:author	*ps:contact*	MIME specific contact information extracted from metadata.
:latlong	*geo:latlong*	MIME specific lat/long information extracted from metadata.
:altitude	*geo:altitude*	MIME specific altitude information extracted from metadata.
:text	*str* lower: True onespace: True	The text contained within the image.
:file	*file:bytes*	The file that the mime info was parsed from.
:file:offs	*int*	The optional offset where the mime info was parsed from.
:file:data	*data*	A mime specific arbitrary data structure for non-indexed data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:path

A normalized file path.

The base type for the form can be found at *file:path*.

An example of `file:path`:

- `c:/windows/system32/calc.exe`

  Properties:

name	type	doc	opts
:dir	*file:path*	The parent directory.	Read Only: True
:base	*file:base*	The file base name.	Read Only: True
:base:ext	*str*	The file extension.	Read Only: True

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:string

Deprecated. Please use the edge -(refs)> it:dev:str.

The base type for the form can be found at *file:string*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file containing the string.	Read Only: True
:string	*str*	The string contained in this file:bytes node.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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Table 105 – continued from previous page

source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

file:subfile

A parent file that fully contains the specified child file.

The base type for the form can be found at *file:subfile*.

Properties:

name	type	doc	opts
:parent	*file:bytes*	The parent file containing the child file.	Read Only: True
:child	*file:bytes*	The child file contained in the parent file.	Read Only: True
:name	*file:base*	Deprecated, please use the :path property.	Deprecated: True
:path	*file:path*	The path that the parent uses to refer to the child file.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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Table 106 – continued from previous page

source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

geo:name

An unstructured place name or address.

The base type for the form can be found at *geo:name*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.

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Table 107 – continued from previous page

source	verb	target	doc
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

geo:nloc

Records a node latitude/longitude in space-time.

The base type for the form can be found at *geo:nloc*.

Properties:

name	type	doc	opts
:ndef	*ndef*	The node with location in geospace and time.	Read Only: True
:ndef:form	*str*	The form of node referenced by the ndef.	Read Only: True
:latlong	*geo:latlong*	The latitude/longitude the node was observed.	Read Only: True
:time	*time*	The time the node was observed at location.	Read Only: True
:place	*geo:place*	The place corresponding to the latlong property.	
:loc	*loc*	The geo-political location string for the node.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

geo:place

A GUID for a geographic place.

The base type for the form can be found at *geo:place*.

Properties:

name	type	doc	opts
:id	*str* strip: True	A type specific identifier such as an airport ID.	
:name	*geo:name*	The name of the place.	alts: ('names',)
:type	*geo:place:taxonomy*	The type of place.	
:names	*array* type: *geo:name* sorted: True uniq: True	An array of alternative place names.	
:parent	*geo:place*	Deprecated. Please use a -(contains)> edge.	Deprecated: True
:desc	*str*	A long form description of the place.	
:loc	*loc*	The geo-political location string for the node.	
:address	*geo:address*	The street/mailing address for the place.	
:geojson	*geo:json*	A GeoJSON representation of the place.	
:latlong	*geo:latlong*	The lat/long position for the place.	
:bbox	*geo:bbox*	A bounding box which encompasses the place.	
:radius	*geo:dist*	An approximate radius to use for bounding box calculation.	
:photo	*file:bytes*	The image file to use as the primary image of the place.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
geo:place	-(contains)>	geo:place	The source place completely contains the target place.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
geo:place	-(contains)>	geo:place	None
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target nod
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the quer
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the comp
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targ
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

geo:place:taxonomy

A taxonomy of place types.

The base type for the form can be found at *geo:place:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*geo:place:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 110 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

geo:telem

The geospatial position and physical characteristics of a node at a given time.

The base type for the form can be found at *geo:telem*.

Properties:

name	type	doc	opts
:time	*time*	The time that the telemetry measurements were taken.	
:desc	*str*	A description of the telemetry sample.	
:latlong	*geo:latlon*	Deprecated. Please use :place:latlong.	Deprecated: True
:accuracy	*geo:dist*	Deprecated. Please use :place:latlong:accuracy.	Deprecated: True
:node	*ndef*	The node that was observed at the associated time and place.	
:phys:mass	*mass*	The mass of the object.	
:phys:volume	*geo:dist*	The cubed volume of the object.	
:phys:length	*geo:dist*	The length of the object.	
:phys:width	*geo:dist*	The width of the object.	
:phys:height	*geo:dist*	The height of the object.	
:place	*geo:place*	The place where the object was located.	
:place:loc	*loc*	The geopolitical location of the object.	
:place:name	*geo:name*	The name of the place where the object was located.	
:place:address	*geo:addre*	The postal address of the place where the object was located.	
:place:latlong	*geo:latlon*	The latlong where the object was located.	
:place:latlong:acc	*geo:dist*	The accuracy of the latlong where the object was located.	
:place:country	*pol:counti*	The country where the object was located.	
:place:country:cod	*pol:iso2*	The country code where the object was located.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target nod
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target n
it:exec:query	-(found)>	*	The target node was returned as a result of running the quer
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target n
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the comp
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targ
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target nod
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

gov:cn:icp

A Chinese Internet Content Provider ID.

The base type for the form can be found at *gov:cn:icp*.

Properties:

name	type	doc
:org	*ou:org*	The org with the Internet Content Provider ID.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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Table 112 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

gov:cn:mucd

A Chinese PLA MUCD.

The base type for the form can be found at *gov:cn:mucd*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 113 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

gov:us:cage

A Commercial and Government Entity (CAGE) code.

The base type for the form can be found at *gov:us:cage*.

Properties:

name	type	doc
:name0	*ou:name*	The name of the organization.
:name1	*str* lower: True	Name Part 1.
:street	*str* lower: True	The base string type.
:city	*str* lower: True	The base string type.
:state	*str* lower: True	The base string type.
:zip	*gov:us:zip*	A US Postal Zip Code.
:cc	*pol:iso2*	The 2 digit ISO 3166 country code.
:country	*str* lower: True	The base string type.
:phone0	*tel:phone*	A phone number.
:phone1	*tel:phone*	A phone number.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

gov:us:ssn

A US Social Security Number (SSN).

The base type for the form can be found at *gov:us:ssn*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

gov:us:zip

A US Postal Zip Code.

The base type for the form can be found at *gov:us:zip*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

graph:cluster

A generic node, used in conjunction with Edge types, to cluster arbitrary nodes to a single node in the model.

The base type for the form can be found at *graph:cluster*.

Properties:

name	type	doc
:name	*str* lower: True	A human friendly name for the cluster.
:desc	*str* lower: True	A human friendly long form description for the cluster.
:type	*str* lower: True	An optional type field used to group clusters.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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Table 117 – continued from previous page

source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

graph:edge

A generic digraph edge to show relationships outside the model.

The base type for the form can be found at *graph:edge*.

Properties:

name	type	doc	opts
:n1	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n1:form	*str*	The base string type.	Read Only: True
:n2	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n2:form	*str*	The base string type.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 118 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

graph:event

A generic event node to represent events outside the model.

The base type for the form can be found at *graph:event*.

Properties:

name	type	doc
:time	*time*	The time of the event.
:type	*str*	A arbitrary type string for the event.
:name	*str*	A name for the event.
:data	*data*	Arbitrary non-indexed msgpack data attached to the event.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

graph:node

A generic node used to represent objects outside the model.

The base type for the form can be found at *graph:node*.

Properties:

name	type	doc
:type	*str*	The type name for the non-model node.
:name	*str*	A human readable name for this record.
:data	*data*	Arbitrary non-indexed msgpack data attached to the node.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.

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Table 120 – continued from previous page

source	verb	target	doc
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

graph:timeedge

A generic digraph time edge to show relationships outside the model.

The base type for the form can be found at *graph:timeedge*.

Properties:

name	type	doc	opts
:time	*time*	A date/time value.	Read Only: True
:n1	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n1:form	*str*	The base string type.	Read Only: True
:n2	*ndef*	The node definition type for a (form,valu) compound field.	Read Only: True
:n2:form	*str*	The base string type.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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Table 121 – continued from previous page

source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

hash:md5

A hex encoded MD5 hash.

The base type for the form can be found at *hash:md5*.

An example of hash:md5:

- d41d8cd98f00b204e9800998ecf8427e

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 122 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

hash:sha1

A hex encoded SHA1 hash.

The base type for the form can be found at *hash:sha1*.

An example of `hash:sha1`:

- `da39a3ee5e6b4b0d3255bfef95601890afd80709`

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

  Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

hash:sha256

A hex encoded SHA256 hash.

The base type for the form can be found at *hash:sha256*.

An example of hash:sha256:

- ad9f4fe922b61e674a09530831759843b1880381de686a43460a76864ca0340c

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

hash:sha384

A hex encoded SHA384 hash.

The base type for the form can be found at *hash:sha384*.

An example of `hash:sha384`:

- `d425f1394e418ce01ed1579069a8bfaa1da8f32cf823982113ccbef531fa36bda9987f389c5af05b5e28035242efab`

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

hash:sha512

A hex encoded SHA512 hash.

The base type for the form can be found at *hash:sha512*.

An example of `hash:sha512`:

- ca74fe2ff2d03b29339ad7d08ba21d192077fece1715291c7b43c20c9136cd132788239189f3441a87eb23ce2660aa

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:asn

An Autonomous System Number (ASN).

The base type for the form can be found at *inet:asn*.

Properties:

name	type	doc
:name	*str* lower: True	The name of the organization currently responsible for the ASN.
:owner	*ou:org*	The guid of the organization currently responsible for the ASN.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:asnet4

An Autonomous System Number (ASN) and its associated IPv4 address range.

The base type for the form can be found at *inet:asnet4*.

An example of `inet:asnet4`:

- `(54959, (1.2.3.4, 1.2.3.20))`

Properties:

name	type	doc	opts
:asn	*inet:asn*	The Autonomous System Number (ASN) of the netblock.	Read Only: True
:net4	*inet:net4*	The IPv4 address range assigned to the ASN.	Read Only: True
:net4:mi	*inet:ipv4*	The first IPv4 in the range assigned to the ASN.	Read Only: True
:net4:ma	*inet:ipv4*	The last IPv4 in the range assigned to the ASN.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:asnet6

An Autonomous System Number (ASN) and its associated IPv6 address range.

The base type for the form can be found at *inet:asnet6*.

An example of `inet:asnet6`:

- `(54959, (ff::00, ff::02))`

  Properties:

name	type	doc	opts
:asn	*inet:asn*	The Autonomous System Number (ASN) of the netblock.	Read Only: True
:net6	*inet:net6*	The IPv6 address range assigned to the ASN.	Read Only: True
:net6:mi	*inet:ipv6*	The first IPv6 in the range assigned to the ASN.	Read Only: True
:net6:ma	*inet:ipv6*	The last IPv6 in the range assigned to the ASN.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 129 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:banner

A network protocol banner string presented by a server.

The base type for the form can be found at *inet:banner*.

Properties:

name	type	doc	opts
:server	*inet:server*	The server which presented the banner string.	Read Only: True
:server:ipv4	*inet:ipv4*	The IPv4 address of the server.	Read Only: True
:server:ipv6	*inet:ipv6*	The IPv6 address of the server.	Read Only: True
:server:port	*inet:port*	The network port.	Read Only: True
:text	*it:dev:str*	The banner text.	Read Only: True Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 130 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:cidr4

An IPv4 address block in Classless Inter-Domain Routing (CIDR) notation.

The base type for the form can be found at *inet:cidr4*.

An example of `inet:cidr4`:

- `1.2.3.0/24`

Properties:

name	type	doc	opts
:broadcast	*inet:ipv4*	The broadcast IP address from the CIDR notation.	Read Only: True
:mask	*int*	The mask from the CIDR notation.	Read Only: True
:network	*inet:ipv4*	The network IP address from the CIDR notation.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:cidr6

An IPv6 address block in Classless Inter-Domain Routing (CIDR) notation.

The base type for the form can be found at *inet:cidr6*.

An example of `inet:cidr6`:

- `2001:db8::/101`

Properties:

name	type	doc	opts
`:broadcast`	*inet:ipv6*	The broadcast IP address from the CIDR notation.	Read Only: `True`
`:mask`	*int*	The mask from the CIDR notation.	Read Only: `True`
`:network`	*inet:ipv6*	The network IP address from the CIDR notation.	Read Only: `True`

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.
`ou:campaign`	`-(targets)>`	*	The campaign targeted the target nodes.
`ou:campaign`	`-(uses)>`	*	The campaign made use of the target node.
`ou:contribution`	`-(includes)>`	*	The contribution includes the specific node.
`ou:org`	`-(has)>`	*	The organization is or was in possession of the target node.
`ou:org`	`-(owns)>`	*	The organization owns or owned the target node.
`ou:org`	`-(targets)>`	*	The organization targets the target node.
`ou:org`	`-(uses)>`	*	The ou:org makes use of the target node.
`plan:procedure:step`	`-(uses)>`	*	The step in the procedure makes use of the target node.
`ps:contact`	`-(has)>`	*	The contact is or was in possession of the target node.
`ps:contact`	`-(owns)>`	*	The contact owns or owned the target node.
`ps:person`	`-(has)>`	*	The person is or was in possession of the target node.
`ps:person`	`-(owns)>`	*	The person owns or owned the target node.
`risk:attack`	`-(targets)>`	*	The attack targeted the target node.
`risk:attack`	`-(uses)>`	*	The attack used the target node to facilitate the attack.
`risk:compromise`	`-(stole)>`	*	The target node was stolen or copied as a result of the compr
`risk:extortion`	`-(leveraged)>`	*	The extortion event was based on attacker access to the targe

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Table 132 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:client

A network client address.

The base type for the form can be found at *inet:client*.

An example of inet:client:

- tcp://1.2.3.4:80

Properties:

name	type	doc	opts
:proto	*str* lower: True	The network protocol of the client.	Read Only: True
:ipv4	*inet:ipv4*	The IPv4 of the client.	Read Only: True
:ipv6	*inet:ipv6*	The IPv6 of the client.	Read Only: True
:host	*it:host*	The it:host node for the client.	Read Only: True
:port	*inet:port*	The client tcp/udp port.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 133 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:a

The result of a DNS A record lookup.

The base type for the form can be found at *inet:dns:a*.

An example of `inet:dns:a`:

- `(vertex.link,1.2.3.4)`

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain queried for its DNS A record.	Read Only: True
:ipv4	*inet:ipv4*	The IPv4 address returned in the A record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:aaaa

The result of a DNS AAAA record lookup.

The base type for the form can be found at *inet:dns:aaaa*.

An example of `inet:dns:aaaa`:

- (vertex.link,2607:f8b0:4004:809::200e)

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain queried for its DNS AAAA record.	Read Only: True
:ipv6	*inet:ipv6*	The IPv6 address returned in the AAAA record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node

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Table 135 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:answer

A single answer from within a DNS reply.

The base type for the form can be found at *inet:dns:answer*.

Properties:

name	type	doc
:ttl	*int*	The base 64 bit signed integer type.
:request	*inet:dns:request*	A single instance of a DNS resolver request and optional reply info.
:a	*inet:dns:a*	The DNS A record returned by the lookup.
:ns	*inet:dns:ns*	The DNS NS record returned by the lookup.
:rev	*inet:dns:rev*	The DNS PTR record returned by the lookup.
:aaaa	*inet:dns:aaaa*	The DNS AAAA record returned by the lookup.
:rev6	*inet:dns:rev6*	The DNS PTR record returned by the lookup of an IPv6 address.
:cname	*inet:dns:cname*	The DNS CNAME record returned by the lookup.
:mx	*inet:dns:mx*	The DNS MX record returned by the lookup.
:mx:priority	*int*	The DNS MX record priority.
:soa	*inet:dns:soa*	The domain queried for its SOA record.
:txt	*inet:dns:txt*	The DNS TXT record returned by the lookup.
:time	*time*	The time that the DNS response was transmitted.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 136 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:cname

The result of a DNS CNAME record lookup.

The base type for the form can be found at *inet:dns:cname*.

An example of `inet:dns:cname`:

- `(foo.vertex.link,vertex.link)`

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain queried for its CNAME record.	Read Only: True
:cname	*inet:fqdn*	The domain returned in the CNAME record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:dynreg

A dynamic DNS registration.

The base type for the form can be found at *inet:dns:dynreg*.

Properties:

name	type	doc
:fqdn	*inet:fqdn*	The FQDN registered within a dynamic DNS provider.
:provider	*ou:org*	The organization which provides the dynamic DNS FQDN.
:provider:name	*ou:name*	The name of the organization which provides the dynamic DNS FQDN.
:provider:fqdn	*inet:fqdn*	The FQDN of the organization which provides the dynamic DNS FQDN.
:contact	*ps:contact*	The contact information of the registrant.
:created	*time*	The time that the dynamic DNS registration was first created.
:client	*inet:client*	The network client address used to register the dynamic FQDN.
:client:ipv4	*inet:ipv4*	The client IPv4 address used to register the dynamic FQDN.
:client:ipv6	*inet:ipv6*	The client IPv6 address used to register the dynamic FQDN.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 138 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:mx

The result of a DNS MX record lookup.

The base type for the form can be found at *inet:dns:mx*.

An example of `inet:dns:mx`:

- `(vertex.link,mail.vertex.link)`

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain queried for its MX record.	Read Only: True
:mx	*inet:fqdn*	The domain returned in the MX record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.

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Table 139 – continued from previous page

source	verb	target	doc
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:ns

The result of a DNS NS record lookup.

The base type for the form can be found at *inet:dns:ns*.

An example of `inet:dns:ns`:

- `(vertex.link,ns.dnshost.com)`

Properties:

name	type	doc	opts
:zone	*inet:fqdn*	The domain queried for its DNS NS record.	Read Only: True
:ns	*inet:fqdn*	The domain returned in the NS record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:query

A DNS query unique to a given client.

The base type for the form can be found at *inet:dns:query*.

An example of `inet:dns:query`:

- `(1.2.3.4, woot.com, 1)`

Properties:

name	type	doc	opts
:client	*inet:client*	A network client address.	Read Only: True
:name	*inet:dns:nar*	A DNS query name string. Likely an FQDN but not always.	Read Only: True
:name:ipv	*inet:ipv4*	An IPv4 address.	
:name:ipv	*inet:ipv6*	An IPv6 address.	
:name:fqd	*inet:fqdn*	A Fully Qualified Domain Name (FQDN).	
:type	*int*	The base 64 bit signed integer type.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe

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Table 141 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:request

A single instance of a DNS resolver request and optional reply info.

The base type for the form can be found at *inet:dns:request*.

Properties:

name	type	doc
:time	*time*	A date/time value.
:query	*inet:dns:query*	A DNS query unique to a given client.
:query:name	*inet:dns:name*	A DNS query name string. Likely an FQDN but not always.
:query:name:ipv4	*inet:ipv4*	An IPv4 address.
:query:name:ipv6	*inet:ipv6*	An IPv6 address.
:query:name:fqdn	*inet:fqdn*	A Fully Qualified Domain Name (FQDN).
:query:type	*int*	The base 64 bit signed integer type.
:server	*inet:server*	A network server address.
:reply:code	*int* enums: ((0, 'NOERROR'), (1, 'FORMERR'), (2, 'SERVFAIL'), (3, 'NXDOMAIN'), (4, 'NOTIMP'), (5, 'REFUSED'), (6, 'YXDOMAIN'), (7, 'YXRRSET'), (8, 'NXRRSET'), (9, 'NOTAUTH'), (10, 'NOTZONE'), (11, 'DSOTYPENI'), (16, 'BADSIG'), (17, 'BADKEY'), (18, 'BADTIME'), (19, 'BADMODE'), (20, 'BADNAME'), (21, 'BADALG'), (22, 'BADTRUNC'), (23, 'BADCOOKIE')) enums:strict: False	The DNS server response code.
:exe	*file:bytes*	The file containing the code that attempted the DNS lookup.
:proc	*it:exec:proc*	The process that attempted the DNS lookup.
:host	*it:host*	The host that attempted the DNS lookup.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:rev

The transformed result of a DNS PTR record lookup.

The base type for the form can be found at *inet:dns:rev*.

An example of `inet:dns:rev`:

- (1.2.3.4,vertex.link)

Properties:

name	type	doc	opts
:ipv4	*inet:ipv4*	The IPv4 address queried for its DNS PTR record.	Read Only: True
:fqdn	*inet:fqdn*	The domain returned in the PTR record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node

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source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:rev6

The transformed result of a DNS PTR record for an IPv6 address.

The base type for the form can be found at *inet:dns:rev6*.

An example of `inet:dns:rev6`:

- `(2607:f8b0:4004:809::200e,vertex.link)`

Properties:

name	type	doc	opts
:ipv6	*inet:ipv6*	The IPv6 address queried for its DNS PTR record.	Read Only: True
:fqdn	*inet:fqdn*	The domain returned in the PTR record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:soa

The result of a DNS SOA record lookup.

The base type for the form can be found at *inet:dns:soa*.

Properties:

name	type	doc
:fqdn	*inet:fqdn*	The domain queried for its SOA record.
:ns	*inet:fqdn*	The domain (MNAME) returned in the SOA record.
:email	*inet:email*	The email address (RNAME) returned in the SOA record.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:txt

The result of a DNS TXT record lookup.

The base type for the form can be found at *inet:dns:txt*.

An example of `inet:dns:txt`:

- `(hehe.vertex.link,"fancy TXT record")`

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain queried for its TXT record.	Read Only: True
:txt	*str*	The string returned in the TXT record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:wild:a

A DNS A wild card record and the IPv4 it resolves to.

The base type for the form can be found at *inet:dns:wild:a*.

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain containing a wild card record.	Read Only: True
:ipv4	*inet:ipv4*	The IPv4 address returned by wild card resolutions.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:dns:wild:aaaa

A DNS AAAA wild card record and the IPv6 it resolves to.

The base type for the form can be found at *inet:dns:wild:aaaa*.

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain containing a wild card record.	Read Only: True
:ipv6	*inet:ipv6*	The IPv6 address returned by wild card resolutions.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:download

An instance of a file downloaded from a server.

The base type for the form can be found at *inet:download*.

Properties:

name	type	doc
:time	*time*	The time the file was downloaded.
:fqdn	*inet:fqdn*	The FQDN used to resolve the server.
:file	*file:bytes*	The file that was downloaded.
:server	*inet:server*	The inet:addr of the server.
:server:host	*it:host*	The it:host node for the server.
:server:ipv4	*inet:ipv4*	The IPv4 of the server.
:server:ipv6	*inet:ipv6*	The IPv6 of the server.
:server:port	*inet:port*	The server tcp/udp port.
:server:proto	*str* lower: True	The server network layer protocol.
:client	*inet:client*	The inet:addr of the client.
:client:host	*it:host*	The it:host node for the client.
:client:ipv4	*inet:ipv4*	The IPv4 of the client.
:client:ipv6	*inet:ipv6*	The IPv6 of the client.
:client:port	*inet:port*	The client tcp/udp port.
:client:proto	*str* lower: True	The client network layer protocol.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:egress

A host using a specific network egress client address.

The base type for the form can be found at *inet:egress*.

Properties:

name	type	doc
:host	*it:host*	The host that used the network egress.
:host:iface	*inet:iface*	The interface which the host used to connect out via the egress.
:account	*inet:service:accoun*	The service account which used the client address to egress.
:client	*inet:client*	The client address the host used as a network egress.
:client:ipv4	*inet:ipv4*	The client IPv4 address the host used as a network egress.
:client:ipv6	*inet:ipv6*	The client IPv6 address the host used as a network egress.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:email

An e-mail address.

The base type for the form can be found at *inet:email*.

Properties:

name	type	doc	opts
:user	*inet:user*	The username of the email address.	Read Only: True
:fqdn	*inet:fqdn*	The domain of the email address.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 151 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:email:header

A unique email message header.

The base type for the form can be found at *inet:email:header*.

Properties:

name	type	doc	opts
:name	*inet:email:header:name*	The name of the email header.	Read Only: True
:value	*str*	The value of the email header.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 152 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:email:message

An individual email message delivered to an inbox.

The base type for the form can be found at *inet:email:message*.

Properties:

name	type	doc	opts
:id	*str* strip: True	The ID parsed from the "message-id" header.	
:to	*inet:email*	The email address of the recipient.	
:from	*inet:email*	The email address of the sender.	
:replyto	*inet:email*	The email address parsed from the "reply-to" header.	
:cc	*array* type: *inet:email* uniq: True sorted: True	Email addresses parsed from the "cc" header.	
:subject	*str*	The email message subject parsed from the "subject" header.	
:body	*str*	The body of the email message.	Display: {'hint': 'text'}
:date	*time*	The time the email message was delivered.	
:bytes	*file:bytes*	The file bytes which contain the email message.	
:headers	*array* type: *inet:email:header*	An array of email headers from the message.	
:received:from:ipv	*inet:ipv4*	The sending SMTP server IPv4, potentially from the Received: header.	
:received:from:ipv	*inet:ipv6*	The sending SMTP server IPv6, potentially from the Received: header.	
:received:from:fqd	*inet:fqdn*	The sending server FQDN, potentially from the Received: header.	
:flow	*inet:flow*	The inet:flow which delivered the message.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:email:message:attachment

A file which was attached to an email message.

The base type for the form can be found at *inet:email:message:attachment*.

Properties:

name	type	doc	opts
:message	*inet:email:message*	The message containing the attached file.	Read Only: True
:file	*file:bytes*	The attached file.	Read Only: True
:name	*file:base*	The name of the attached file.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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Table 154 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:email:message:link

A url/link embedded in an email message.

The base type for the form can be found at *inet:email:message:link*.

Properties:

name	type	doc	opts
:message	*inet:email:messag*	The message containing the embedded link.	Read Only: True
:url	*inet:url*	The url contained within the email message.	Read Only: True
:text	*str*	The displayed hyperlink text if it was not the raw URL.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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Table 155 – continued from previous page

source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:flow

An individual network connection between a given source and destination.

The base type for the form can be found at *inet:flow*.

Properties:

name	type	doc	opts
:time	*time*	The time the network connection was initiated.	
:duration	*int*	The duration of the flow in seconds.	
:from	*guid*	The ingest source file/iden. Used for reparsing.	
:dst	*inet:server*	The destination address / port for a connection.	
:dst:ipv4	*inet:ipv4*	The destination IPv4 address.	
:dst:ipv6	*inet:ipv6*	The destination IPv6 address.	
:dst:port	*inet:port*	The destination port.	

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name	type	doc	opts
:dst:proto	*str* lower: True	The destination protocol.	
:dst:host	*it:host*	The guid of the destination host.	
:dst:proc	*it:exec:proc*	The guid of the destination process.	
:dst:exe	*file:bytes*	The file (executable) that received the connection.	
:dst:txfiles	*array* type: *file:attachment* sorted: True uniq: True	An array of files sent by the destination host.	
:dst:txcount	*int*	The number of packets sent by the destination host.	
:dst:txbytes	*int*	The number of bytes sent by the destination host.	
:dst:handshake	*str*	A text representation of the initial handshake sent by the server.	Display: {'hint': 'text'}
:src	*inet:client*	The source address / port for a connection.	
:src:ipv4	*inet:ipv4*	The source IPv4 address.	
:src:ipv6	*inet:ipv6*	The source IPv6 address.	
:src:port	*inet:port*	The source port.	
:src:proto	*str* lower: True	The source protocol.	
:src:host	*it:host*	The guid of the source host.	
:src:proc	*it:exec:proc*	The guid of the source process.	
:src:exe	*file:bytes*	The file (executable) that created the connection.	

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Table 156 – continued from previous page

name	type	doc	opts
:src:txfiles	*array* type: *file:attachment* sorted: True uniq: True	An array of files sent by the source host.	
:src:txcount	*int*	The number of packets sent by the source host.	
:src:txbytes	*int*	The number of bytes sent by the source host.	
:tot:txcount	*int*	The number of packets sent in both directions.	
:tot:txbytes	*int*	The number of bytes sent in both directions.	
:src:handshake	*str*	A text representation of the initial handshake sent by the client.	Display: {'hint': 'text'}
:dst:cpes	*array* type: *it:sec:cpe* uniq: True sorted: True	An array of NIST CPEs identified on the destination host.	
:dst:softnames	*array* type: *it:prod:softname* uniq: True sorted: True	An array of software names identified on the destination host.	
:src:cpes	*array* type: *it:sec:cpe* uniq: True sorted: True	An array of NIST CPEs identified on the source host.	
:src:softnames	*array* type: *it:prod:softname* uniq: True sorted: True	An array of software names identified on the source host.	

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Table 156 – continued from previous page

name	type	doc	opts
:ip:proto	*int* min: 0 max: 255	The IP protocol number of the flow.	
:ip:tcp:flags	*int* min: 0 max: 255	An aggregation of observed TCP flags commonly provided by flow APIs.	
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.	
:src:ssl:cert	*crypto:x509:cert*	The x509 certificate sent by the client as part of an SSL/TLS negotiation.	
:dst:ssl:cert	*crypto:x509:cert*	The x509 certificate sent by the server as part of an SSL/TLS negotiation.	
:src:rdp:hostname	*it:hostname*	The hostname sent by the client as part of an RDP session setup.	
:src:rdp:keyboard:	*str* lower: True onespace: True	The keyboard layout sent by the client as part of an RDP session setup.	
:src:ssh:key	*crypto:key*	The key sent by the client as part of an SSH session setup.	
:dst:ssh:key	*crypto:key*	The key sent by the server as part of an SSH session setup.	
:capture:host	*it:host*	The host which captured the flow.	
:raw	*data*	A raw record used to create the flow which may contain additional protocol details.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:fqdn

A Fully Qualified Domain Name (FQDN).

The base type for the form can be found at *inet:fqdn*.

An example of `inet:fqdn`:

- `vertex.link`

Properties:

name	type	doc	opts
`:domain`	*inet:fqdn*	The parent domain for the FQDN.	Read Only: `True`
`:host`	*str* lower: `True`	The host part of the FQDN.	Read Only: `True`
`:issuffix`	*bool*	True if the FQDN is considered a suffix.	
`:iszone`	*bool*	True if the FQDN is considered a zone.	
`:zone`	*inet:fqdn*	The zone level parent for this FQDN.	

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.
`ou:campaign`	`-(targets)>`	*	The campaign targeted the target nodes.
`ou:campaign`	`-(uses)>`	*	The campaign made use of the target node.
`ou:contribution`	`-(includes)>`	*	The contribution includes the specific node.
`ou:org`	`-(has)>`	*	The organization is or was in possession of the target node.
`ou:org`	`-(owns)>`	*	The organization owns or owned the target node.
`ou:org`	`-(targets)>`	*	The organization targets the target node.
`ou:org`	`-(uses)>`	*	The ou:org makes use of the target node.

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source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:group

A group name string.

The base type for the form can be found at *inet:group*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:cookie

An individual HTTP cookie string.

The base type for the form can be found at *inet:http:cookie*.

An example of `inet:http:cookie`:

- `PHPSESSID=el4ukv0kqbvoirg7nkp4dncpk3`

Properties:

name	type	doc
:name	*str*	The name of the cookie preceding the equal sign.
:value	*str*	The value of the cookie after the equal sign if present.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:param

An HTTP request path query parameter.

The base type for the form can be found at *inet:http:param*.

Properties:

name	type	doc	opts
:name	*str* lower: True	The name of the HTTP query parameter.	Read Only: True
:value	*str*	The value of the HTTP query parameter.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:request

A single HTTP request.

The base type for the form can be found at *inet:http:request*.

Properties:

name	type	doc
:method	*str*	The HTTP request method string.
:path	*str*	The requested HTTP path (without query parameters).
:url	*inet:url*	The reconstructed URL for the request if known.
:query	*str*	The HTTP query string which optionally follows the path.
:headers	*array* type: *inet:http:request:header*	An array of HTTP headers from the request.
:body	*file:bytes*	The body of the HTTP request.
:referer	*inet:url*	The referer URL parsed from the "Referer:" header in the request.
:cookies	*array* type: *inet:http:cookie* sorted: True uniq: True	An array of HTTP cookie values parsed from the "Cookies:" header in the request.
:response:time	*time*	A date/time value.
:response:code	*int*	The base 64 bit signed integer type.
:response:reason	*str*	The base string type.
:response:headers	*array* type: *inet:http:response:header*	An array of HTTP headers from the response.

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name	type	doc
:response:body	*file:bytes*	The file bytes type with SHA256 based primary property.
:session	*inet:http:session*	The HTTP session this request was part of.
:flow	*inet:flow*	The raw inet:flow containing the request.
:client	*inet:client*	The inet:addr of the client.
:client:ipv4	*inet:ipv4*	The server IPv4 address that the request was sent from.
:client:ipv6	*inet:ipv6*	The server IPv6 address that the request was sent from.
:client:host	*it:host*	The host that the request was sent from.
:server	*inet:server*	The inet:addr of the server.
:server:ipv4	*inet:ipv4*	The server IPv4 address that the request was sent to.
:server:ipv6	*inet:ipv6*	The server IPv6 address that the request was sent to.
:server:port	*inet:port*	The server port that the request was sent to.
:server:host	*it:host*	The host that the request was sent to.
:exe	*file:bytes*	The executable file which caused the activity.
:proc	*it:exec:proc*	The host process which caused the activity.
:thread	*it:exec:thread*	The host thread which caused the activity.
:host	*it:host*	The host on which the activity occurred.
:time	*time*	The time that the activity started.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:request:header

An HTTP request header.

The base type for the form can be found at *inet:http:request:header*.

Properties:

name	type	doc	opts
:name	*inet:http:header:name*	The name of the HTTP request header.	Read Only: True
:value	*str*	The value of the HTTP request header.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:response:header

An HTTP response header.

The base type for the form can be found at *inet:http:response:header*.

Properties:

name	type	doc	opts
:name	*inet:http:header:name*	The name of the HTTP response header.	Read Only: True
:value	*str*	The value of the HTTP response header.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:http:session

An HTTP session.

The base type for the form can be found at *inet:http:session*.

Properties:

name	type	doc
:contact	*ps:contact*	The ps:contact which owns the session.
:cookies	*array* type: *inet:http:cookie* sorted: True uniq: True	An array of cookies used to identify this specific session.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:iface

A network interface with a set of associated protocol addresses.

The base type for the form can be found at *inet:iface*.

Properties:

name	type	doc	opts
:host	*it:host*	The guid of the host the interface is associated with.	
:name	*str* strip: True	The interface name.	Example: eth0
:network	*it:network*	The guid of the it:network the interface connected to.	
:type	*str* lower: True	The free-form interface type.	
:mac	*inet:mac*	The ethernet (MAC) address of the interface.	
:ipv4	*inet:ipv4*	The IPv4 address of the interface.	
:ipv6	*inet:ipv6*	The IPv6 address of the interface.	
:phone	*tel:phone*	The telephone number of the interface.	
:wifi:ssid	*inet:wifi:ssid*	The wifi SSID of the interface.	
:wifi:bssid	*inet:mac*	The wifi BSSID of the interface.	
:adid	*it:adid*	An advertising ID associated with the interface.	
:mob:imei	*tel:mob:imei*	The IMEI of the interface.	
:mob:imsi	*tel:mob:imsi*	The IMSI of the interface.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:ipv4

An IPv4 address.

The base type for the form can be found at *inet:ipv4*.

An example of `inet:ipv4`:

- `1.2.3.4`

Properties:

name	type	doc
:asn	*inet:asn*	The ASN to which the IPv4 address is currently assigned.
:latlong	*geo:latlong*	The best known latitude/longitude for the node.
:loc	*loc*	The geo-political location string for the IPv4.
:place	*geo:place*	The geo:place associated with the latlong property.
:type	*str*	The type of IP address (e.g., private, multicast, etc.).
:dns:rev	*inet:fqdn*	The most current DNS reverse lookup for the IPv4.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
inet:whois:iprec	-(ipwhois)>	inet:ipv4	The source IP whois record describes the target IPv4 a
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the targe
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the targ
it:exec:query	-(found)>	*	The target node was returned as a result of running the
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targ
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target n
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the c
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target

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source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target noc
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target node

inet:ipv6

An IPv6 address.

The base type for the form can be found at *inet:ipv6*.

An example of `inet:ipv6`:

- `2607:f8b0:4004:809::200e`

Properties:

name	type	doc
:asn	*inet:asn*	The ASN to which the IPv6 address is currently assigned.
:ipv4	*inet:ipv4*	The mapped ipv4.
:latlong	*geo:latlong*	The last known latitude/longitude for the node.
:place	*geo:place*	The geo:place associated with the latlong property.
:dns:rev	*inet:fqdn*	The most current DNS reverse lookup for the IPv6.
:loc	*loc*	The geo-political location string for the IPv6.
:type	*str*	The type of IP address (e.g., private, multicast, etc.).
:scope	*str* enums: `reserved`, `interface-local`, `link-local`, `realm-local`, `admin-local`, `site-local`, `organization-local`, `global`,`unassigned`	The IPv6 scope of the address (e.g., global, link-local, etc.).

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
inet:whois:iprec	-(ipwhois)>	inet:ipv6	The source IP whois record describes the target IPv6 ad
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the targ
it:exec:query	-(found)>	*	The target node was returned as a result of running the
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targ
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target n
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the c
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nod
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes

inet:mac

A 48-bit Media Access Control (MAC) address.

The base type for the form can be found at *inet:mac*.

An example of `inet:mac`:

- `aa:bb:cc:dd:ee:ff`

Properties:

name	type	doc
`:vendor`	*str*	The vendor associated with the 24-bit prefix of a MAC address.

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.
`ou:campaign`	`-(targets)>`	*	The campaign targeted the target nodes.
`ou:campaign`	`-(uses)>`	*	The campaign made use of the target node.
`ou:contribution`	`-(includes)>`	*	The contribution includes the specific node.
`ou:org`	`-(has)>`	*	The organization is or was in possession of the target node.
`ou:org`	`-(owns)>`	*	The organization owns or owned the target node.
`ou:org`	`-(targets)>`	*	The organization targets the target node.
`ou:org`	`-(uses)>`	*	The ou:org makes use of the target node.
`plan:procedure:step`	`-(uses)>`	*	The step in the procedure makes use of the target node.
`ps:contact`	`-(has)>`	*	The contact is or was in possession of the target node.
`ps:contact`	`-(owns)>`	*	The contact owns or owned the target node.
`ps:person`	`-(has)>`	*	The person is or was in possession of the target node.
`ps:person`	`-(owns)>`	*	The person owns or owned the target node.
`risk:attack`	`-(targets)>`	*	The attack targeted the target node.
`risk:attack`	`-(uses)>`	*	The attack used the target node to facilitate the attack.
`risk:compromise`	`-(stole)>`	*	The target node was stolen or copied as a result of the compr

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:passwd

A password string.

The base type for the form can be found at *inet:passwd*.

Properties:

name	type	doc	opts
:md5	*hash:md5*	The MD5 hash of the password.	Read Only: True
:sha1	*hash:sha1*	The SHA1 hash of the password.	Read Only: True
:sha256	*hash:sha256*	The SHA256 hash of the password.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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Table 171 – continued from previous page

source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:proto

A network protocol name.

The base type for the form can be found at *inet:proto*.

Properties:

name	type	doc
:port	*inet:port*	The default port this protocol typically uses if applicable.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 172 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:rfc2822:addr

An RFC 2822 Address field.

The base type for the form can be found at *inet:rfc2822:addr*.

An example of `inet:rfc2822:addr`:

- `"Visi Kenshoto" <visi@vertex.link>`

Properties:

name	type	doc	opts
:name	*ps:name*	The name field parsed from an RFC 2822 address string.	Read Only: True
:email	*inet:email*	The email field parsed from an RFC 2822 address string.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:search:query

An instance of a search query issued to a search engine.

The base type for the form can be found at *inet:search:query*.

Properties:

name	type	doc	opts
:text	*str*	The search query text.	Display: {'hint': 'text'}
:time	*time*	The time the web search was issued.	
:acct	*inet:web:acct*	The account that the query was issued as.	
:host	*it:host*	The host that issued the query.	
:engine	*str* lower: True	A simple name for the search engine used.	Example: google
:request	*inet:http:request*	The HTTP request used to issue the query.	
:app	*inet:service:app*	The app which handled the action.	
:account	*inet:service:account*	The account which initiated the action.	
:success	*bool*	Set to true if the action was successful.	
:rule	*inet:service:rule*	The rule which allowed or denied the action.	
:error:code	*str* strip: True	The platform specific error code if the action was unsuccessful.	
:error:reason	*str* strip: True	The platform specific friendly error reason if the action was unsuccessful.	
:platform	*inet:service:platform*	The platform where the action was initiated.	
:instance	*inet:service:instance*	The platform instance where the action was initiated.	
:session	*inet:service:session*	The session which initiated the action.	
:client	*inet:client*	The network address of the client which initiated the action.	
:client:host	*it:host*	The client host which initiated the action.	
:client:app	*inet:service:app*	The client service app which initiated the action.	
:server	*inet:server*	The network address of the server which handled the action.	
:server:host	*it:host*	The server host which handled the action.	
:id	*str*	A platform specific ID which identifies the node.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:search:result

A single result from a web search.

The base type for the form can be found at *inet:search:result*.

Properties:

name	type	doc
:query	*inet:search:query*	The search query that produced the result.
:title	*str* lower: True	The title of the matching web page.
:rank	*int*	The rank/order of the query result.
:url	*inet:url*	The URL hosting the matching content.
:text	*str* lower: True	Extracted/matched text from the matched content.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:server

A network server address.

The base type for the form can be found at *inet:server*.

An example of `inet:server`:

- `tcp://1.2.3.4:80`

Properties:

name	type	doc	opts
:proto	*str* lower: True	The network protocol of the server.	Read Only: True
:ipv4	*inet:ipv4*	The IPv4 of the server.	Read Only: True
:ipv6	*inet:ipv6*	The IPv6 of the server.	Read Only: True
:host	*it:host*	The it:host node for the server.	Read Only: True
:port	*inet:port*	The server tcp/udp port.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:servfile

A file hosted on a server for access over a network protocol.

The base type for the form can be found at *inet:servfile*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file hosted by the server.	Read Only: True
:server	*inet:server*	The inet:addr of the server.	Read Only: True
:server:proto	*str* lower: True	The network protocol of the server.	Read Only: True
:server:ipv4	*inet:ipv4*	The IPv4 of the server.	Read Only: True
:server:ipv6	*inet:ipv6*	The IPv6 of the server.	Read Only: True
:server:host	*it:host*	The it:host node for the server.	Read Only: True
:server:port	*inet:port*	The server tcp/udp port.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:access

Represents a user access request to a service resource.

The base type for the form can be found at *inet:service:access*.

Properties:

name	type	doc
:action	*inet:service:access:action:taxo*	The platform specific action which this access records.
:resource	*inet:service:resource*	The resource which the account attempted to access.
:type	*int* enums: ((10, 'create'), (30, 'read'), (40, 'update'), (50, 'delete'), (60, 'list'), (70, 'execute'))	The type of access requested.
:app	*inet:service:app*	The app which handled the action.
:time	*time*	The time that the account initiated the action.
:account	*inet:service:account*	The account which initiated the action.
:success	*bool*	Set to true if the action was successful.
:rule	*inet:service:rule*	The rule which allowed or denied the action.
:error:code	*str* strip: True	The platform specific error code if the action was unsuccessful.
:error:reason	*str* strip: True	The platform specific friendly error reason if the action was unsuccessful.
:platform	*inet:service:platform*	The platform where the action was initiated.
:instance	*inet:service:instance*	The platform instance where the action was initiated.
:session	*inet:service:session*	The session which initiated the action.
:client	*inet:client*	The network address of the client which initiated the action.
:client:host	*it:host*	The client host which initiated the action.
:client:app	*inet:service:app*	The client service app which initiated the action.
:server	*inet:server*	The network address of the server which handled the action.
:server:host	*it:host*	The server host which handled the action.
:id	*str* strip: True	A platform specific ID which identifies the node.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:account

An account within a service platform. Accounts may be instance specific.

The base type for the form can be found at *inet:service:account*.

Properties:

name	type	doc
:user	*inet:user*	The current user name of the account.
:email	*inet:email*	The current email address associated with the account.
:tenant	*inet:service:tenant*	The tenant which contains the account.
:profile	*ps:contact*	The primary contact information for the account.
:url	*inet:url*	The primary URL associated with the account.
:status	*inet:service:object:status*	The status of the account.
:period	*ival*	The period when the account existed.
:creator	*inet:service:account*	The service account which created the account.
:remover	*inet:service:account*	The service account which removed or decommissioned the account.
:app	*inet:service:app*	The app which contains the account.
:id	*str* strip: True	A platform specific ID which identifies the account.
:platform	*inet:service:platform*	The platform which defines the account.
:instance	*inet:service:instance*	The platform instance which defines the account.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None

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Table 179 – continued from previous page

source	verb	target	doc
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:app

A platform specific application.

The base type for the form can be found at *inet:service:app*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the platform specific application.	alts: ('names',)
:names	*array* type: *str* typeopts: {'onespace': True, 'lower': True} sorted: True uniq: True	An array of alternate names for the application.	
:desc	*str*	A description of the platform specific application.	Display: {'hint': 'text'}
:url	*inet:url*	The primary URL associated with the application.	
:status	*inet:service:object:statu*	The status of the application.	
:period	*ival*	The period when the application existed.	
:creator	*inet:service:account*	The service account which created the application.	
:remover	*inet:service:account*	The service account which removed or decommissioned the application.	
:app	*inet:service:app*	The app which contains the application.	
:id	*str* strip: True	A platform specific ID which identifies the application.	
:platform	*inet:service:platform*	The platform which defines the application.	
:instance	*inet:service:instance*	The platform instance which defines the application.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:bucket

A file/blob storage object within a service architecture.

The base type for the form can be found at *inet:service:bucket*.

Properties:

name	type	doc
:name	*str* onespace: True lower: True	The name of the service resource.
:url	*inet:url*	The primary URL associated with the bucket.
:status	*inet:service:object:status*	The status of the bucket.
:period	*ival*	The period when the bucket existed.
:creator	*inet:service:account*	The service account which created the bucket.
:remover	*inet:service:account*	The service account which removed or decommissioned the bucket.
:app	*inet:service:app*	The app which contains the bucket.
:id	*str* strip: True	A platform specific ID which identifies the bucket.
:platform	*inet:service:platform*	The platform which defines the bucket.
:instance	*inet:service:instance*	The platform instance which defines the bucket.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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Table 181 – continued from previous page

source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:bucket:item

An individual file stored within a bucket.

The base type for the form can be found at *inet:service:bucket:item*.

Properties:

name	type	doc
:bucket	*inet:service:bucket*	The bucket which contains the item.
:file	*file:bytes*	The bytes stored within the bucket item.
:file:name	*file:path*	The name of the file stored in the bucket item.
:url	*inet:url*	The primary URL associated with the bucket item.
:status	*inet:service:object:status*	The status of the bucket item.
:period	*ival*	The period when the bucket item existed.
:creator	*inet:service:account*	The service account which created the bucket item.
:remover	*inet:service:account*	The service account which removed or decommissioned the bucket item.
:app	*inet:service:app*	The app which contains the bucket item.
:id	*str* strip: True	A platform specific ID which identifies the bucket item.
:platform	*inet:service:platform*	The platform which defines the bucket item.
:instance	*inet:service:instance*	The platform instance which defines the bucket item.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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Table 182 – continued from previous page

source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:channel

A channel used to distribute messages.

The base type for the form can be found at *inet:service:channel*.

Properties:

name	type	doc
:name	*str* onespace: True lower: True	The name of the channel.
:period	*ival*	The time period where the channel was available.
:topic	*media:topic*	The visible topic of the channel.
:url	*inet:url*	The primary URL associated with the channel.
:status	*inet:service:object:status*	The status of the channel.
:creator	*inet:service:account*	The service account which created the channel.
:remover	*inet:service:account*	The service account which removed or decommissioned the channel.
:app	*inet:service:app*	The app which contains the channel.
:id	*str* strip: True	A platform specific ID which identifies the channel.
:platform	*inet:service:platform*	The platform which defines the channel.
:instance	*inet:service:instance*	The platform instance which defines the channel.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 183 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:channel:member

Represents a service account being a member of a channel.

The base type for the form can be found at *inet:service:channel:member*.

Properties:

name	type	doc
:channel	*inet:service:channel*	The channel that the account was a member of.
:account	*inet:service:account*	The account that was a member of the channel.
:period	*ival*	The time period where the account was a member of the channel.
:url	*inet:url*	The primary URL associated with the channel membership.
:status	*inet:service:object:status*	The status of the channel membership.
:creator	*inet:service:account*	The service account which created the channel membership.
:remover	*inet:service:account*	The service account which removed or decommissioned the channel membership.
:app	*inet:service:app*	The app which contains the channel membership.
:id	*str* strip: True	A platform specific ID which identifies the channel membership.
:platform	*inet:service:platform*	The platform which defines the channel membership.
:instance	*inet:service:instance*	The platform instance which defines the channel membership.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 184 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:emote

An emote or reaction by an account.

The base type for the form can be found at *inet:service:emote*.

Properties:

name	type	doc	opts
:about	*inet:service:object*	The node that the emote is about.	
:text	*str* strip: True	The unicode or emote text of the reaction.	Example: :partyparrot:
:url	*inet:url*	The primary URL associated with the emote.	
:status	*inet:service:object:statu*	The status of the emote.	
:period	*ival*	The period when the emote existed.	
:creator	*inet:service:account*	The service account which created the emote.	
:remover	*inet:service:account*	The service account which removed or decommissioned the emote.	
:app	*inet:service:app*	The app which contains the emote.	
:id	*str* strip: True	A platform specific ID which identifies the emote.	
:platform	*inet:service:platform*	The platform which defines the emote.	
:instance	*inet:service:instance*	The platform instance which defines the emote.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.

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Table 185 – continued from previous page

source	verb	target	doc
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:group

A group or role which contains member accounts.

The base type for the form can be found at *inet:service:group*.

Properties:

name	type	doc
:name	*inet:group*	The name of the group on this platform.
:profile	*ps:contact*	Current detailed contact information for this group.
:url	*inet:url*	The primary URL associated with the group.
:status	*inet:service:object:status*	The status of the group.
:period	*ival*	The period when the group existed.
:creator	*inet:service:account*	The service account which created the group.
:remover	*inet:service:account*	The service account which removed or decommissioned the group.
:app	*inet:service:app*	The app which contains the group.
:id	*str* strip: True	A platform specific ID which identifies the group.
:platform	*inet:service:platform*	The platform which defines the group.
:instance	*inet:service:instance*	The platform instance which defines the group.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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Table 186 – continued from previous page

source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:group:member

Represents a service account being a member of a group.

The base type for the form can be found at *inet:service:group:member*.

Properties:

name	type	doc
:account	*inet:service:account*	The account that is a member of the group.
:group	*inet:service:group*	The group that the account is a member of.
:period	*ival*	The time period when the account was a member of the group.
:url	*inet:url*	The primary URL associated with the group membership.
:status	*inet:service:object:status*	The status of the group membership.
:creator	*inet:service:account*	The service account which created the group membership.
:remover	*inet:service:account*	The service account which removed or decommissioned the group membership.
:app	*inet:service:app*	The app which contains the group membership.
:id	*str* strip: True	A platform specific ID which identifies the group membership.
:platform	*inet:service:platform*	The platform which defines the group membership.
:instance	*inet:service:instance*	The platform instance which defines the group membership.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 187 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:instance

An instance of the platform such as Slack or Discord instances.

The base type for the form can be found at *inet:service:instance*.

Properties:

name	type	doc	opts
:id	*str* strip: True	A platform specific ID to identify the service instance.	Example: B8ZS2
:platform	*inet:service:platform*	The platform which defines the service instance.	
:url	*inet:url*	The primary URL which identifies the service instance.	Example: https://v.vtx.lk/slack
:name	*str* lower: True onespace: True	The name of the service instance.	Example: synapse users slack
:desc	*str*	A description of the service instance.	Display: {'hint': 'text'}
:period	*ival*	The time period where the instance existed.	
:status	*inet:service:object:statu*	The status of this instance.	
:creator	*inet:service:account*	The service account which created the instance.	
:owner	*inet:service:account*	The service account which owns the instance.	
:tenant	*inet:service:tenant*	The tenant which contains the instance.	
:app	*inet:service:app*	The app which contains the instance.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 188 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:login

A login event for a service account.

The base type for the form can be found at *inet:service:login*.

Properties:

name	type	doc
:method	*inet:service:login:method:taxor*	The type of authentication used for the login. For example "password" or "multifactor.sms".
:app	*inet:service:app*	The app which handled the action.
:time	*time*	The time that the account initiated the action.
:account	*inet:service:account*	The account which initiated the action.
:success	*bool*	Set to true if the action was successful.
:rule	*inet:service:rule*	The rule which allowed or denied the action.
:error:code	*str* strip: True	The platform specific error code if the action was unsuccessful.
:error:reason	*str* strip: True	The platform specific friendly error reason if the action was unsuccessful.
:platform	*inet:service:platform*	The platform where the action was initiated.
:instance	*inet:service:instance*	The platform instance where the action was initiated.
:session	*inet:service:session*	The session which initiated the action.
:client	*inet:client*	The network address of the client which initiated the action.
:client:host	*it:host*	The client host which initiated the action.
:client:app	*inet:service:app*	The client service app which initiated the action.
:server	*inet:server*	The network address of the server which handled the action.
:server:host	*it:host*	The server host which handled the action.
:id	*str* strip: True	A platform specific ID which identifies the node.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:message

A message or post created by an account.

The base type for the form can be found at *inet:service:message*.

Properties:

name	type	doc	opts
:account	*inet:service:account*	The account which sent the message.	
:to	*inet:service:account*	The destination account. Used for direct messages.	
:url	*inet:url*	The URL where the message may be viewed.	
:group	*inet:service:group*	The group that the message was sent to.	
:channel	*inet:service:channel*	The channel that the message was sent to.	
:thread	*inet:service:thread*	The thread which contains the message.	
:public	*bool*	Set to true if the message is publicly visible.	
:title	*str* lower: True onespace: True	The message title.	
:text	*str*	The text body of the message.	Display: {'hint': 'text'}
:status	*inet:service:object:stat*	The message status.	
:replyto	*inet:service:message*	The message that this message was sent in reply to. Used for message threading.	
:repost	*inet:service:message*	The original message reposted by this message.	
:links	*array* type: *inet:service:message:li* uniq: True sorted: True	An array of links contained within the message.	
:attachments	*array* type: *inet:service:message:a* uniq: True sorted: True	An array of files attached to the message.	

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name	type	doc	opts
:hashtags	*array* type: *inet:web:hashtag* uniq: True sorted: True split: ,	An array of hashtags mentioned within the message.	
:place	*geo:place*	The place that the message was sent from.	
:place:name	*geo:name*	The name of the place that the message was sent from.	
:client:address	*inet:client*	Deprecated. Please use :client.	Deprecated: True
:client:software	*it:prod:softver*	The client software version used to send the message.	
:client:software:n	*it:prod:softname*	The name of the client software used to send the message.	
:file	*file:bytes*	The raw file that the message was extracted from.	
:type	*inet:service:message:ty*	The type of message.	
:mentions	*array* type: *ndef* typeopts: {'forms': ('inet:service:acc 'inet:service:grou uniq: True sorted: True	Contactable entities mentioned within the message.	
:app	*inet:service:app*	The app which handled the action.	
:time	*time*	The time that the account initiated the action.	
:success	*bool*	Set to true if the action was successful.	
:rule	*inet:service:rule*	The rule which allowed or denied the action.	

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Table 190 – continued from previous page

name	type	doc	opts
:error:code	*str* strip: True	The platform specific error code if the action was unsuccessful.	
:error:reason	*str* strip: True	The platform specific friendly error reason if the action was unsuccessful.	
:platform	*inet:service:platform*	The platform where the action was initiated.	
:instance	*inet:service:instance*	The platform instance where the action was initiated.	
:session	*inet:service:session*	The session which initiated the action.	
:client	*inet:client*	The network address of the client which initiated the action.	
:client:host	*it:host*	The client host which initiated the action.	
:client:app	*inet:service:app*	The client service app which initiated the action.	
:server	*inet:server*	The network address of the server which handled the action.	
:server:host	*it:host*	The server host which handled the action.	
:id	*str* strip: True	A platform specific ID which identifies the node.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 191 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:message:attachment

A file attachment included within a message.

The base type for the form can be found at *inet:service:message:attachment*.

Properties:

name	type	doc
:name	*file:path*	The name of the attached file.
:text	*str*	Any text associated with the file such as alt-text for images.
:file	*file:bytes*	The file which was attached to the message.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:message:link

A URL link included within a message.

The base type for the form can be found at *inet:service:message:link*.

Properties:

name	type	doc
:title	*str* strip: True	The title text for the link.
:url	*inet:url*	The URL which was attached to the message.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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Table 193 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:message:type:taxonomy

A message type taxonomy.

The base type for the form can be found at *inet:service:message:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:service:message:ty*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 194 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:permission

A permission which may be granted to a service account or role.

The base type for the form can be found at *inet:service:permission*.

Properties:

name	type	doc
:name	*str* onespace: True lower: True	The name of the permission.
:type	*inet:service:permission:type:ta*	The type of permission.
:url	*inet:url*	The primary URL associated with the permission.
:status	*inet:service:object:status*	The status of the permission.
:period	*ival*	The period when the permission existed.
:creator	*inet:service:account*	The service account which created the permission.
:remover	*inet:service:account*	The service account which removed or decommissioned the permission.
:app	*inet:service:app*	The app which contains the permission.
:id	*str* strip: True	A platform specific ID which identifies the permission.
:platform	*inet:service:platform*	The platform which defines the permission.
:instance	*inet:service:instance*	The platform instance which defines the permission.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 195 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:permission:type:taxonomy

A permission type taxonomy.

The base type for the form can be found at *inet:service:permission:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:service:permission*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 196 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:platform

A network platform which provides services.

The base type for the form can be found at *inet:service:platform*.

Properties:

name	type	doc	opts
:url	*inet:url*	The primary URL of the platform.	Example: `https://twitter.com` alts: `('urls',)`
:urls	*array* type: *inet:url* sorted: `True` uniq: `True`	An array of alternate URLs for the platform.	
:name	*str* onespace: `True` lower: `True`	A friendly name for the platform.	Example: `twitter` alts: `('names',)`
:names	*array* type: *str* typeopts: `{'onespace': True, 'lower': True}` sorted: `True` uniq: `True`	An array of alternate names for the platform.	
:desc	*str*	A description of the service platform.	Display: `{'hint': 'text'}`
:provider	*ou:org*	The organization which operates the platform.	
:provider:name	*ou:name*	The name of the organization which operates the platform.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:relationship

A relationship between two service objects.

The base type for the form can be found at *inet:service:relationship*.

Properties:

name	type	doc	opts
:source	*inet:service:object*	The source object.	
:target	*inet:service:object*	The target object.	
:type	*inet:service:relationshi*	The type of relationship between the source and the target.	Example: follows
:url	*inet:url*	The primary URL associated with the relationship.	
:status	*inet:service:object:statu*	The status of the relationship.	
:period	*ival*	The period when the relationship existed.	
:creator	*inet:service:account*	The service account which created the relationship.	
:remover	*inet:service:account*	The service account which removed or decommissioned the relationship.	
:app	*inet:service:app*	The app which contains the relationship.	
:id	*str* strip: True	A platform specific ID which identifies the relationship.	
:platform	*inet:service:platform*	The platform which defines the relationship.	
:instance	*inet:service:instance*	The platform instance which defines the relationship.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:relationship:type:taxonomy

A service object relationship type taxonomy.

The base type for the form can be found at *inet:service:relationship:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:service:relationshi*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:resource

A generic resource provided by the service architecture.

The base type for the form can be found at *inet:service:resource*.

Properties:

name	type	doc	opts
:name	*str* onespace: True lower: True	The name of the service resource.	
:desc	*str*	A description of the service resource.	Display: {'hint': 'text'}
:url	*inet:url*	The primary URL where the resource is available from the service.	
:type	*inet:service:resource:ty*	The resource type. For example “rpc.endpoint”.	
:status	*inet:service:object:statu*	The status of the resource.	
:period	*ival*	The period when the resource existed.	
:creator	*inet:service:account*	The service account which created the resource.	
:remover	*inet:service:account*	The service account which removed or decommissioned the resource.	
:app	*inet:service:app*	The app which contains the resource.	
:id	*str* strip: True	A platform specific ID which identifies the resource.	
:platform	*inet:service:platform*	The platform which defines the resource.	
:instance	*inet:service:instance*	The platform instance which defines the resource.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:resource:type:taxonomy

A taxonomy of inet service resource types.

The base type for the form can be found at *inet:service:resource:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:service:resource:ty*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:rule

A rule which grants or denies a permission to a service account or role.

The base type for the form can be found at *inet:service:rule*.

Properties:

name	type	doc
:permission	*inet:service:permission*	The permission which is granted.
:denied	*bool*	Set to (true) to denote that the rule is an explicit deny.
:object	*ndef* interface: inet:service:object	The object that the permission controls access to.
:grantee	*ndef* forms: ('inet:service:account', 'inet:service:group')	The user or role which is granted the permission.
:url	*inet:url*	The primary URL associated with the rule.
:status	*inet:service:object:status*	The status of the rule.
:period	*ival*	The period when the rule existed.
:creator	*inet:service:account*	The service account which created the rule.
:remover	*inet:service:account*	The service account which removed or decommissioned the rule.
:app	*inet:service:app*	The app which contains the rule.
:id	*str* strip: True	A platform specific ID which identifies the rule.
:platform	*inet:service:platform*	The platform which defines the rule.
:instance	*inet:service:instance*	The platform instance which defines the rule.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting th
it:exec:query	-(found)>	*	The target node was returned as a result of runnin
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of th
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:ruleset	-(has)>	inet:service:rule	The meta:ruleset includes the inet:service:rule.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the ta
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target
ps:contact	-(has)>	*	The contact is or was in possession of the target n
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target n
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the at
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result o
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access
risk:leak	-(leaked)>	*	The leak included the disclosure of the target nod
risk:mitigation	-(uses)>	inet:service:rule	The mitigation uses the service rule.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the targ
sci:experiment	-(uses)>	*	The experiment used the target nodes when it wa
sci:observation	-(has)>	*	The observations are summarized from the target

inet:service:session

An authenticated session.

The base type for the form can be found at *inet:service:session*.

Properties:

name	type	doc
:creator	*inet:service:account*	The account which authenticated to create the session.
:period	*ival*	The period where the session was valid.
:http:session	*inet:http:session*	The HTTP session associated with the service session.
:url	*inet:url*	The primary URL associated with the session.
:status	*inet:service:object:status*	The status of the session.
:remover	*inet:service:account*	The service account which removed or decommissioned the session.
:app	*inet:service:app*	The app which contains the session.
:id	*str* strip: True	A platform specific ID which identifies the session.
:platform	*inet:service:platform*	The platform which defines the session.
:instance	*inet:service:instance*	The platform instance which defines the session.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:subscription

A subscription to a service platform or instance.

The base type for the form can be found at *inet:service:subscription*.

Properties:

name	type	doc
:level	*inet:service:subscription:level:t*	A platform specific subscription level.
:pay:instrument	*econ:pay:instrument*	The primary payment instrument used to pay for the subscription.
:subscriber	*inet:service:subscriber*	The subscriber who owns the subscription.
:url	*inet:url*	The primary URL associated with the subscription.
:status	*inet:service:object:status*	The status of the subscription.
:period	*ival*	The period when the subscription existed.
:creator	*inet:service:account*	The service account which created the subscription.
:remover	*inet:service:account*	The service account which removed or decommissioned the subscription.
:app	*inet:service:app*	The app which contains the subscription.
:id	*str* strip: True	A platform specific ID which identifies the subscription.
:platform	*inet:service:platform*	The platform which defines the subscription.
:instance	*inet:service:instance*	The platform instance which defines the subscription.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 204 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:subscription:level:taxonomy

A taxonomy of platform specific subscription levels.

The base type for the form can be found at *inet:service:subscription:level:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:service:subscriptio*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:tenant

A tenant which groups accounts and instances.

The base type for the form can be found at *inet:service:tenant*.

Properties:

name	type	doc
:profile	*ps:contact*	The primary contact information for the tenant.
:url	*inet:url*	The primary URL associated with the tenant.
:status	*inet:service:object:status*	The status of the tenant.
:period	*ival*	The period when the tenant existed.
:creator	*inet:service:account*	The service account which created the tenant.
:remover	*inet:service:account*	The service account which removed or decommissioned the tenant.
:app	*inet:service:app*	The app which contains the tenant.
:id	*str* strip: True	A platform specific ID which identifies the tenant.
:platform	*inet:service:platform*	The platform which defines the tenant.
:instance	*inet:service:instance*	The platform instance which defines the tenant.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:service:thread

A message thread.

The base type for the form can be found at *inet:service:thread*.

Properties:

name	type	doc
:title	*str* lower: True onespace: True	The title of the thread.
:channel	*inet:service:channel*	The channel that contains the thread.
:message	*inet:service:message*	The message which initiated the thread.
:url	*inet:url*	The primary URL associated with the thread.
:status	*inet:service:object:status*	The status of the thread.
:period	*ival*	The period when the thread existed.
:creator	*inet:service:account*	The service account which created the thread.
:remover	*inet:service:account*	The service account which removed or decommissioned the thread.
:app	*inet:service:app*	The app which contains the thread.
:id	*str* strip: True	A platform specific ID which identifies the thread.
:platform	*inet:service:platform*	The platform which defines the thread.
:instance	*inet:service:instance*	The platform instance which defines the thread.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:ssl:cert

Deprecated. Please use inet:tls:servercert or inet:tls:clientcert.

The base type for the form can be found at *inet:ssl:cert*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file bytes for the SSL certificate.	Read Only: True
:server	*inet:server*	The server that presented the SSL certificate.	Read Only: True
:server:ipv4	*inet:ipv4*	The SSL server IPv4 address.	Read Only: True
:server:ipv6	*inet:ipv6*	The SSL server IPv6 address.	Read Only: True
:server:port	*inet:port*	The SSL server listening port.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:ssl:jarmhash

A TLS JARM fingerprint hash.

The base type for the form can be found at *inet:ssl:jarmhash*.

Properties:

name	type	doc	opts
:ciphers	*str* lower: True strip: True regex: ^[0-9a-f]{30}$	The encoded cipher and TLS version of the server.	Read Only: True
:extensions	*str* lower: True strip: True regex: ^[0-9a-f]{32}$	The truncated SHA256 of the TLS server extensions.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:ssl:jarmsample

A JARM hash sample taken from a server.

The base type for the form can be found at *inet:ssl:jarmsample*.

Properties:

name	type	doc	opts
:jarmhash	*inet:ssl:jarmhas*	The JARM hash computed from the server responses.	Read Only: True
:server	*inet:server*	The server that was sampled to compute the JARM hash.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:clientcert

An x509 certificate sent by a client for TLS.

The base type for the form can be found at *inet:tls:clientcert*.

An example of `inet:tls:clientcert`:

- `(1.2.3.4:443, 3fdf364e081c14997b291852d1f23868)`

Properties:

name	type	doc	opts
:client	*inet:client*	The client associated with the x509 certificate.	Read Only: True
:cert	*crypto:x509:cer*	The x509 certificate sent by the client.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:handshake

An instance of a TLS handshake between a server and client.

The base type for the form can be found at *inet:tls:handshake*.

Properties:

name	type	doc	opts
:time	*time*	The time the handshake was initiated.	
:flow	*inet:flow*	The raw inet:flow associated with the handshake.	
:server	*inet:server*	The TLS server during the handshake.	
:server:cert	*crypto:x509:*	The x509 certificate sent by the server during the handshake.	
:server:ja3s	*hash:md5*	The JA3S fingerprint of the server response.	
:server:ja4s	*inet:tls:ja4s*	The JA4S fingerprint of the server response.	
:client	*inet:client*	The TLS client during the handshake.	
:client:cert	*crypto:x509:*	The x509 certificate sent by the client during the handshake.	
:client:ja3	*hash:md5*	The JA3 fingerprint of the client request.	
:client:ja4	*inet:tls:ja4*	The JA4 fingerprint of the client request.	
:client:fingerpri	*hash:md5*	Deprecated. Please use :client:ja3.	Deprecated: True
:server:fingerpri	*hash:md5*	Deprecated. Please use :server:ja3s.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja3:sample

A JA3 sample taken from a client.

The base type for the form can be found at *inet:tls:ja3:sample*.

Properties:

name	type	doc	opts
:client	*inet:client*	The client that was sampled to produce the JA3 hash.	Read Only: True
:ja3	*hash:md5*	The JA3 hash computed from the client's TLS hello packet.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.

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source	verb	target	doc
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja3s:sample

A JA3 sample taken from a server.

The base type for the form can be found at *inet:tls:ja3s:sample*.

Properties:

name	type	doc	opts
:server	*inet:server*	The server that was sampled to produce the JA3S hash.	Read Only: True
:ja3s	*hash:md5*	The JA3S hash computed from the server's TLS hello packet.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja4

A JA4 TLS client fingerprint.

The base type for the form can be found at *inet:tls:ja4*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja4:sample

A JA4 TLS client fingerprint used by a client.

The base type for the form can be found at *inet:tls:ja4:sample*.

Properties:

name	type	doc	opts
:ja4	*inet:tls:ja4*	The JA4 TLS client fingerprint.	Read Only: True
:client	*inet:client*	The client which initiated the TLS handshake with a JA4 fingerprint.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja4s

A JA4S TLS server fingerprint.

The base type for the form can be found at *inet:tls:ja4s*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:ja4s:sample

A JA4S TLS server fingerprint used by a server.

The base type for the form can be found at *inet:tls:ja4s:sample*.

Properties:

name	type	doc	opts
:ja4s	*inet:tls:ja4*	The JA4S TLS server fingerprint.	Read Only: True
:server	*inet:server*	The server which responded to the TLS handshake with a JA4S fingerprint.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tls:servercert

An x509 certificate sent by a server for TLS.

The base type for the form can be found at *inet:tls:servercert*.

An example of `inet:tls:servercert`:

- `(1.2.3.4:443, c7437790af01ae1bb2f8f3b684c70bf8)`

Properties:

name	type	doc	opts
:server	*inet:server*	The server associated with the x509 certificate.	Read Only: True
:cert	*crypto:x509:cer*	The x509 certificate sent by the server.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tunnel

A specific sequence of hosts forwarding connections such as a VPN or proxy.

The base type for the form can be found at *inet:tunnel*.

Properties:

name	type	doc
:anon	*bool*	Indicates that this tunnel provides anonymization.
:type	*inet:tunnel:type:taxonomy*	The type of tunnel such as vpn or proxy.
:ingress	*inet:server*	The server where client traffic enters the tunnel.
:egress	*inet:server*	The server where client traffic leaves the tunnel.
:operator	*ps:contact*	The contact information for the tunnel operator.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:tunnel:type:taxonomy

A taxonomy of network tunnel types.

The base type for the form can be found at *inet:tunnel:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*inet:tunnel:type:taxono*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:url

A Universal Resource Locator (URL).

The base type for the form can be found at *inet:url*.

An example of `inet:url`:

- `http://www.woot.com/files/index.html`

  Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The fqdn used in the URL (e.g., http://www.woot.com/page.html).	Read Only: True
:ipv4	*inet:ipv4*	The IPv4 address used in the URL (e.g., http://1.2.3.4/page.html).	Read Only: True
:ipv6	*inet:ipv6*	The IPv6 address used in the URL.	Read Only: True
:passwd	*inet:passwd*	The optional password used to access the URL.	Read Only: True
:base	*str*	The base scheme, user/pass, fqdn, port and path w/o parameters.	Read Only: True
:path	*str*	The path in the URL w/o parameters.	Read Only: True
:params	*str*	The URL parameter string.	Read Only: True
:port	*inet:port*	The port of the URL. URLs prefixed with http will be set to port 80 and URLs prefixed with https will be set to port 443 unless otherwise specified.	Read Only: True
:proto	*str* lower: True	The protocol in the URL.	Read Only: True
:user	*inet:user*	The optional username used to access the URL.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the targe
it:dev:repo	-(has)>	inet:url	The repo has content hosted at the URL.
it:exec:query	-(found)>	*	The target node was returned as a result of running the q
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targe
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target no
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the co
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the t
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target r
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target node
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:url:mirror

A URL mirror site.

The base type for the form can be found at *inet:url:mirror*.

Properties:

name	type	doc	opts
:of	*inet:url*	The URL being mirrored.	Read Only: True
:at	*inet:url*	The URL of the mirror.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:urlfile

A file hosted at a specific Universal Resource Locator (URL).

The base type for the form can be found at *inet:urlfile*.

Properties:

name	type	doc	opts
:url	*inet:url*	The URL where the file was hosted.	Read Only: True
:file	*file:bytes*	The file that was hosted at the URL.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:urlredir

A URL that redirects to another URL, such as via a URL shortening service or an HTTP 302 response.

The base type for the form can be found at *inet:urlredir*.

An example of inet:urlredir:

- (http://foo.com/,http://bar.com/)

Properties:

name	type	doc	opts
:src	*inet:url*	The original/source URL before redirect.	Read Only: True
:src:fqdn	*inet:fqdn*	The FQDN within the src URL (if present).	Read Only: True
:dst	*inet:url*	The redirected/destination URL.	Read Only: True
:dst:fqdn	*inet:fqdn*	The FQDN within the dst URL (if present).	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:user

A username string.

The base type for the form can be found at *inet:user*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:acct

An account with a given Internet-based site or service.

The base type for the form can be found at *inet:web:acct*.

An example of `inet:web:acct`:

- `twitter.com/invisig0th`

Properties:

name	type	doc	opts
:avatar	*file:bytes*	The file representing the avatar (e.g., profile picture) for the account.	
:banner	*file:bytes*	The file representing the banner for the account.	
:dob	*time*	A self-declared date of birth for the account (if the account belongs to a person).	
:email	*inet:email*	The email address associated with the account.	
:linked:accts	*array* type: *inet:web:acct* uniq: True sorted: True	Linked accounts specified in the account profile.	
:latlong	*geo:latlong*	The last known latitude/longitude for the node.	
:place	*geo:place*	The geo:place associated with the latlong property.	
:loc	*loc*	A self-declared location for the account.	
:name	*inet:user*	The localized name associated with the account (may be different from the account identifier, e.g., a display name).	
:name:en	*inet:user*	The English version of the name associated with the (may be different from the account identifier, e.g., a display name).	Deprecated: True
:aliases	*array* type: *inet:user* uniq: True sorted: True	An array of alternate names for the user.	
:occupation	*str* lower: True	A self-declared occupation for the account.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:action

An instance of an account performing an action at an Internet-based site or service.

The base type for the form can be found at *inet:web:action*.

Properties:

name	type	doc
:act	*str* lower: True strip: True	The action performed by the account.
:acct	*inet:web:acct*	The web account associated with the action.
:acct:site	*inet:fqdn*	The site or service associated with the account.
:acct:user	*inet:user*	The unique identifier for the account.
:time	*time*	The date and time the account performed the action.
:client	*inet:client*	The source client address of the action.
:client:ipv4	*inet:ipv4*	The source IPv4 address of the action.
:client:ipv6	*inet:ipv6*	The source IPv6 address of the action.
:loc	*loc*	The location of the user executing the web action.
:latlong	*geo:latlong*	The latlong of the user when executing the web action.
:place	*geo:place*	The geo:place of the user when executing the web action.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.

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source	verb	target	doc
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:attachment

An instance of a file being sent to a web service by an account.

The base type for the form can be found at *inet:web:attachment*.

Properties:

name	type	doc	opts
:acct	*inet:web:acct*	The account that uploaded the file.	
:post	*inet:web:post*	The optional web post that the file was attached to.	
:mesg	*inet:web:mes*	The optional web message that the file was attached to.	
:proto	*inet:proto*	The protocol used to transmit the file to the web service.	Example: `https`
:interactiv	*bool*	Set to true if the upload was interactive. False if automated.	
:file	*file:bytes*	The file that was sent.	
:name	*file:path*	The name of the file at the time it was sent.	
:time	*time*	The time the file was sent.	
:client	*inet:client*	The client address which initiated the upload.	
:client:ipv	*inet:ipv4*	The IPv4 address of the client that initiated the upload.	
:client:ipv	*inet:ipv6*	The IPv6 address of the client that initiated the upload.	
:place	*geo:place*	The place the file was sent from.	
:place:loc	*loc*	The geopolitical location that the file was sent from.	
:place:name	*geo:name*	The reported name of the place that the file was sent from.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:channel

A channel within a web service or instance such as slack or discord.

The base type for the form can be found at *inet:web:channel*.

Properties:

name	type	doc	opts
:url	*inet:url*	The primary URL used to identify the channel.	Example: https://app.slack.com/client/T2XK1223Y/C2XHHNDS7
:id	*str* strip: True	The operator specified ID of this channel.	Example: C2XHHNDS7
:instance	*inet:web:instance*	The instance which contains the channel.	
:name	*str* strip: True	The visible name of the channel.	Example: general
:topic	*str* strip: True	The visible topic of the channel.	Example: Synapse Discussion - Feel free to invite others!
:created	*time*	The time the channel was created.	
:creator	*inet:web:acct*	The account which created the channel.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:chprofile

A change to a web account. Used to capture historical properties associated with an account, as opposed to current data in the inet:web:acct node.

The base type for the form can be found at *inet:web:chprofile*.

Properties:

name	type	doc
:acct	*inet:wel*	The web account associated with the change.
:acct:s	*inet:fqd*	The site or service associated with the account.
:acct:u	*inet:use*	The unique identifier for the account.
:client	*inet:clie*	The source address used to make the account change.
:client	*inet:ipv4*	The source IPv4 address used to make the account change.
:client	*inet:ipv6*	The source IPv6 address used to make the account change.
:time	*time*	The date and time when the account change occurred.
:pv	*node-prop*	The prop=valu of the account property that was changed. Valu should be the old / original value, while the new value should be updated on the inet:web:acct form.
:pv:prc	*str*	The property that was changed.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:file

A file posted by a web account.

The base type for the form can be found at *inet:web:file*.

Properties:

name	type	doc	opts
:acct	*inet:web:acc*	The account that owns or is associated with the file.	Read Only: True
:acct:site	*inet:fqdn*	The site or service associated with the account.	Read Only: True
:acct:user	*inet:user*	The unique identifier for the account.	Read Only: True
:file	*file:bytes*	The file owned by or associated with the account.	Read Only: True
:name	*file:base*	The name of the file owned by or associated with the account.	
:posted	*time*	Deprecated. Instance data belongs on inet:web:attachment.	Deprecated: True
:client	*inet:client*	Deprecated. Instance data belongs on inet:web:attachment.	Deprecated: True
:client:ipv	*inet:ipv4*	Deprecated. Instance data belongs on inet:web:attachment.	Deprecated: True
:client:ipv	*inet:ipv6*	Deprecated. Instance data belongs on inet:web:attachment.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:follows

A web account follows or is connected to another web account.

The base type for the form can be found at *inet:web:follows*.

Properties:

name	type	doc	opts
:follower	*inet:web:acct*	The account following an account.	Read Only: True
:followee	*inet:web:acct*	The account followed by an account.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:group

A group hosted within or registered with a given Internet-based site or service.

The base type for the form can be found at *inet:web:group*.

An example of `inet:web:group`:

- `somesite.com/mycoolgroup`

  Properties:

name	type	doc	opts
:site	*inet:fqdn*	The site or service associated with the group.	Read Only: True
:id	*inet:group*	The site-specific unique identifier for the group (may be different from the common name or display name).	Read Only: True
:name	*inet:group*	The localized name associated with the group (may be different from the account identifier, e.g., a display name).	
:aliases	*array* type: *inet:group* uniq: True sorted: True	An array of alternate names for the group.	
:name:en	*inet:group*	The English version of the name associated with the group (may be different from the localized name).	Deprecated: True
:url	*inet:url*	The service provider URL where the group is hosted.	
:avatar	*file:bytes*	The file representing the avatar (e.g., profile picture) for the group.	
:desc	*str*	The text of the description of the group.	
:webpage	*inet:url*	A related URL specified by the group (e.g., primary web site, etc.).	
:loc	*str* lower: True	A self-declared location for the group.	
:latlong	*geo:latlong*	The last known latitude/longitude for the node.	
:place	*geo:place*	The geo:place associated with the latlong property.	
:signup	*time*	The date and time the group was cre-	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:hashtag

A hashtag used in a web post.

The base type for the form can be found at *inet:web:hashtag*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:instance

An instance of a web service such as slack or discord.

The base type for the form can be found at *inet:web:instance*.

Properties:

name	type	doc	opts
:url	*inet:url*	The primary URL used to identify the instance.	Example: https://app.slack.com/client/T2XK1223Y
:id	*str* strip: True	The operator specified ID of this instance.	Example: T2XK1223Y
:name	*str* strip: True	The visible name of the instance.	Example: vertex synapse
:created	*time*	The time the instance was created.	
:creator	*inet:web:acct*	The account which created the instance.	
:owner	*ou:org*	The organization which created the instance.	
:owner:fqdn	*inet:fqdn*	The FQDN of the organization which created the instance. Used for entity resolution.	Example: vertex.link
:owner:name	*ou:name*	The name of the organization which created the instance. Used for entity resolution.	Example: the vertex project, llc.
:operator	*ou:org*	The organization which operates the instance.	
:operator:name	*ou:name*	The name of the organization which operates the instance. Used for entity resolution.	Example: slack
:operator:fqdn	*inet:fqdn*	The FQDN of the organization which operates the instance. Used for entity resolution.	Example: slack.com

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:logon

An instance of an account authenticating to an Internet-based site or service.

The base type for the form can be found at *inet:web:logon*.

Properties:

name	type	doc
:acct	*inet:web:acct*	The web account associated with the logon event.
:acct:site	*inet:fqdn*	The site or service associated with the account.
:acct:user	*inet:user*	The unique identifier for the account.
:time	*time*	The date and time the account logged into the service.
:client	*inet:client*	The source address of the logon.
:client:ipv4	*inet:ipv4*	The source IPv4 address of the logon.
:client:ipv6	*inet:ipv6*	The source IPv6 address of the logon.
:logout	*time*	The date and time the account logged out of the service.
:loc	*loc*	The location of the user executing the logon.
:latlong	*geo:latlong*	The latlong of the user executing the logon.
:place	*geo:place*	The geo:place of the user executing the logon.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 237 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:memb

Deprecated. Please use inet:web:member.

The base type for the form can be found at *inet:web:memb*.

Properties:

name	type	doc	opts
:acct	*inet:web:acct*	The account that is a member of the group.	Read Only: True
:group	*inet:web:group*	The group that the account is a member of.	Read Only: True
:title	*str* lower: True	The title or status of the member (e.g., admin, new member, etc.).	
:joined	*time*	The date / time the account joined the group.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 238 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:member

Represents a web account membership in a channel or group.

The base type for the form can be found at *inet:web:member*.

Properties:

name	type	doc
:acct	*inet:web:acct*	The account that is a member of the group or channel.
:group	*inet:web:group*	The group that the account is a member of.
:channel	*inet:web:channel*	The channel that the account is a member of.
:added	*time*	The date / time the account was added to the group or channel.
:removed	*time*	The date / time the account was removed from the group or channel.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:mesg

A message sent from one web account to another web account or channel.

The base type for the form can be found at *inet:web:mesg*.

An example of `inet:web:mesg`:

- `((twitter.com, invisig0th), (twitter.com, gobbles), 20041012130220)`

Properties:

name	type	doc	opts
`:from`	*inet:web:a*	The web account that sent the message.	Read Only: `True`
`:to`	*inet:web:a*	The web account that received the message.	Read Only: `True`
`:client`	*inet:client*	The source address of the message.	
`:client`	*inet:ipv4*	The source IPv4 address of the message.	
`:client`	*inet:ipv6*	The source IPv6 address of the message.	
`:time`	*time*	The date and time at which the message was sent.	Read Only: `True`
`:url`	*inet:url*	The URL where the message is posted / visible.	
`:text`	*str*	The text of the message.	Display: `{'hint': 'text'}`
`:delete`	*bool*	The message was deleted.	
`:file`	*file:bytes*	The file attached to or sent with the message.	
`:place`	*geo:place*	The place that the message was reportedly sent from.	
`:place:`	*geo:name*	The name of the place that the message was reportedly sent from. Used for entity resolution.	
`:instan`	*inet:web:i*	The instance where the message was sent.	

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:post

A post made by a web account.

The base type for the form can be found at *inet:web:post*.

Properties:

name	type	doc	opts
:acct	*inet:web:acct*	The web account that made the post.	
:acct:site	*inet:fqdn*	The site or service associated with the account.	
:client	*inet:client*	The source address of the post.	
:client:ipv4	*inet:ipv4*	The source IPv4 address of the post.	
:client:ipv6	*inet:ipv6*	The source IPv6 address of the post.	
:acct:user	*inet:user*	The unique identifier for the account.	
:text	*str*	The text of the post.	Display: {'hint': 'text'}
:time	*time*	The date and time that the post was made.	
:deleted	*bool*	The message was deleted by the poster.	
:url	*inet:url*	The URL where the post is published / visible.	
:file	*file:bytes*	The file that was attached to the post.	
:replyto	*inet:web:post*	The post that this post is in reply to.	
:repost	*inet:web:post*	The original post that this is a repost of.	
:hashtags	*array* type: *inet:web:hashtag* uniq: True sorted: True split: ,	Hashtags mentioned within the post.	
:mentions:users	*array* type: *inet:web:acct* uniq: True sorted: True split: ,	Accounts mentioned within the post.	
:mentions:groups	*array* type: *inet:web:group* uniq: True sorted: True split: ,	Groups mentioned within the post.	
:loc	*loc*	The location that the post was reportedly sent from.	
:place	*geo:place*	The place that the post was reportedly sent	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:web:post:link

A link contained within post text.

The base type for the form can be found at *inet:web:post:link*.

Properties:

name	type	doc
:post	*inet:web:post*	The post containing the embedded link.
:url	*inet:url*	The url that the link forwards to.
:text	*str*	The displayed hyperlink text if it was not the raw URL.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:contact

An individual contact from a domain whois record.

The base type for the form can be found at *inet:whois:contact*.

Properties:

name	type	doc	opts
:rec	*inet:whois:rec*	The whois record containing the contact data.	Read Only: True
:rec:fqdn	*inet:fqdn*	The domain associated with the whois record.	Read Only: True
:rec:asof	*time*	The date of the whois record.	Read Only: True
:type	*str* lower: True	The contact type (e.g., registrar, registrant, admin, billing, tech, etc.).	Read Only: True
:id	*str* lower: True	The ID associated with the contact.	
:name	*str* lower: True	The name of the contact.	
:email	*inet:email*	The email address of the contact.	
:orgname	*ou:name*	The name of the contact organization.	
:address	*str* lower: True	The content of the street address field(s) of the contact.	
:city	*str* lower: True	The content of the city field of the contact.	
:state	*str* lower: True	The content of the state field of the contact.	
:country	*str* lower: True	The two-letter country code of the contact.	
:phone	*tel:phone*	The content of the phone field of the contact.	
:fax	*tel:phone*	The content of the fax field of the contact.	
:url	*inet:url*	The URL specified for the contact.	
:whois:fqdn	*inet:fqdn*	The whois server FQDN for the given contact (most likely a registrar).	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:email

An email address associated with an FQDN via whois registration text.

The base type for the form can be found at *inet:whois:email*.

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain with a whois record containing the email address.	Read Only: True
:email	*inet:email*	The email address associated with the domain whois record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:ipcontact

An individual contact from an IP block record.

The base type for the form can be found at *inet:whois:ipcontact*.

Properties:

name	type	doc
:contact	*ps:contact*	Contact information associated with a registration.
:asof	*time*	The date of the record.
:created	*time*	The "created" time from the record.
:updated	*time*	The "last updated" time from the record.
:role	*str* lower: True	The primary role for the contact.
:roles	*array* type: *str* uniq: True sorted: True	Additional roles assigned to the contact.
:asn	*inet:asn*	The associated Autonomous System Number (ASN).
:id	*inet:whois:regid*	The registry unique identifier (e.g. NET-74-0-0-0-1).
:links	*array* type: *inet:url* uniq: True sorted: True	URLs provided with the record.
:status	*str* lower: True	The state of the registered contact (e.g. validated, obscured).
:contacts	*array* type: *inet:whois:ipcontact* uniq: True sorted: True	Additional contacts referenced by this contact.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:ipquery

Query details used to retrieve an IP record.

The base type for the form can be found at *inet:whois:ipquery*.

Properties:

name	type	doc
:time	*time*	The time the request was made.
:url	*inet:url*	The query URL when using the HTTP RDAP Protocol.
:fqdn	*inet:fqdn*	The FQDN of the host server when using the legacy WHOIS Protocol.
:ipv4	*inet:ipv4*	The IPv4 address queried.
:ipv6	*inet:ipv6*	The IPv6 address queried.
:success	*bool*	Whether the host returned a valid response for the query.
:rec	*inet:whois:iprec*	The resulting record from the query.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:iprec

An IPv4/IPv6 block registration record.

The base type for the form can be found at *inet:whois:iprec*.

Properties:

name	type	doc	opts
:net4	*inet:net4*	The IPv4 address range assigned.	
:net4:min	*inet:ipv4*	The first IPv4 in the range assigned.	
:net4:max	*inet:ipv4*	The last IPv4 in the range assigned.	
:net6	*inet:net6*	The IPv6 address range assigned.	
:net6:min	*inet:ipv6*	The first IPv6 in the range assigned.	
:net6:max	*inet:ipv6*	The last IPv6 in the range assigned.	
:asof	*time*	The date of the record.	
:created	*time*	The "created" time from the record.	
:updated	*time*	The "last updated" time from the record.	
:text	*str* lower: True	The full text of the record.	Display: {'hint': 'text'}
:desc	*str* lower: True	Notes concerning the record.	Display: {'hint': 'text'}
:asn	*inet:asn*	The associated Autonomous System Number (ASN).	
:id	*inet:whois:regid*	The registry unique identifier (e.g. NET-74-0-0-0-1).	
:name	*str*	The name assigned to the network by the registrant.	
:parentid	*inet:whois:regid*	The registry unique identifier of the parent whois record (e.g. NET-74-0-0-0-0).	
:registrant	*inet:whois:ipcontact*	Deprecated. Add the registrant inet:whois:ipcontact to the :contacts array.	Deprecated: True
:contacts	*array* type: *inet:whois:ipcontact* uniq: True sorted: True	Additional contacts from the record.	
:country	*str* lower: True regex: ^[a-z]{2}$	The two-letter ISO 3166 country code.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
inet:whois:ip	-(ipwhois)	inet:ipv4	The source IP whois record describes the target IPv4 address.
inet:whois:ip	-(ipwhois)	inet:ipv6	The source IP whois record describes the target IPv6 address.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:rar

A domain registrar.

The base type for the form can be found at *inet:whois:rar*.

An example of `inet:whois:rar`:

- `godaddy, inc.`

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.

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Table 248 – continued from previous page

source	verb	target	doc
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:rec

A domain whois record.

The base type for the form can be found at *inet:whois:rec*.

Properties:

name	type	doc	opts
:fqdn	*inet:fqdn*	The domain associated with the whois record.	Read Only: True
:asof	*time*	The date of the whois record.	Read Only: True
:text	*str* lower: True	The full text of the whois record.	Display: {'hint': 'text'}
:created	*time*	The "created" time from the whois record.	
:updated	*time*	The "last updated" time from the whois record.	
:expires	*time*	The "expires" time from the whois record.	
:registrar	*inet:whois:rar*	The registrar name from the whois record.	
:registrant	*inet:whois:reg*	The registrant name from the whois record.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:recns

A nameserver associated with a domain whois record.

The base type for the form can be found at *inet:whois:recns*.

Properties:

name	type	doc	opts
:ns	*inet:fqdn*	A nameserver for a domain as listed in the domain whois record.	Read Only: True
:rec	*inet:whois:re*	The whois record containing the nameserver data.	Read Only: True
:rec:fqdn	*inet:fqdn*	The domain associated with the whois record.	Read Only: True
:rec:asof	*time*	The date of the whois record.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 250 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:reg

A domain registrant.

The base type for the form can be found at *inet:whois:reg*.

An example of inet:whois:reg:

- woot hostmaster

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.

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Table 251 – continued from previous page

source	verb	target	doc
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:whois:regid

The registry unique identifier of the registration record.

The base type for the form can be found at *inet:whois:regid*.

An example of `inet:whois:regid`:

- `NET-10-0-0-0-1`

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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Table 252 – continued from previous page

source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:wifi:ap

An SSID/MAC address combination for a wireless access point.

The base type for the form can be found at *inet:wifi:ap*.

Properties:

name	type	doc	opts
:ssid	*inet:wifi:ssid*	The SSID for the wireless access point.	Read Only: True
:bssid	*inet:mac*	The MAC address for the wireless access point.	Read Only: True
:latlong	*geo:latlong*	The best known latitude/longitude for the wireless access point.	
:accuracy	*geo:dist*	The reported accuracy of the latlong telemetry reading.	
:channel	*int*	The WIFI channel that the AP was last observed operating on.	
:encryption	*str* lower: True strip: True	The type of encryption used by the WIFI AP such as "wpa2".	
:place	*geo:place*	The geo:place associated with the latlong property.	
:loc	*loc*	The geo-political location string for the wireless access point.	
:org	*ou:org*	The organization that owns/operates the access point.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 253 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

inet:wifi:ssid

A WiFi service set identifier (SSID) name.

The base type for the form can be found at *inet:wifi:ssid*.

An example of `inet:wifi:ssid`:

- `The Vertex Project`

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

  Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

iso:oid

An ISO Object Identifier string.

The base type for the form can be found at *iso:oid*.

Properties:

name	type	doc
:descr	*str*	A description of the value or meaning of the OID.
:identifier	*str*	The string identifier for the deepest tree element.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:account

A GUID that represents an account on a host or network.

The base type for the form can be found at *it:account*.

Properties:

name	type	doc	opts
:user	*inet:user*	The username associated with the account.	
:contact	*ps:contact*	Additional contact information associated with this account.	
:host	*it:host*	The host where the account is registered.	
:domain	*it:domain*	The authentication domain where the account is registered.	
:posix:uid	*int*	The user ID of the account.	Example: 1001
:posix:gid	*int*	The primary group ID of the account.	Example: 1001
:posix:gecos	*int*	The GECOS field for the POSIX account.	
:posix:home	*file:path*	The path to the POSIX account's home directory.	Example: /home/visi
:posix:shell	*file:path*	The path to the POSIX account's default shell.	Example: /bin/bash
:windows:sid	*it:os:windows:sid*	The Microsoft Windows Security Identifier of the account.	
:groups	*array* type: *it:group* uniq: True sorted: True	An array of groups that the account is a member of.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:adid

An advertising identification string.

The base type for the form can be found at *it:adid*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:app:snort:hit

An instance of a snort rule hit.

The base type for the form can be found at *it:app:snort:hit*.

Properties:

name	type	doc
:rule	*it:app:snort:rule*	The snort rule that matched the file.
:flow	*inet:flow*	The inet:flow that matched the snort rule.
:src	*inet:addr*	The source address of flow that caused the hit.
:src:ipv4	*inet:ipv4*	The source IPv4 address of the flow that caused the hit.
:src:ipv6	*inet:ipv6*	The source IPv6 address of the flow that caused the hit.
:src:port	*inet:port*	The source port of the flow that caused the hit.
:dst	*inet:addr*	The destination address of the trigger.
:dst:ipv4	*inet:ipv4*	The destination IPv4 address of the flow that caused the hit.
:dst:ipv6	*inet:ipv6*	The destination IPv4 address of the flow that caused the hit.
:dst:port	*inet:port*	The destination port of the flow that caused the hit.
:time	*time*	The time of the network flow that caused the hit.
:sensor	*it:host*	The sensor host node that produced the hit.
:version	*it:semver*	The version of the rule at the time of match.
:dropped	*bool*	Set to true if the network traffic was dropped due to the match.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:app:snort:rule

A snort rule.

The base type for the form can be found at *it:app:snort:rule*.

Properties:

name	type	doc	opts
:id	*str*	The snort rule id.	
:text	*str*	The snort rule text.	Display: {'hint': 'text'}
:name	*str*	The name of the snort rule.	
:desc	*str*	A brief description of the snort rule.	Display: {'hint': 'text'}
:engine	*int*	The snort engine ID which can parse and evaluate the rule text.	
:versio	*it:semver*	The current version of the rule.	
:author	*ps:contact*	Contact info for the author of the rule.	
:create	*time*	The time the rule was initially created.	
:update	*time*	The time the rule was most recently modified.	
:enable	*bool*	The rule enabled status to be used for snort evaluation engines.	
:family	*it:prod:softna*	The name of the software family the rule is designed to detect.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.
it:app:snort:r	-(detects)	*	The snort rule is intended for use in detecting the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting th
it:exec:query	-(found)>	*	The target node was returned as a result of runnin
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of th
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:ruleset	-(has)>	it:app:snort:rule	The meta:ruleset includes the it:app:snort:rule.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the ta
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target
ps:contact	-(has)>	*	The contact is or was in possession of the target n
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target n
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the at
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result o
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access
risk:leak	-(leaked)>	*	The leak included the disclosure of the target nod
risk:mitigation	-(uses)>	it:app:snort:rule	The mitigation uses the Snort rule.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the targ
sci:experiment	-(uses)>	*	The experiment used the target nodes when it wa
sci:observation	-(has)>	*	The observations are summarized from the target

it:app:yara:match

A YARA rule match to a file.

The base type for the form can be found at *it:app:yara:match*.

Properties:

name	type	doc	opts
:rule	*it:app:yara:rul*	The YARA rule that matched the file.	Read Only: True
:file	*file:bytes*	The file that matched the YARA rule.	Read Only: True
:version	*it:semver*	The most recent version of the rule evaluated as a match.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.

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source	verb	target	doc
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:app:yara:netmatch

An instance of a YARA rule network hunting match.

The base type for the form can be found at *it:app:yara:netmatch*.

Properties:

name	type	doc
:rule	*it:app:yara:rule*	The YARA rule that triggered the match.
:version	*it:semver*	The most recent version of the rule evaluated as a match.
:node	*ndef* forms: ('inet:fqdn', 'inet:ipv4', 'inet:ipv6', 'inet:url')	The node which matched the rule.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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Table 261 – continued from previous page

source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:app:yara:procmatch

An instance of a YARA rule match to a process.

The base type for the form can be found at *it:app:yara:procmatch*.

Properties:

name	type	doc
:rule	*it:app:yara:rule*	The YARA rule that matched the process.
:proc	*it:exec:proc*	The process that matched the YARA rule.
:time	*time*	The time that the YARA engine matched the process to the rule.
:version	*it:semver*	The most recent version of the rule evaluated as a match.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:app:yara:rule

A YARA rule unique identifier.

The base type for the form can be found at *it:app:yara:rule*.

Properties:

name	type	doc	opts
:text	*str*	The YARA rule text.	Display: {'hint': 'text', 'syntax': 'yara'}
:ext:i	*str*	The YARA rule ID from an external system.	
:url	*inet:url*	A URL which documents the YARA rule.	
:name	*str*	The name of the YARA rule.	
:autho	*ps:contact*	Contact info for the author of the YARA rule.	
:versi	*it:semver*	The current version of the rule.	
:creat	*time*	The time the YARA rule was initially created.	
:updat	*time*	The time the YARA rule was most recently modified.	
:enabl	*bool*	The rule enabled status to be used for YARA evaluation engines.	
:famil	*it:prod:soft*	The name of the software family the rule is designed to detect.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
it:app:yara:r	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the t
it:exec:query	-(found)>	*	The target node was returned as a result of running
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of th
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:ruleset	-(has)>	it:app:yara:rule	The meta:ruleset includes the it:app:yara:rule.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the tar
ou:org	-(owns)>	*	The organization owns or owned the target node.

continue

Table 263 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target n
ps:contact	-(has)>	*	The contact is or was in possession of the target no
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target no
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the atta
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node
risk:mitigation	-(uses)>	it:app:yara:rule	The mitigation uses the YARA rule.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the ta
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the targe
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was
sci:observation	-(has)>	*	The observations are summarized from the target n

it:auth:passwdhash

An instance of a password hash.

The base type for the form can be found at *it:auth:passwdhash*.

Properties:

name	type	doc
:salt	*hex*	The (optional) hex encoded salt value used to calculate the password hash.
:hash:md5	*hash:md5*	The MD5 password hash value.
:hash:sha1	*hash:sha1*	The SHA1 password hash value.
:hash:sha256	*hash:sha256*	The SHA256 password hash value.
:hash:sha512	*hash:sha512*	The SHA512 password hash value.
:hash:lm	*hash:lm*	The LM password hash value.
:hash:ntlm	*hash:ntlm*	The NTLM password hash value.
:passwd	*inet:passwd*	The (optional) clear text password for this password hash.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:av:filehit

Deprecated. Please use it:av:scan:result.

The base type for the form can be found at *it:av:filehit*.

Properties:

name	type	doc	opts
:file	*file:bytes*	The file that triggered the signature hit.	Read Only: True
:sig	*it:av:sig*	The signature that the file triggered on.	Read Only: True
:sig:name	*it:av:signame*	The signature name.	Read Only: True
:sig:soft	*it:prod:soft*	The anti-virus product which contains the signature.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 265 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:av:prochit

Deprecated. Please use it:av:scan:result.

The base type for the form can be found at *it:av:prochit*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The file that triggered the signature hit.
:sig	*it:av:sig*	The signature that the file triggered on.
:time	*time*	The time that the AV engine detected the signature.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.

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Table 266 – continued from previous page

source	verb	target	doc
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:av:scan:result

The result of running an antivirus scanner.

The base type for the form can be found at *it:av:scan:result*.

Properties:

name	type	doc
:time	*time*	The time the scan was run.
:verdict	*int* enums: ((10, 'benign'), (20, 'unknown'), (30, 'suspicious'), (40, 'malicious'))	The scanner provided verdict for the scan.
:scanner	*it:prod:softver*	The scanner software used to produce the result.
:scanner:name	*it:prod:softname*	The name of the scanner software.
:signame	*it:av:signame*	The name of the signature returned by the scanner.
:categories	*array* sorted: True uniq: True type: *str* typeopts: {'lower': True, 'onespace': True}	A list of categories for the result returned by the scanner.
:target:file	*file:bytes*	The file that was scanned to produce the result.
:target:proc	*it:exec:proc*	The process that was scanned to produce the result.
:target:host	*it:host*	The host that was scanned to produce the result.
:target:fqdn	*inet:fqdn*	The FQDN that was scanned to produce the result.
:target:url	*inet:url*	The URL that was scanned to produce the result.
:target:ipv4	*inet:ipv4*	The IPv4 address that was scanned to produce the result.
:target:ipv6	*inet:ipv6*	The IPv6 address that was scanned to produce the result.
:multi:scan	*it:av:scan:result*	Set if this result was part of running multiple scanners.
:multi:count	*int* min: 0	The total number of scanners which were run by a multi-scanner.
:multi:count:benign	*int* min: 0	The number of scanners which returned a benign verdict.
:multi:count:unknown	*int* min: 0	The number of scanners which returned a unknown/unsupported verdict.
:multi:count:suspicious	*int*	The number of scanners which returned a suspicious verdict.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:av:sig

Deprecated. Please use it:av:scan:result.

The base type for the form can be found at *it:av:sig*.

Properties:

name	type	doc	opts
:soft	*it:prod:soft*	The anti-virus product which contains the signature.	Read Only: True
:name	*it:av:signam*	The signature name.	Read Only: True
:desc	*str*	A free-form description of the signature.	Display: {'hint': 'text'}
:url	*inet:url*	A reference URL for information about the signature.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.

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Table 268 – continued from previous page

source	verb	target	doc
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:av:signame

An antivirus signature name.

The base type for the form can be found at *it:av:signame*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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Table 269 – continued from previous page

source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:cmd

A unique command-line string.

The base type for the form can be found at *it:cmd*.

An example of `it:cmd`:

- `foo.exe --dostuff bar`

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

continues on nex

Table 270 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:cmd:history

A single command executed within a session.

The base type for the form can be found at *it:cmd:history*.

Properties:

name	type	doc
:cmd	*it:cmd*	The command that was executed.
:session	*it:cmd:session*	The session that contains this history entry.
:time	*time*	The time that the command was executed.
:index	*int*	Used to order the commands when times are not available.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:cmd:session

A command line session with multiple commands run over time.

The base type for the form can be found at *it:cmd:session*.

Properties:

name	type	doc
:host	*it:host*	The host where the command line session was executed.
:proc	*it:exec:proc*	The process which was interpreting this command line session.
:period	*ival*	The period over which the command line session was running.
:file	*file:bytes*	The file containing the command history such as a .bash_history file.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:int

A developer selected integer constant.

The base type for the form can be found at *it:dev:int*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:mutex

A string representing a mutex.

The base type for the form can be found at *it:dev:mutex*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:pipe

A string representing a named pipe.

The base type for the form can be found at *it:dev:pipe*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:regkey

A Windows registry key.

The base type for the form can be found at *it:dev:regkey*.

An example of `it:dev:regkey`:

- HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run

  Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

  Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:regval

A Windows registry key/value pair.

The base type for the form can be found at *it:dev:regval*.

Properties:

name	type	doc
:key	*it:dev:regkey*	The Windows registry key.
:str	*it:dev:str*	The value of the registry key, if the value is a string.
:int	*it:dev:int*	The value of the registry key, if the value is an integer.
:bytes	*file:bytes*	The file representing the value of the registry key, if the value is binary data.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

continues on next pag

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo

A version control system instance.

The base type for the form can be found at *it:dev:repo*.

Properties:

name	type	doc	opts
:name	*str* lower: True strip: True	The name of the repository.	
:desc	*str*	A free-form description of the repository.	Display: {'hint': 'text'}
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:url	*inet:url*	The URL where the repository is hosted.	
:type	*it:dev:repo:type:taxono*	The type of the version control system used.	Example: svn
:submodules	*array* type: *it:dev:repo:commit*	An array of other repos that this repo has as submodules, pinned at specific commits.	
:status	*inet:service:object:statu*	The status of the repository.	
:period	*ival*	The period when the repository existed.	
:creator	*inet:service:account*	The service account which created the repository.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository.	
:app	*inet:service:app*	The app which contains the repository.	
:id	*str* strip: True	A platform specific ID which identifies the repository.	
:platform	*inet:service:platform*	The platform which defines the repository.	
:instance	*inet:service:instance*	The platform instance which defines the repository.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
it:dev:repc	-(has)>	inet:url	The repo has content hosted at the URL.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:branch

A branch in a version control system instance.

The base type for the form can be found at *it:dev:repo:branch*.

Properties:

name	type	doc	opts
:parent	*it:dev:repo:branch*	The branch this branch was branched from.	
:start	*it:dev:repo:commit*	The commit in the parent branch this branch was created at.	
:name	*str* strip: True	The name of the branch.	
:url	*inet:url*	The URL where the branch is hosted.	
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:merged	*time*	The time this branch was merged back into its parent.	
:deleted	*time*	Deprecated. Please use :period.	Deprecated: True
:status	*inet:service:object:stati*	The status of the repository branch.	
:period	*ival*	The period when the repository branch existed.	
:creator	*inet:service:account*	The service account which created the repository branch.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository branch.	
:app	*inet:service:app*	The app which contains the repository branch.	
:id	*str* strip: True	A platform specific ID which identifies the repository branch.	
:platform	*inet:service:platform*	The platform which defines the repository branch.	
:instance	*inet:service:instance*	The platform instance which defines the repository branch.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:commit

A commit to a repository.

The base type for the form can be found at *it:dev:repo:commit*.

Properties:

name	type	doc	opts
:repo	*it:dev:repo*	The repository the commit lives in.	
:parents	*array* type: *it:dev:repo:commit*	The commit or commits this commit is immediately based on.	
:branch	*it:dev:repo:branch*	The name of the branch the commit was made to.	
:mesg	*str*	The commit message describing the changes in the commit.	Display: {'hint': 'text'}
:id	*str* strip: True	The version control system specific commit identifier.	
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:url	*inet:url*	The URL where the commit is hosted.	
:status	*inet:service:object:stat*	The status of the repository commit.	
:period	*ival*	The period when the repository commit existed.	
:creator	*inet:service:account*	The service account which created the repository commit.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository commit.	
:app	*inet:service:app*	The app which contains the repository commit.	
:platform	*inet:service:platform*	The platform which defines the repository commit.	
:instance	*inet:service:instance*	The platform instance which defines the repository commit.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:diff

A diff of a file being applied in a single commit.

The base type for the form can be found at *it:dev:repo:diff*.

Properties:

name	type	doc
:commit	*it:dev:repo:commit*	The commit that produced this diff.
:file	*file:bytes*	The file after the commit has been applied.
:path	*file:path*	The path to the file in the repo that the diff is being applied to.
:url	*inet:url*	The URL where the diff is hosted.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:diff:comment

A comment on a diff in a repository.

The base type for the form can be found at *it:dev:repo:diff:comment*.

Properties:

name	type	doc	opts
:diff	*it:dev:repo:diff*	The diff the comment is being added to.	
:text	*str*	The body of the comment.	Display: {'hint': 'text'}
:replyto	*it:dev:repo:diff:comme*	The comment that this comment is replying to.	
:line	*int*	The line in the file that is being commented on.	
:offset	*int*	The offset in the line in the file that is being commented on.	
:url	*inet:url*	The URL where the comment is hosted.	
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:updated	*time*	The time the comment was updated.	
:status	*inet:service:object:statu*	The status of the repository diff comment.	
:period	*ival*	The period when the repository diff comment existed.	
:creator	*inet:service:account*	The service account which created the repository diff comment.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository diff comment.	
:app	*inet:service:app*	The app which contains the repository diff comment.	
:id	*str* strip: True	A platform specific ID which identifies the repository diff comment.	
:platform	*inet:service:platform*	The platform which defines the repository diff comment.	
:instance	*inet:service:instance*	The platform instance which defines the repository diff comment.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:issue

An issue raised in a repository.

The base type for the form can be found at *it:dev:repo:issue*.

Properties:

name	type	doc	opts
:repo	*it:dev:repo*	The repo where the issue was logged.	
:title	*str* lower: True strip: True	The title of the issue.	
:desc	*str*	The text describing the issue.	Display: {'hint': 'text'}
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:updated	*time*	The time the issue was updated.	
:url	*inet:url*	The URL where the issue is hosted.	
:id	*str* strip: True	The ID of the issue in the repository system.	
:status	*inet:service:object:statu*	The status of the repository issue.	
:period	*ival*	The period when the repository issue existed.	
:creator	*inet:service:account*	The service account which created the repository issue.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository issue.	
:app	*inet:service:app*	The app which contains the repository issue.	
:platform	*inet:service:platform*	The platform which defines the repository issue.	
:instance	*inet:service:instance*	The platform instance which defines the repository issue.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:issue:comment

A comment on an issue in a repository.

The base type for the form can be found at *it:dev:repo:issue:comment*.

Properties:

name	type	doc	opts
:issue	*it:dev:repo:issue*	The issue thread that the comment was made in.	
:text	*str*	The body of the comment.	Display: {'hint': 'text'}
:replyto	*it:dev:repo:issue:comm*	The comment that this comment is replying to.	
:url	*inet:url*	The URL where the comment is hosted.	
:created	*time*	Deprecated. Please use :period.	Deprecated: True
:updated	*time*	The time the comment was updated.	
:status	*inet:service:object:statu*	The status of the repository issue comment.	
:period	*ival*	The period when the repository issue comment existed.	
:creator	*inet:service:account*	The service account which created the repository issue comment.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository issue comment.	
:app	*inet:service:app*	The app which contains the repository issue comment.	
:id	*str* strip: True	A platform specific ID which identifies the repository issue comment.	
:platform	*inet:service:platform*	The platform which defines the repository issue comment.	
:instance	*inet:service:instance*	The platform instance which defines the repository issue comment.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:issue:label

A label applied to a repository issue.

The base type for the form can be found at *it:dev:repo:issue:label*.

Properties:

name	type	doc	opts
:issue	*it:dev:repo:issue*	The issue the label was applied to.	
:label	*it:dev:repo:label*	The label that was applied to the issue.	
:applied	*time*	Deprecated. Please use :period.	Deprecated: True
:removed	*time*	Deprecated. Please use :period.	Deprecated: True
:url	*inet:url*	The primary URL associated with the repository issue label.	
:status	*inet:service:object:statu*	The status of the repository issue label.	
:period	*ival*	The period when the repository issue label existed.	
:creator	*inet:service:account*	The service account which created the repository issue label.	
:remover	*inet:service:account*	The service account which removed or decommissioned the repository issue label.	
:app	*inet:service:app*	The app which contains the repository issue label.	
:id	*str* strip: True	A platform specific ID which identifies the repository issue label.	
:platform	*inet:service:platform*	The platform which defines the repository issue label.	
:instance	*inet:service:instance*	The platform instance which defines the repository issue label.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:label

A developer selected label.

The base type for the form can be found at *it:dev:repo:label*.

Properties:

name	type	doc	opts
:id	*str* strip: True	The ID of the label.	
:title	*str* lower: True strip: True	The human friendly name of the label.	
:desc	*str*	The description of the label.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.

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source	verb	target	doc
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:remote

A remote repo that is tracked for changes/branches/etc.

The base type for the form can be found at *it:dev:repo:remote*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name the repo is using for the remote repo.	Example: origin
:url	*inet:url*	The URL the repo is using to access the remote repo.	
:repo	*it:dev:repo*	The repo that is tracking the remote repo.	
:remote	*it:dev:repo*	The instance of the remote repo.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:repo:type:taxonomy

A version control system type taxonomy.

The base type for the form can be found at *it:dev:repo:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:dev:repo:type:taxono*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:dev:str

A developer selected string.

The base type for the form can be found at *it:dev:str*.

Properties:

name	type	doc
:norm	*str* lower: True	Lower case normalized version of the it:dev:str.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
file:bytes	-(refs)>	it:dev:str	The source file contains the target string.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target no
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target r
it:exec:query	-(found)>	*	The target node was returned as a result of running the que

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source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the com
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the tar
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target no
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:domain

A logical boundary of authentication and configuration such as a windows domain.

The base type for the form can be found at *it:domain*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the domain.
:desc	*str*	A brief description of the domain.
:org	*ou:org*	The org that operates the given domain.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:bind

An instance of a host binding a listening port.

The base type for the form can be found at *it:exec:bind*.

Properties:

name	type	doc
:proc	*it:exec:pr*	The main process executing code that bound the listening port.
:host	*it:host*	The host running the process that bound the listening port. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that bound the listening port. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the port was bound.
:server	*inet:serve*	The inet:addr of the server when binding the port.
:server:i	*inet:ipv4*	The IPv4 address specified to bind().
:server:i	*inet:ipv6*	The IPv6 address specified to bind().
:server:p	*inet:port*	The bound (listening) TCP port.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:th*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:file:add

An instance of a host adding a file to a filesystem.

The base type for the form can be found at *it:exec:file:add*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The main process executing code that created the new file.
:host	*it:host*	The host running the process that created the new file. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that created the new file. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the file was created.
:path	*file:path*	The path where the file was created.
:path:dir	*file:path*	The parent directory of the file path (parsed from :path).
:path:ext	*str* lower: True strip: True	The file extension of the file name (parsed from :path).
:path:base	*file:base*	The final component of the file path (parsed from :path).
:file	*file:bytes*	The file that was created.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thread*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 292 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:file:del

An instance of a host deleting a file from a filesystem.

The base type for the form can be found at *it:exec:file:del*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The main process executing code that deleted the file.
:host	*it:host*	The host running the process that deleted the file. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that deleted the file. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the file was deleted.
:path	*file:path*	The path where the file was deleted.
:path:dir	*file:path*	The parent directory of the file path (parsed from :path).
:path:ext	*str* lower: True strip: True	The file extension of the file name (parsed from :path).
:path:base	*file:base*	The final component of the file path (parsed from :path).
:file	*file:bytes*	The file that was deleted.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thread*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 293 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:file:read

An instance of a host reading a file from a filesystem.

The base type for the form can be found at *it:exec:file:read*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The main process executing code that read the file.
:host	*it:host*	The host running the process that read the file. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that read the file. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the file was read.
:path	*file:path*	The path where the file was read.
:path:dir	*file:path*	The parent directory of the file path (parsed from :path).
:path:ext	*str* lower: True strip: True	The file extension of the file name (parsed from :path).
:path:base	*file:base*	The final component of the file path (parsed from :path).
:file	*file:bytes*	The file that was read.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thread*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 294 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:file:write

An instance of a host writing a file to a filesystem.

The base type for the form can be found at *it:exec:file:write*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The main process executing code that wrote to / modified the existing file.
:host	*it:host*	The host running the process that wrote to the file. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that wrote to the file. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the file was written to/modified.
:path	*file:path*	The path where the file was written to/modified.
:path:dir	*file:path*	The parent directory of the file path (parsed from :path).
:path:ext	*str* lower: True strip: True	The file extension of the file name (parsed from :path).
:path:base	*file:base*	The final component of the file path (parsed from :path).
:file	*file:bytes*	The file that was modified.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thread*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 295 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:loadlib

A library load event in a process.

The base type for the form can be found at *it:exec:loadlib*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The process where the library was loaded.
:va	*int*	The base memory address where the library was loaded in the process.
:loaded	*time*	The time the library was loaded.
:unloaded	*time*	The time the library was unloaded.
:path	*file:path*	The path that the library was loaded from.
:file	*file:bytes*	The library file that was loaded.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:exe	*file:bytes*	The executable file which caused the activity.
:thread	*it:exec:thread*	The host thread which caused the activity.
:host	*it:host*	The host on which the activity occurred.
:time	*time*	The time that the activity started.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.

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Table 296 – continued from previous page

source	verb	target	doc
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:mmap

A memory mapped segment located in a process.

The base type for the form can be found at *it:exec:mmap*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The process where the memory was mapped.
:va	*int*	The base memory address where the map was created in the process.
:size	*int*	The size of the memory map in bytes.
:perms:read	*bool*	True if the mmap is mapped with read permissions.
:perms:write	*bool*	True if the mmap is mapped with write permissions.
:perms:execu	*bool*	True if the mmap is mapped with execute permissions.
:created	*time*	The time the memory map was created.
:deleted	*time*	The time the memory map was deleted.
:path	*file:path*	The file path if the mmap is a mapped view of a file.
:hash:sha256	*hash:sha256*	A SHA256 hash of the memory map. Bytes may optionally be present in the axon.
:sandbox:fil	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:exe	*file:bytes*	The executable file which caused the activity.
:thread	*it:exec:threa*	The host thread which caused the activity.
:host	*it:host*	The host on which the activity occurred.
:time	*time*	The time that the activity started.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:mutex

A mutex created by a process at runtime.

The base type for the form can be found at *it:exec:mutex*.

Properties:

name	type	doc
:proc	*it:exec:pr*	The main process executing code that created the mutex.
:host	*it:host*	The host running the process that created the mutex. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that created the mutex. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the mutex was created.
:name	*it:dev:mu*	The mutex string.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:th*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromi
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target no

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source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:pipe

A named pipe created by a process at runtime.

The base type for the form can be found at *it:exec:pipe*.

Properties:

name	type	doc
:proc	*it:exec:pr*	The main process executing code that created the named pipe.
:host	*it:host*	The host running the process that created the named pipe. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that created the named pipe. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the named pipe was created.
:name	*it:dev:pip*	The named pipe string.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:th*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 299 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:proc

A process executing on a host. May be an actual (e.g., endpoint) or virtual (e.g., malware sandbox) host.

The base type for the form can be found at *it:exec:proc*.

Properties:

name	type	doc	opts
:host	*it:host*	The host that executed the process. May be an actual or a virtual / notional host.	
:exe	*file:bytes*	The file considered the "main" executable for the process. For example, rundll32.exe may be considered the "main" executable for DLLs loaded by that program.	
:cmd	*it:cmd*	The command string used to launch the process, including any command line parameters.	Display: {'hint': 'text'}
:cmd:hi	*it:cmd:his*	The command history entry which caused this process to be run.	
:pid	*int*	The process ID.	
:time	*time*	The start time for the process.	
:name	*str*	The display name specified by the process.	
:exited	*time*	The time the process exited.	
:exitco	*int*	The exit code for the process.	
:user	*inet:user*	The user name of the process owner.	Deprecated: True
:accoun	*it:accoun*	The account of the process owner.	
:path	*file:path*	The path to the executable of the process.	
:path:b	*file:base*	The file basename of the executable of the process.	
:src:ex	*file:path*	Deprecated. Create :src:proc and set :path.	Deprecated: True
:src:pr	*it:exec:pr*	The process which created the process.	
:killed	*it:exec:pr*	The process which killed this process.	
:sandbo	*file:bytes*	The initial sample given to a sandbox environment to analyze.	
:window	*it:os:win*	The Microsoft Windows service responsible for starting the process.	
:proc	*it:exec:pr*	The host process which caused the activity.	
:thread	*it:exec:th*	The host thread which caused the activity.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:query

An instance of an executed query.

The base type for the form can be found at *it:exec:query*.

Properties:

name	type	doc
:text	*it:query*	The query string that was executed.
:opts	*data*	An opaque JSON object containing query parameters and options.
:api:url	*inet:url*	The URL of the API endpoint the query was sent to.
:language	*str* lower: True onespace: True	The name of the language that the query is expressed in.
:offset	*int*	The offset of the last record consumed from the query.
:synuser	*syn:user*	The synapse user who executed the query.
:service:platform	*inet:service:platform*	The service platform which was queried.
:service:instance	*inet:service:instance*	The service instance which was queried.
:service:account	*inet:service:account*	The service account which ran the query.
:exe	*file:bytes*	The executable file which caused the activity.
:proc	*it:exec:proc*	The host process which caused the activity.
:thread	*it:exec:thread*	The host thread which caused the activity.
:host	*it:host*	The host on which the activity occurred.
:time	*time*	The time that the activity started.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.
it:exec:que	-(found)>	*	The target node was returned as a result of running the query.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:reg:del

An instance of a host deleting a registry key.

The base type for the form can be found at *it:exec:reg:del*.

Properties:

name	type	doc
:proc	*it:exec:pı*	The main process executing code that deleted data from the registry.
:host	*it:host*	The host running the process that deleted data from the registry. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that deleted data from the registry. May or may not be the same :exe referenced in :proc, if present.
:time	*time*	The time the data from the registry was deleted.
:reg	*it:dev:reg*	The registry key or value that was deleted.
:sandbox	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:th*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:reg:get

An instance of a host getting a registry key.

The base type for the form can be found at *it:exec:reg:get*.

Properties:

name	type	doc
:proc	*it:exec:pr*	The main process executing code that read the registry.
:host	*it:host*	The host running the process that read the registry. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that read the registry. May or may not be the same :exe referenced in :proc, if present.
:time	*time*	The time the registry was read.
:reg	*it:dev:reg*	The registry key or value that was read.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thr*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 303 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:reg:set

An instance of a host creating or setting a registry key.

The base type for the form can be found at *it:exec:reg:set*.

Properties:

name	type	doc
:proc	*it:exec:pr*	The main process executing code that wrote to the registry.
:host	*it:host*	The host running the process that wrote to the registry. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that wrote to the registry. May or may not be the same :exe referenced in :proc, if present.
:time	*time*	The time the registry was written to.
:reg	*it:dev:reg*	The registry key or value that was written to.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:th*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:thread

A thread executing in a process.

The base type for the form can be found at *it:exec:thread*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The process which contains the thread.
:created	*time*	The time the thread was created.
:exited	*time*	The time the thread exited.
:exitcode	*int*	The exit code or return value for the thread.
:src:proc	*it:exec:proc*	An external process which created the thread.
:src:thread	*it:exec:thread*	The thread which created this thread.
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:exe	*file:bytes*	The executable file which caused the activity.
:thread	*it:exec:thread*	The host thread which caused the activity.
:host	*it:host*	The host on which the activity occurred.
:time	*time*	The time that the activity started.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 305 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:exec:url

An instance of a host requesting a URL using any protocol scheme.

The base type for the form can be found at *it:exec:url*.

Properties:

name	type	doc
:proc	*it:exec:proc*	The main process executing code that requested the URL.
:browser	*it:prod:soft*	The software version of the browser.
:host	*it:host*	The host running the process that requested the URL. Typically the same host referenced in :proc, if present.
:exe	*file:bytes*	The specific file containing code that requested the URL. May or may not be the same :exe specified in :proc, if present.
:time	*time*	The time the URL was requested.
:url	*inet:url*	The URL that was requested.
:page:pdf	*file:bytes*	The rendered DOM saved as a PDF file.
:page:htm	*file:bytes*	The rendered DOM saved as an HTML file.
:page:ima	*file:bytes*	The rendered DOM saved as an image.
:http:req	*inet:http:re*	The HTTP request made to retrieve the initial URL contents.
:client	*inet:client*	The address of the client during the URL retrieval.
:client:i	*inet:ipv4*	The IPv4 of the client during the URL retrieval.
:client:i	*inet:ipv6*	The IPv6 of the client during the URL retrieval.
:client:p	*inet:port*	The client port during the URL retrieval.
:sandbox:	*file:bytes*	The initial sample given to a sandbox environment to analyze.
:thread	*it:exec:thre*	The host thread which caused the activity.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:fs:file

A file on a host.

The base type for the form can be found at *it:fs:file*.

Properties:

name	type	doc
:host	*it:host*	The host containing the file.
:path	*file:path*	The path for the file.
:path:dir	*file:path*	The parent directory of the file path (parsed from :path).
:path:ext	*str* lower: True strip: True	The file extension of the file name (parsed from :path).
:path:base	*file:base*	The final component of the file path (parsed from :path).
:file	*file:bytes*	The file on the host.
:ctime	*time*	The file creation time.
:mtime	*time*	The file modification time.
:atime	*time*	The file access time.
:user	*inet:user*	The owner of the file.
:group	*inet:user*	The group owner of the file.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:group

A GUID that represents a group on a host or network.

The base type for the form can be found at *it:group*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the group.	
:desc	*str*	A brief description of the group.	
:host	*it:host*	The host where the group is registered.	
:domain	*it:domain*	The authentication domain where the group is registered.	
:groups	*array* type: *it:group* uniq: True sorted: True	Groups that are a member of this group.	
:posix:gid	*int*	The primary group ID of the account.	Example: 1001
:windows:sid	*it:os:windows:sid*	The Microsoft Windows Security Identifier of the group.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:host

A GUID that represents a host or system.

The base type for the form can be found at *it:host*.

Properties:

name	type	doc	opts
:name	*it:hostname*	The name of the host or system.	
:desc	*str*	A free-form description of the host.	
:domain	*it:domain*	The authentication domain that the host is a member of.	
:ipv4	*inet:ipv4*	The last known ipv4 address for the host.	
:latlong	*geo:latlong*	The last known location for the host.	
:place	*geo:place*	The place where the host resides.	
:loc	*loc*	The geo-political location string for the node.	
:os	*it:prod:softver*	The operating system of the host.	
:os:name	*it:prod:softname*	A software product name for the host operating system. Used for entity resolution.	
:hardware	*it:prod:hardware*	The hardware specification for this host.	
:manu	*str*	Please use :hardware::manufacturer:nar	Deprecated: True
:model	*str*	Please use :hardware::model.	Deprecated: True
:serial	*str*	The serial number of the host.	
:operator	*ps:contact*	The operator of the host.	
:org	*ou:org*	The org that operates the given host.	
:ext:id	*str*	An external identifier for the host.	
:keyboard:layout	*str* lower: True onespace: True	The primary keyboard layout configured on the host.	

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name	type	doc	opts
:keyboard:language	*lang:language*	The primary keyboard input language configured on the host.	
:image	*it:software:image*	The container image or OS image running on the host.	
:url	*inet:url*	The primary URL associated with the host.	
:status	*inet:service:object:statu*	The status of the host.	
:period	*ival*	The period when the host existed.	
:creator	*inet:service:account*	The service account which created the host.	
:remover	*inet:service:account*	The service account which removed or decommissioned the host.	
:app	*inet:service:app*	The app which contains the host.	
:id	*str* strip: True	A platform specific ID which identifies the host.	
:platform	*inet:service:platform*	The platform which defines the host.	
:instance	*inet:service:instance*	The platform instance which defines the host.	
:phys:mass	*mass*	The mass of the physical host.	
:phys:volume	*geo:dist*	The cubed volume of the physical host.	
:phys:length	*geo:dist*	The length of the physical host.	
:phys:width	*geo:dist*	The width of the physical host.	
:phys:height	*geo:dist*	The height of the physical host.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:host:tenancy

A time window where a host was a tenant run by another host.

The base type for the form can be found at *it:host:tenancy*.

Properties:

name	type	doc
:lessor	*it:host*	The host which provides runtime resources to the tenant host.
:tenant	*it:host*	The host which is run within the resources provided by the lessor.
:url	*inet:url*	The primary URL associated with the host tenancy.
:status	*inet:service:object:status*	The status of the host tenancy.
:period	*ival*	The period when the host tenancy existed.
:creator	*inet:service:account*	The service account which created the host tenancy.
:remover	*inet:service:account*	The service account which removed or decommissioned the host tenancy.
:app	*inet:service:app*	The app which contains the host tenancy.
:id	*str* strip: True	A platform specific ID which identifies the host tenancy.
:platform	*inet:service:platform*	The platform which defines the host tenancy.
:instance	*inet:service:instance*	The platform instance which defines the host tenancy.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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Table 311 – continued from previous page

source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:hostname

The name of a host or system.

The base type for the form can be found at *it:hostname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 312 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:hostsoft

A version of a software product which is present on a given host.

The base type for the form can be found at *it:hostsoft*.

Properties:

name	type	doc	opts
:host	*it:host*	Host with the software.	Read Only: True
:softver	*it:prod:softver*	Software on the host.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:hosturl

A url hosted on or served by a host or system.

The base type for the form can be found at *it:hosturl*.

Properties:

name	type	doc	opts
:host	*it:host*	Host serving a url.	Read Only: True
:url	*inet:url*	URL available on the host.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:log:event

A GUID representing an individual log event.

The base type for the form can be found at *it:log:event*.

Properties:

name	type	doc	opts
:mesg	*str*	The log message text.	
:type	*it:log:event:type:taxonc*	A taxonometric type for the log event.	Example: `windows.eventlog.securitylog`
:severity	*int* enums: `((10, 'debug'), (20, 'info'), (30, 'notice'), (40, 'warning'), (50, 'err'), (60, 'crit'), (70, 'alert'), (80, 'emerg'))`	A log level integer that increases with severity.	
:data	*data*	A raw JSON record of the log event.	
:ext:id	*str*	An external id that uniquely identifies this log entry.	
:product	*it:prod:softver*	The software which produced the log entry.	
:service:platform	*inet:service:platform*	The service platform which generated the log event.	
:service:instance	*inet:service:instance*	The service instance which generated the log event.	
:service:account	*inet:service:account*	The service account which generated the log event.	
:exe	*file:bytes*	The executable file which caused the activity.	
:proc	*it:exec:proc*	The host process which caused the activity.	
:thread	*it:exec:thread*	The host thread which caused the activity.	
:host	*it:host*	The host on which the activity occurred.	
:time	*time*	The time that the activity started.	
:sandbox:file	*file:bytes*	The initial sample given to a sandbox environment to analyze.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:log:event:type:taxonomy

A taxonomy of log event types.

The base type for the form can be found at *it:log:event:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:log:event:type:taxonc*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:logon

A GUID that represents an individual logon/logoff event.

The base type for the form can be found at *it:logon*.

Properties:

name	type	doc
:time	*time*	The time the logon occurred.
:success	*bool*	Set to false to indicate an unsuccessful logon attempt.
:logoff:time	*time*	The time the logon session ended.
:host	*it:host*	The host that the account logged in to.
:account	*it:account*	The account that logged in.
:creds	*auth:creds*	The credentials that were used for the logon.
:duration	*duration*	The duration of the logon session.
:client:host	*it:host*	The host where the logon originated.
:client:ipv4	*inet:ipv4*	The IPv4 where the logon originated.
:client:ipv6	*inet:ipv6*	The IPv6 where the logon originated.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:campaign

A MITRE ATT&CK Campaign ID.

The base type for the form can be found at *it:mitre:attack:campaign*.

An example of `it:mitre:attack:campaign`:

- `C0028`

Properties:

name	type	doc	opts
:name	*ou:campname*	The primary name for the ATT&CK campaign.	
:names	*array* type: *ou:campname* uniq: True sorted: True	An array of alternate names for the ATT&CK campaign.	
:desc	*str* strip: True	A description of the ATT&CK campaign.	Display: {'hint': 'text'}
:url	*inet:url*	The URL that documents the ATT&CK campaign.	
:groups	*array* type: *it:mitre:attack:group* uniq: True sorted: True split: ,	An array of ATT&CK group IDs attributed to the campaign.	
:software	*array* type: *it:mitre:attack:softw* uniq: True sorted: True split: ,	An array of ATT&CK software IDs used in the campaign.	
:techniques	*array* type: *it:mitre:attack:techn* uniq: True sorted: True split: ,	An array of ATT&CK technique IDs used in the campaign.	
:matrices	*array* type: *it:mitre:attack:matri* uniq: True sorted: True split: ,	The ATT&CK matrices which define the campaign.	
:references	*array*	An array of URLs that document the	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:data:component

A MITRE ATT&CK data component.

The base type for the form can be found at *it:mitre:attack:data:component*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the data component.	Read Only: True
:description	*str*	A description of the data component.	Display: {'hint': 'text'}
:datasource	*it:mitre:attack:datasou*	The datasource this data component belongs to.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:datasource

A MITRE ATT&CK Datasource ID.

The base type for the form can be found at *it:mitre:attack:datasource*.

An example of `it:mitre:attack:datasource`:

- `DS0026`

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the datasource.	
:description	*str*	A description of the datasource.	Display: {'hint': 'text'}
:references	*array* type: *inet:url* uniq: True sorted: True	An array of URLs that document the datasource.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:flow

A MITRE ATT&CK Flow diagram.

The base type for the form can be found at *it:mitre:attack:flow*.

Properties:

name	type	doc
:name	*str*	The name of the attack-flow diagram.
:data	*data* schema: {'$schema': 'https://json-schema.org/draft/2020-12/schema', '$id': 'https://center-for-threat-inform github.io/attack-flow/schema/attack-flow-schema-2.0.0.json', 'title': 'Attack Flow STIX 2.1 Extension', 'description': 'This schema is the normative definition of the STIX 2.1 extension `extension-definition--f 24172197f4`. It extends STIX with additional STIX Data Objects (SDOs) that model Attack Flow concepts.', 'type': 'object', 'unevaluatedProperties': False, 'allOf': ({'$ref': 'http://raw.githubusercontent.com/oasis-open/cti-stix2-json-schemas/stix2.1/schemas/common/core.json'},), 'properties': {'type': {'const': 'bundle'}, 'objects': {'type': 'array', 'items': {'$comment': 'Try each of the Attack Flow types in order, eventually falling through to the STIX common object definition.', 'if': {'type': 'object', 'properties': {'type': {'type': 'string', 'const': 'attack-flow'}}}, 'then': {'$ref': 'https://center-for-threat-inform github.io/attack-flow/schema/	The ATT&CK Flow diagram. Schema version 2.0.0 enforced.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:group

A MITRE ATT&CK Group ID.

The base type for the form can be found at *it:mitre:attack:group*.

An example of `it:mitre:attack:group`:

- `G0100`

  Properties:

name	type	doc	opts
:org	*ou:org*	Used to map an ATT&CK group to a synapse ou:org.	
:name	*ou:name*	The primary name for the ATT&CK group.	
:names	*array* type: *ou:name* uniq: True sorted: True	An array of alternate names for the ATT&CK group.	
:desc	*str*	A description of the ATT&CK group.	Display: {'hint': 'text'}
:isnow	*it:mitre:attack:group*	If deprecated, this field may contain the current value for the group.	
:url	*inet:url*	The URL that documents the ATT&CK group.	
:tag	*syn:tag*	Deprecated. Please use a risk:threat:tag.	Deprecated: True
:references	*array* type: *inet:url* uniq: True	An array of URLs that document the ATT&CK group.	
:techniques	*array* type: *it:mitre:attack:techn* uniq: True sorted: True split: ,	An array of ATT&CK technique IDs used by the group.	
:software	*array* type: *it:mitre:attack:softw* uniq: True sorted: True split: ,	An array of ATT&CK software IDs used by the group.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:mitigation

A MITRE ATT&CK Mitigation ID.

The base type for the form can be found at *it:mitre:attack:mitigation*.

An example of `it:mitre:attack:mitigation`:

- `M1036`

Properties:

name	type	doc	opts
`:name`	*str* lower: `True` onespace: `True`	The primary name for the ATT&CK mitigation.	
`:matrix`	*it:mitre:attack:matri*	The ATT&CK matrix which defines the mitigation.	
`:desc`	*str* strip: `True`	A description of the ATT&CK mitigation.	Display: `{'hint': 'text'}`
`:url`	*inet:url*	The URL that documents the ATT&CK mitigation.	
`:tag`	*syn:tag*	Deprecated. Please use risk:mitigation:tag.	Deprecated: `True`
`:references`	*array* type: *inet:url* uniq: `True`	An array of URLs that document the ATT&CK mitigation.	
`:addresses`	*array* type: *it:mitre:attack:techn* uniq: `True` sorted: `True` split: `,`	An array of ATT&CK technique IDs addressed by the mitigation.	

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:software

A MITRE ATT&CK Software ID.

The base type for the form can be found at *it:mitre:attack:software*.

An example of `it:mitre:attack:software`:

- `S0154`

  Properties:

name	type	doc	opts
:software	*it:prod:soft*	Used to map an ATT&CK software to a synapse it:prod:soft.	
:name	*it:prod:softname*	The primary name for the ATT&CK software.	
:names	*array* type: *it:prod:softname* uniq: True sorted: True	Associated names for the ATT&CK software.	
:desc	*str* strip: True	A description of the ATT&CK software.	Display: {'hint': 'text'}
:isnow	*it:mitre:attack:softw*	If deprecated, this field may contain the current value for the software.	
:url	*inet:url*	The URL that documents the ATT&CK software.	
:tag	*syn:tag*	Deprecated. Please use risk:tool:software:tag	Deprecated: True
:references	*array* type: *inet:url* uniq: True	An array of URLs that document the ATT&CK software.	
:techniques	*array* type: *it:mitre:attack:techn* uniq: True sorted: True split: ,	An array of techniques used by the software.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:tactic

A MITRE ATT&CK Tactic ID.

The base type for the form can be found at *it:mitre:attack:tactic*.

An example of `it:mitre:attack:tactic`:

- `TA0040`

Properties:

name	type	doc	opts
`:name`	*str* strip: `True`	The primary name for the ATT&CK tactic.	
`:matrix`	*it:mitre:attack:matri*	The ATT&CK matrix which defines the tactic.	
`:desc`	*str*	A description of the ATT&CK tactic.	Display: `{'hint': 'text'}`
`:url`	*inet:url*	The URL that documents the ATT&CK tactic.	
`:tag`	*syn:tag*	Deprecated.	Deprecated: `True`
`:references`	*array* type: *inet:url* uniq: `True`	An array of URLs that document the ATT&CK tactic.	

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.
`ou:campaign`	`-(targets)>`	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:mitre:attack:technique

A MITRE ATT&CK Technique ID.

The base type for the form can be found at *it:mitre:attack:technique*.

An example of `it:mitre:attack:technique`:

- `T1548`

  Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The primary name for the ATT&CK technique.	
:matrix	*it:mitre:attack:matri*	The ATT&CK matrix which defines the technique.	
:status	*it:mitre:attack:status*	The status of this ATT&CK technique.	
:isnow	*it:mitre:attack:techn*	If deprecated, this field may contain the current value for the technique.	
:desc	*str* strip: True	A description of the ATT&CK technique.	Display: {'hint': 'text'}
:url	*inet:url*	The URL that documents the ATT&CK technique.	
:tag	*syn:tag*	Deprecated. Please use ou:technique:tag.	Deprecated: True
:references	*array* type: *inet:url* uniq: True	An array of URLs that document the ATT&CK technique.	
:parent	*it:mitre:attack:techn*	The parent ATT&CK technique on this sub-technique.	
:tactics	*array* type: *it:mitre:attack:tactic* uniq: True sorted: True split: ,	An array of ATT&CK tactics that include this technique.	
:data:components	*array* type: *it:mitre:attack:data:* uniq: True sorted: True	An array of MITRE ATT&CK data components that detect the ATT&CK technique.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:network

A GUID that represents a logical network.

The base type for the form can be found at *it:network*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the network.
:desc	*str*	A brief description of the network.
:type	*it:network:type:taxonomy*	The type of network.
:org	*ou:org*	The org that owns/operates the network.
:net4	*inet:net4*	The optional contiguous IPv4 address range of this network.
:net6	*inet:net6*	The optional contiguous IPv6 address range of this network.
:dns:resolvers	*array* type: *inet:server* typeopts: {'defport': 53, 'defproto': 'udp'} sorted: True uniq: True	An array of DNS servers configured to resolve requests for hosts on the network.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 327 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:network:type:taxonomy

A taxonomy of network types.

The base type for the form can be found at *it:network:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:network:type:taxonor*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 328 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:aaid

Deprecated. Please use it:adid.

The base type for the form can be found at *it:os:android:aaid*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 329 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:ibroadcast

The given software broadcasts the given Android intent.

The base type for the form can be found at *it:os:android:ibroadcast*.

Properties:

name	type	doc	opts
:app	*it:prod:softver*	The app software which broadcasts the android intent.	Read Only: True
:intent	*it:os:android:inten*	The android intent which is broadcast by the app.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 330 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:ilisten

The given software listens for an android intent.

The base type for the form can be found at *it:os:android:ilisten*.

Properties:

name	type	doc	opts
:app	*it:prod:softver*	The app software which listens for the android intent.	Read Only: True
:intent	*it:os:android:inten*	The android intent which is listened for by the app.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:intent

An android intent string.

The base type for the form can be found at *it:os:android:intent*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:perm

An android permission string.

The base type for the form can be found at *it:os:android:perm*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:android:reqperm

The given software requests the android permission.

The base type for the form can be found at *it:os:android:reqperm*.

Properties:

name	type	doc	opts
:app	*it:prod:softver*	The android app which requests the permission.	Read Only: True
:perm	*it:os:android:perm*	The android permission requested by the app.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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Table 334 – continued from previous page

source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:ios:idfa

Deprecated. Please use it:adid.

The base type for the form can be found at *it:os:ios:idfa*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 335 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:os:windows:service

A Microsoft Windows service configuration on a host.

The base type for the form can be found at *it:os:windows:service*.

Properties:

name	type	doc
:host	*it:host*	The host that the service was configured on.
:name	*str* lower: True onespace: True	The name of the service from the registry key within Services.
:type	*int* min: 0	The type of service from the Type registry key.
:start	*int* min: 0	The start configuration of the service from the Start registry key.
:errorcontrol	*int* min: 0	The service error handling behavior from the ErrorControl registry key.
:displayname	*str* lower: True onespace: True	The friendly name of the service from the DisplayName registry key.
:description	*str*	The description of the service from the Description registry key.
:imagepath	*file:path*	The path to the service binary from the ImagePath registry key.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:component

A specific instance of an it:prod:hardware most often as part of an it:host.

The base type for the form can be found at *it:prod:component*.

Properties:

name	type	doc
:hardware	*it:prod:hardware*	The hardware specification of this component.
:serial	*str*	The serial number of this component.
:host	*it:host*	The it:host which has this component installed.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc

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Table 337 – continued from previous page

source	verb	target	doc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:hardware

A specification for a piece of IT hardware.

The base type for the form can be found at *it:prod:hardware*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The display name for this hardware specification.	
:type	*it:prod:hardwaretype*	The type of hardware.	
:desc	*str*	A brief description of the hardware.	Display: {'hint': 'text'}
:cpe	*it:sec:cpe*	The NIST CPE 2.3 string specifying this hardware.	
:manufacturer	*ou:org*	The organization that manufactures this hardware.	
:manufacturer:name	*ou:name*	The name of the organization that manufactures this hardware.	
:make	*ou:name*	Deprecated. Please use :manufacturer:name.	Deprecated: True
:model	*str* lower: True onespace: True	The model name or number for this hardware specification.	
:version	*str* lower: True onespace: True	Version string associated with this hardware specification.	
:released	*time*	The initial release date for this hardware.	
:parts	*array* type: *it:prod:hardware* uniq: True sorted: True	An array of it:prod:hardware parts included in this hardware specification.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the t
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the
it:exec:query	-(found)>	*	The target node was returned as a result of running
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the targ
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target n
ps:contact	-(has)>	*	The contact is or was in possession of the target no
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target no
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the atta
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node
risk:mitigation	-(uses)>	it:prod:hardware	The mitigation uses the hardware.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the ta
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the targe
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was
sci:observation	-(has)>	*	The observations are summarized from the target n

it:prod:hardwaretype

An IT hardware type taxonomy.

The base type for the form can be found at *it:prod:hardwaretype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:prod:hardwaretype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:soft

A software product.

The base type for the form can be found at *it:prod:soft*.

Properties:

name	type	doc	opts
:id	*str* strip: True	An ID for the software.	
:name	*it:prod:softname*	Name of the software.	alts: ('names',)
:type	*it:prod:soft:taxonomy*	The software type.	
:names	*array* type: *it:prod:softname* uniq: True sorted: True	Observed/variant names for this software.	
:desc	*str*	A description of the software.	Display: {'hint': 'text'}
:desc:short	*str* lower: True	A short description of the software.	
:cpe	*it:sec:cpe*	The NIST CPE 2.3 string specifying this software.	
:author	*ps:contact*	The contact information of the org or person who authored the software.	
:author:org	*ou:org*	Deprecated. Please use :author to link to a ps:contact.	Deprecated: True
:author:acct	*inet:web:acct*	Deprecated. Please use :author to link to a ps:contact.	Deprecated: True
:author:email	*inet:email*	Deprecated. Please use :author to link to a ps:contact.	Deprecated: True
:author:person	*ps:person*	Deprecated. Please use :author to link to a ps:contact.	Deprecated: True
:url	*inet:url*	URL relevant for the software.	
:isos	*bool*	Set to True if the software is an operating system.	
:islib	*bool*	Set to True if the software is a library.	
:techniques	*array* type: *ou:technique* sorted: True uniq: True	Deprecated for scalability. Please use -(uses)> ou:technique.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
it:prod:sof	-(uses)>	ou:technique	The software uses the technique.
it:prod:sof	-(uses)>	risk:vuln	The software uses the vulnerability.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:soft:taxonomy

A software type taxonomy.

The base type for the form can be found at *it:prod:soft:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:prod:soft:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softfile

A file is distributed by a specific software version.

The base type for the form can be found at *it:prod:softfile*.

Properties:

name	type	doc	opts
:soft	*it:prod:softver*	The software which distributes the file.	Read Only: True
:file	*file:bytes*	The file distributed by the software.	Read Only: True
:path	*file:path*	The default installation path of the file.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softid

An identifier issued to a given host by a specific software application.

The base type for the form can be found at *it:prod:softid*.

Properties:

name	type	doc
:id	*str*	The ID issued by the software to the host.
:host	*it:host*	The host which was issued the ID by the software.
:soft	*it:prod:softver*	The software which issued the ID to the host.
:soft:name	*it:prod:softname*	The name of the software which issued the ID to the host.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softlib

A software version contains a library software version.

The base type for the form can be found at *it:prod:softlib*.

Properties:

name	type	doc	opts
:soft	*it:prod:softver*	The software version that contains the library.	Read Only: True
:lib	*it:prod:softver*	The library software version.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softname

A software product name.

The base type for the form can be found at *it:prod:softname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.

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Table 345 – continued from previous page

source	verb	target	doc
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softos

The software version is known to be compatible with the given os software version.

The base type for the form can be found at *it:prod:softos*.

Properties:

name	type	doc	opts
:soft	*it:prod:softver*	The software which can run on the operating system.	Read Only: True
:os	*it:prod:softver*	The operating system which the software can run on.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 346 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softreg

A registry entry is created by a specific software version.

The base type for the form can be found at *it:prod:softreg*.

Properties:

name	type	doc	opts
:softver	*it:prod:softver*	The software which creates the registry entry.	Read Only: True
:regval	*it:dev:regval*	The registry entry created by the software.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 347 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:prod:softver

A specific version of a software product.

The base type for the form can be found at *it:prod:softver*.

Properties:

name	type	doc	opts
:software	*it:prod:soft*	Software associated with this version instance.	
:software:name	*str* lower: True strip: True	Deprecated. Please use it:prod:softver:name.	Deprecated: True
:name	*it:prod:softname*	Name of the software version.	alts: ('names',)
:names	*array* type: *it:prod:softname* uniq: True sorted: True	Observed/variant names for this software version.	
:desc	*str*	A description of the software.	Display: {'hint': 'text'}
:cpe	*it:sec:cpe*	The NIST CPE 2.3 string specifying this software version.	
:cves	*array* type: *it:sec:cve* uniq: True sorted: True	A list of CVEs that apply to this software version.	
:vers	*it:dev:str*	Version string associated with this version instance.	
:vers:norm	*str* lower: True	Normalized version of the version string.	
:arch	*it:dev:str*	Software architecture.	
:released	*time*	Timestamp for when this version of the software was released.	
:semver	*it:semver*	System normalized semantic version number.	
:semver:major	*int*	Deprecated. Please use semver range queries.	Deprecated: True
:semver:minor	*int*	Deprecated. Please use semver range queries.	Deprecated: True
:semver:patch	*int*	Deprecated. Please use semver range queries.	Deprecated: True
:semver:pre	*str*	Deprecated.	Deprecated: True
:semver:build	*str*	Deprecated.	Deprecated: True
:url	*inet:url*	URL where a spe-	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.
it:prod:softv	-(uses)>	math:algorith	The software uses the algorithm.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the ta
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the
it:exec:query	-(found)>	*	The target node was returned as a result of running
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the targe
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target no
ps:contact	-(has)>	*	The contact is or was in possession of the target nod
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target nod
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attac
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of t
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:mitigation	-(uses)>	it:prod:softver	The mitigation uses the software version.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the tar
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was r
sci:observation	-(has)>	*	The observations are summarized from the target no

it:query

A unique query string.

The base type for the form can be found at *it:query*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.

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Table 349 – continued from previous page

source	verb	target	doc
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:reveng:filefunc

An instance of a function in an executable.

The base type for the form can be found at *it:reveng:filefunc*.

Properties:

name	type	doc	opts
:function	*it:reveng:function*	The guid matching the function.	Read Only: True
:file	*file:bytes*	The file that contains the function.	Read Only: True
:va	*int*	The virtual address of the first codeblock of the function.	
:rank	*int*	The function rank score used to evaluate if it exhibits interesting behavior.	
:complexity	*int*	The complexity of the function.	
:funccalls	*array* type: *it:reveng:filefunc* uniq: True sorted: True	Other function calls within the scope of the function.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.

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Table 350 – continued from previous page

source	verb	target	doc
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:reveng:funcstr

A reference to a string inside a function.

The base type for the form can be found at *it:reveng:funcstr*.

Properties:

name	type	doc	opts
:function	*it:reveng:function*	The guid matching the function.	Read Only: True
:string	*str*	The string that the function references.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:reveng:function

A function inside an executable.

The base type for the form can be found at *it:reveng:function*.

Properties:

name	type	doc
:name	*str*	The name of the function.
:description	*str*	Notes concerning the function.
:impcalls	*array* type: *it:reveng:impfunc* uniq: True sorted: True	Calls to imported library functions within the scope of the function.
:strings	*array* type: *it:dev:str* uniq: True	An array of strings referenced within the function.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 352 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:reveng:impfunc

A function from an imported library.

The base type for the form can be found at *it:reveng:impfunc*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:screenshot

A screenshot of a host.

The base type for the form can be found at *it:screenshot*.

Properties:

name	type	doc	opts
:image	*file:bytes*	The image file.	
:desc	*str*	A brief description of the screenshot.	Display: {'hint': 'text'}
:exe	*file:bytes*	The executable file which caused the activity.	
:proc	*it:exec:proc*	The host process which caused the activity.	
:thread	*it:exec:thre*	The host thread which caused the activity.	
:host	*it:host*	The host on which the activity occurred.	
:time	*time*	The time that the activity started.	
:sandbox:f	*file:bytes*	The initial sample given to a sandbox environment to analyze.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:c2:config

An extracted C2 config from an executable.

The base type for the form can be found at *it:sec:c2:config*.

Properties:

name	type	doc
:family	*it:prod:softname*	The name of the software family which uses the config.
:file	*file:bytes*	The file that the C2 config was extracted from.
:decoys	*array* type: *inet:url*	An array of URLs used as decoy connections to obfuscate the C2 servers.
:servers	*array* type: *inet:url*	An array of connection URLs built from host/port/passwd combinations.
:proxies	*array* type: *inet:url*	An array of proxy URLs used to communicate with the C2 server.
:listens	*array* type: *inet:url*	An array of listen URLs that the software should bind.
:dns:resolvers	*array* type: *inet:server*	An array of inet:servers to use when resolving DNS names.
:mutex	*it:dev:mutex*	The mutex that the software uses to prevent multiple-installations.
:campaigncode	*it:dev:str*	The operator selected string used to identify the campaign or group of targets.
:crypto:key	*crypto:key*	Static key material used to encrypt C2 communications.
:connect:delay	*duration*	The time delay from first execution to connecting to the C2 server.
:connect:interval	*duration*	The configured duration to sleep between connections to the C2 server.
:raw	*data*	A JSON blob containing the raw config extracted from the binary.
:http:headers	*array* type: *inet:http:header*	An array of HTTP headers that the sample should transmit to the C2 server.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:cpe

A NIST CPE 2.3 Formatted String.

The base type for the form can be found at *it:sec:cpe*.

Properties:

name	type	doc	opts
:v2_2	*it:sec:cpe:v2_2*	The CPE 2.2 string which is equivalent to the primary property.	
:part	*str* lower: True strip: True	The "part" field from the CPE 2.3 string.	Read Only: True
:vendor	*ou:name*	The "vendor" field from the CPE 2.3 string.	Read Only: True
:product	*str* lower: True strip: True	The "product" field from the CPE 2.3 string.	Read Only: True
:version	*str* lower: True strip: True	The "version" field from the CPE 2.3 string.	Read Only: True
:update	*str* lower: True strip: True	The "update" field from the CPE 2.3 string.	Read Only: True
:edition	*str* lower: True strip: True	The "edition" field from the CPE 2.3 string.	Read Only: True
:language	*str* lower: True strip: True	The "language" field from the CPE 2.3 string.	Read Only: True
:sw_edition	*str* lower: True strip: True	The "sw_edition" field from the CPE 2.3 string.	Read Only: True
:target_sw	*str* lower: True strip: True	The "target_sw" field from the CPE 2.3 string.	Read Only: True
:target_hw	*str* lower: True strip: True	The "target_hw" field from the CPE 2.3 string.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:cve

A vulnerability as designated by a Common Vulnerabilities and Exposures (CVE) number.

The base type for the form can be found at *it:sec:cve*.

An example of `it:sec:cve`:

- `cve-2012-0158`

  Properties:

name	type	doc	opts
:desc	*str*	Deprecated. Please use risk:vuln:cve:desc.	Deprecated: True
:url	*inet:url*	Deprecated. Please use risk:vuln:cve:url.	Deprecated: True
:references	*array* type: *inet:url* uniq: True sorted: True	Deprecated. Please use risk:vuln:cve:referen	Deprecated: True
:nist:nvd:source	*ou:name*	The name of the organization which reported the vulnerability to NIST.	
:nist:nvd:publis	*time*	The date the vulnerability was first published in the NVD.	
:nist:nvd:modifi	*time* ismax: True	The date the vulnerability was last modified in the NVD.	
:cisa:kev:name	*str*	The name of the vulnerability according to the CISA KEV database.	
:cisa:kev:desc	*str*	The description of the vulnerability according to the CISA KEV database.	
:cisa:kev:action	*str*	The action to mitigate the vulnerability according to the CISA KEV database.	
:cisa:kev:vendor	*ou:name*	The vendor name listed in the CISA KEV database.	
:cisa:kev:produc	*it:prod:softname*	The product name listed in the CISA KEV database.	
:cisa:kev:added	*time*	The date the vulnerability was added to the CISA KEV database.	
:cisa:kev:duedat	*time*	The date the action is due according to the CISA KEV database.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:cwe

NIST NVD Common Weaknesses Enumeration Specification.

The base type for the form can be found at *it:sec:cwe*.

An example of `it:sec:cwe`:

- `CWE-120`

Properties:

name	type	doc	opts
`:name`	*str*	The CWE description field.	Example: `Buffer Copy without Checking Size of Input (Classic Buffer Overflow)`
`:desc`	*str*	The CWE description field.	Display: `{'hint': 'text'}`
`:url`	*inet:url*	A URL linking this CWE to a full description.	
`:parents`	*array* type: *it:sec:cwe* uniq: `True` sorted: `True` split: `,`	An array of ChildOf CWE Relationships.	

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)>`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.

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source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:metrics

A node used to track metrics of an organization's infosec program.

The base type for the form can be found at *it:sec:metrics*.

Properties:

name	type	doc
:org	*ou:org*	The organization whose security program is being measured.
:org:name	*ou:nan*	The organization name. Used for entity resolution.
:org:fqdn	*inet:fqd*	The organization FQDN. Used for entity resolution.
:period	*ival*	The time period used to compute the metrics.
:alerts:meantime:tri	*dura-tion*	The mean time to triage alerts generated within the time period.
:alerts:count	*int*	The total number of alerts generated within the time period.
:alerts:falsepos	*int*	The number of alerts generated within the time period that were determined to be false positives.
:assets:hosts	*int*	The total number of hosts within scope for the information security program.
:assets:users	*int*	The total number of users within scope for the information security program.
:assets:vulns:count	*int*	The number of asset vulnerabilities being tracked at the end of the time period.
:assets:vulns:preexi	*int*	The number of asset vulnerabilities being tracked at the beginning of the time period.
:assets:vulns:discov	*int*	The number of asset vulnerabilities discovered during the time period.
:assets:vulns:mitiga	*int*	The number of asset vulnerabilities mitigated during the time period.
:assets:vulns:meantii	*dura-tion*	The mean time to mitigate for vulnerable assets mitigated during the time period.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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Table 359 – continued from previous page

source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:stix:bundle

A STIX bundle.

The base type for the form can be found at *it:sec:stix:bundle*.

Properties:

name	type	doc
:id	*str*	The id field from the STIX bundle.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 360 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:stix:indicator

A STIX indicator pattern.

The base type for the form can be found at *it:sec:stix:indicator*.

Properties:

name	type	doc
:id	*str*	The STIX id field from the indicator pattern.
:name	*str*	The name of the STIX indicator pattern.
:confidence	*int* min: 0 max: 100	The confidence field from the STIX indicator.
:revoked	*bool*	The revoked field from the STIX indicator.
:description	*str*	The description field from the STIX indicator.
:pattern	*str*	The STIX indicator pattern text.
:pattern_type	*str* strip: True lower: True enums: stix,pcre,sigma,snort,suricata,yara	The STIX indicator pattern type.
:created	*time*	The time that the indicator pattern was first created.
:updated	*time*	The time that the indicator pattern was last modified.
:labels	*array* type: *str* uniq: True sorted: True	The label strings embedded in the STIX indicator pattern.
:valid_from	*time*	The valid_from field from the STIX indicator.
:valid_until	*time*	The valid_until field from the STIX indicator.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:vuln:scan

An instance of running a vulnerability scan.

The base type for the form can be found at *it:sec:vuln:scan*.

Properties:

name	type	doc	opts
:time	*time*	The time that the scan was started.	
:desc	*str*	Description of the scan and scope.	Display: {'hint': 'text'}
:ext:id	*str*	An externally generated ID for the scan.	
:ext:url	*inet:url*	An external URL which documents the scan.	
:software	*it:prod:softver*	The scanning software used.	
:software:na	*it:prod:softna*	The name of the scanner software.	
:operator	*ps:contact*	Contact information for the scan operator.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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Table 362 – continued from previous page

source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:sec:vuln:scan:result

A vulnerability scan result for an asset.

The base type for the form can be found at *it:sec:vuln:scan:result*.

Properties:

name	type	doc
:scan	*it:sec:vuln:sc*	The scan that discovered the vulnerability in the asset.
:vuln	*risk:vuln*	The vulnerability detected in the asset.
:asset	*ndef*	The node which is vulnerable.
:desc	*str*	A description of the vulnerability and how it was detected in the asset.
:time	*time*	The time that the scan result was produced.
:ext:id	*str*	An externally generated ID for the scan result.
:ext:url	*inet:url*	An external URL which documents the scan result.
:mitigatic	*risk:mitigatio*	The mitigation used to address this asset vulnerability.
:mitigatec	*time*	The time that the vulnerability in the asset was mitigated.
:priority	*meta:priority*	The priority of mitigating the vulnerability.
:severity	*meta:severity*	The severity of the vulnerability in the asset. Use “none” for no vulnerability discovered.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

continues on next pag

Table 363 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:software:image

The base image used to create a container or OS.

The base type for the form can be found at *it:software:image*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the image.
:type	*it:software:image:type:taxonom*	The type of software image.
:published	*time*	The time the image was published.
:publisher	*ps:contact*	The contact information of the org or person who published the image.
:parents	*array* type: *it:software:image*	An array of parent images in precedence order.
:url	*inet:url*	The primary URL associated with the software image.
:status	*inet:service:object:status*	The status of the software image.
:period	*ival*	The period when the software image existed.
:creator	*inet:service:account*	The service account which created the software image.
:remover	*inet:service:account*	The service account which removed or decommissioned the software image.
:app	*inet:service:app*	The app which contains the software image.
:id	*str* strip: True	A platform specific ID which identifies the software image.
:platform	*inet:service:platform*	The platform which defines the software image.
:instance	*inet:service:instance*	The platform instance which defines the software image.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:storage:mount

A storage volume that has been attached to an image.

The base type for the form can be found at *it:storage:mount*.

Properties:

name	type	doc
:host	*it:host*	The host that has mounted the volume.
:volume	*it:storage:volume*	The volume that the host has mounted.
:path	*file:path*	The path where the volume is mounted in the host filesystem.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:storage:volume

A physical or logical storage volume that can be attached to a physical/virtual machine or container.

The base type for the form can be found at *it:storage:volume*.

Properties:

name	type	doc
:id	*str* strip: True	The unique volume ID.
:name	*str* lower: True onespace: True	The name of the volume.
:type	*it:storage:volume:type:taxonom*	The type of storage volume.
:size	*int* min: 0	The size of the volume in bytes.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 366 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

it:storage:volume:type:taxonomy

A taxonomy of storage volume types.

The base type for the form can be found at *it:storage:volume:type:taxonomy*.

An example of `it:storage:volume:type:taxonomy`:

- `network.smb`

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*it:storage:volume:typ*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:idiom

Deprecated. Please use lang:translation.

The base type for the form can be found at *lang:idiom*.

Properties:

name	type	doc	opts
:url	*inet:url*	Authoritative URL for the idiom.	
:desc:en	*str*	English description.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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Table 368 – continued from previous page

source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:language

A specific written or spoken language.

The base type for the form can be found at *lang:language*.

Properties:

name	type	doc
:code	*lang:code*	The language code for this language.
:name	*lang:name*	The primary name of the language.
:names	*array* type: *lang:name* sorted: True uniq: True	An array of alternative names for the language.
:skill	*ps:skill*	The skill used to annotate proficiency in the language.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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Table 369 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:name

A name used to refer to a language.

The base type for the form can be found at *lang:name*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 370 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:phrase

A small group of words which stand together as a concept.

The base type for the form can be found at *lang:phrase*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 371 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:trans

Deprecated. Please use lang:translation.

The base type for the form can be found at *lang:trans*.

Properties:

name	type	doc	opts
:text:en	*str*	English translation.	Display: {'hint': 'text'}
:desc:en	*str*	English description.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

lang:translation

A translation of text from one language to another.

The base type for the form can be found at *lang:translation*.

Properties:

name	type	doc	opts
:input	*str*	The input text.	Example: hola
:input:lang	*lang:code*	The input language code.	
:output	*str*	The output text.	Example: hi
:output:lan	*lang:code*	The output language code.	
:desc	*str*	A description of the meaning of the output.	Example: A standard greeting
:engine	*it:prod:softve*	The translation engine version used.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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Table 373 – continued from previous page

source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

mat:item

A GUID assigned to a material object.

The base type for the form can be found at *mat:item*.

Properties:

name	type	doc	opts
:name	*str* lower: True	The name of the material item.	
:type	*mat:type*	The taxonomy type of the item.	
:spec	*mat:spec*	The specification which defines this item.	
:latlong	*geo:latlong*	Deprecated. Please use :place:latlong.	Deprecated: True
:loc	*loc*	Deprecated. Please use :place:loc.	Deprecated: True
:phys:mass	*mass*	The mass of the item.	
:phys:volume	*geo:dist*	The cubed volume of the item.	
:phys:length	*geo:dist*	The length of the item.	
:phys:width	*geo:dist*	The width of the item.	
:phys:height	*geo:dist*	The height of the item.	
:place	*geo:place*	The place where the item was located.	
:place:loc	*loc*	The geopolitical location of the item.	
:place:name	*geo:name*	The name of the place where the item was located.	
:place:address	*geo:address*	The postal address of the place where the item was located.	
:place:latlong	*geo:latlong*	The latlong where the item was located.	
:place:latlong:acc	*geo:dist*	The accuracy of the latlong where the item was located.	
:place:country	*pol:country*	The country where the item was located.	
:place:country:cod	*pol:iso2*	The country code where the item was located.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

mat:itemimage

The base type for compound node fields.

The base type for the form can be found at *mat:itemimage*.

Properties:

name	type	doc	opts
:item	*mat:item*	The item contained within the image file.	Read Only: True
:file	*file:bytes*	The file containing an image of the item.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

mat:spec

A GUID assigned to a material specification.

The base type for the form can be found at *mat:spec*.

Properties:

name	type	doc
:name	*str* lower: True	The name of the material specification.
:type	*mat:type*	The taxonomy type for the specification.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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Table 376 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

mat:specimage

The base type for compound node fields.

The base type for the form can be found at *mat:specimage*.

Properties:

name	type	doc	opts
:spec	*mat:spec*	The spec contained within the image file.	Read Only: True
:file	*file:bytes*	The file containing an image of the spec.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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Table 377 – continued from previous page

source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

math:algorithm

A mathematical algorithm.

The base type for the form can be found at *math:algorithm*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the algorithm.	
:type	*math:algorithm:type:ta*	The type of algorithm.	
:desc	*str*	A description of the algorithm.	Display: {'hint': 'text'}
:created	*time*	The time that the algorithm was authored.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
math:algorit	-(generates)	*	The target node was generated by the algorithm.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
file:bytes	-(uses)>	math:algorithm	The file uses the algorithm.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the targ
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the ta
it:exec:query	-(found)>	*	The target node was returned as a result of running th
it:prod:softver	-(uses)>	math:algorithm	The software uses the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the ta
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target nod
ps:contact	-(has)>	*	The contact is or was in possession of the target node
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to t
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the targ
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	math:algorithm	The tool uses the algorithm.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target n
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was ru
sci:observation	-(has)>	*	The observations are summarized from the target nod

math:algorithm:type:taxonomy

A hierarchical taxonomy of algorithm types.

The base type for the form can be found at *math:algorithm:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*math:algorithm:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

media:news

A GUID for a news article or report.

The base type for the form can be found at *media:news*.

Properties:

name	type	doc	opts
:url	*inet:url*	The (optional) URL where the news was published.	Example: http://cnn.com/news/mars-lander.html
:url:fqdn	*inet:fqdn*	The FQDN within the news URL.	Example: cnn.com
:type	*media:news:taxonomy*	A taxonomy for the type of reporting or news.	
:file	*file:bytes*	The (optional) file blob containing or published as the news.	
:title	*str* lower: True	Title/Headline for the news.	Example: mars lander reaches mars Display: {'hint': 'text'}
:summary	*str*	A brief summary of the news item.	Example: lorum ipsum Display: {'hint': 'text'}
:publisher	*ou:org*	The organization which published the news.	
:publisher:name	*ou:name*	The name of the publishing org used to publish the news.	
:published	*time*	The date the news item was published.	Example: 20161201180433
:updated	*time* ismax: True	The last time the news item was updated.	Example: 20161201180433
:org	*ou:alias*	Deprecated. Please use :publisher:name.	Deprecated: True
:author	*ps:name*	Deprecated. Please use :authors array of ps:contact nodes.	Deprecated: True
:authors	*array* type: *ps:contact* split: , uniq: True sorted: True	An array of authors of the news item.	
:rss:feed	*inet:url*	The RSS feed that published the news.	
:ext:id	*str*	An external identifier specified by the publisher.	
:topics		An array of relevant	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

media:news:taxonomy

A taxonomy of types or sources of news.

The base type for the form can be found at *media:news:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*media:news:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

media:topic

A topic string.

The base type for the form can be found at *media:topic*.

Properties:

name	type	doc
:desc	*str*	A brief description of the topic.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:aggregate

A node which represents an aggregate count of a specific type.

The base type for the form can be found at *meta:aggregate*.

Properties:

name	type	doc	opts
:type	*meta:aggregate:type:tax*	The type of items being counted in aggregate.	Example: casualties.civilian
:time	*time*	The time that the count was computed.	
:count	*int*	The number of items counted in aggregate.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:aggregate:type:taxonomy

A type of item being counted in aggregate.

The base type for the form can be found at *meta:aggregate:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:aggregate:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:event

An analytically relevant event in a curated timeline.

The base type for the form can be found at *meta:event*.

Properties:

name	type	doc	opts
:timelir	*meta:timeline*	The timeline containing the event.	
:title	*str*	A title for the event.	
:summary	*str*	A prose summary of the event.	Display: {'hint': 'text'}
:time	*time*	The time that the event occurred.	
:index	*int*	The index of this event in a timeline without exact times.	
:duratic	*duration*	The duration of the event.	
:type	*meta:event:taxon*	Type of event.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
meta:event	-(caused)>	risk:outage	The event caused the outage.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:event:taxonomy

A taxonomy of event types for meta:event nodes.

The base type for the form can be found at *meta:event:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:event:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:feed

A data feed provided by a specific source.

The base type for the form can be found at *meta:feed*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	A name for the feed.
:type	*meta:feed:type:taxonomy*	The type of data feed.
:source	*meta:source*	The meta:source which provides the feed.
:url	*inet:url*	The URL of the feed API endpoint.
:query	*str*	The query logic associated with generating the feed output.
:opts	*data*	An opaque JSON object containing feed parameters and options.
:period	*ival*	The time window over which results have been ingested.
:latest	*time*	The time of the last record consumed from the feed.
:offset	*int*	The offset of the last record consumed from the feed.
:cursor	*str* strip: True	A cursor used to track ingest offset within the feed.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
meta:feed	-(found)>	*	The meta:feed produced the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:note	-(about)>	*	The meta:note is about the target node.

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source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:feed:type:taxonomy

A data feed type taxonomy.

The base type for the form can be found at *meta:feed:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:feed:type:taxonon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:note

An analyst note about nodes linked with -(about)> edges.

The base type for the form can be found at *meta:note*.

Properties:

name	type	doc	opts
:type	*meta:note:type:ta*	The note type.	
:text	*str*	The analyst authored note text.	Display: {'hint': 'text', 'syntax': 'markdown'}
:autho	*ps:contact*	The contact information of the author.	
:creat	*syn:user*	The synapse user who authored the note.	
:creat	*time*	The time the note was created.	
:updat	*time*	The time the note was updated.	
:reply	*meta:note*	The note is a reply to the specified note.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
meta:note	-(about)>	*	The meta:note is about the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:note:type:taxonomy

An analyst note type taxonomy.

The base type for the form can be found at *meta:note:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:note:type:taxonon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:rule

A generic rule linked to matches with -(matches)> edges.

The base type for the form can be found at *meta:rule*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A name for the rule.	
:type	*meta:rule:type:taxonon*	The rule type.	
:desc	*str*	A description of the rule.	Display: {'hint': 'text'}
:text	*str*	The text of the rule logic.	Display: {'hint': 'text'}
:author	*ps:contact*	The contact information of the rule author.	
:created	*time*	The time the rule was initially created.	
:updated	*time*	The time the rule was most recently modified.	
:url	*inet:url*	A URL which documents the rule.	
:ext:id	*str*	An external identifier for the rule.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
meta:rule	-(detects)	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)	*	The meta:rule has matched on target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target nod
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the quer
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:ruleset	-(has)>	meta:rule	The meta:ruleset includes the meta:rule.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the comp
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targ
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:mitigation	-(uses)>	meta:rule	The mitigation uses the rule.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:rule:type:taxonomy

A taxonomy for meta:rule types.

The base type for the form can be found at *meta:rule:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:rule:type:taxonon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:ruleset

A set of rules linked with -(has)> edges.

The base type for the form can be found at *meta:ruleset*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A name for the ruleset.	
:type	*meta:ruleset:type:taxon*	The ruleset type.	
:desc	*str*	A description of the ruleset.	Display: {'hint': 'text'}
:author	*ps:contact*	The contact information of the ruleset author.	
:created	*time*	The time the ruleset was initially created.	
:updated	*time*	The time the ruleset was most recently modified.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.
meta:rulese	-(has)>	meta:rule	The meta:ruleset includes the meta:rule.
meta:rulese	-(has)>	inet:service:ru	The meta:ruleset includes the inet:service:rule.
meta:rulese	-(has)>	it:app:snort:ru	The meta:ruleset includes the it:app:snort:rule.
meta:rulese	-(has)>	it:app:yara:rul	The meta:ruleset includes the it:app:yara:rule.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:seen

Annotates that the data in a node was obtained from or observed by a given source.

The base type for the form can be found at *meta:seen*.

Properties:

name	type	doc	opts
:source	*meta:source*	The source which observed or provided the node.	Read Only: True
:node	*ndef*	The node which was observed by or received from the source.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.

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source	verb	target	doc
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:source

A data source unique identifier.

The base type for the form can be found at *meta:source*.

Properties:

name	type	doc
:name	*str* lower: True	A human friendly name for the source.
:type	*str* lower: True	An optional type field used to group sources.
:url	*inet:url*	A URL which documents the meta source.
:ingest:cursor	*str*	Used by ingest logic to capture the current ingest cursor within a feed.
:ingest:latest	*time*	Used by ingest logic to capture the last time a feed ingest ran.
:ingest:offset	*int*	Used by ingest logic to capture the current ingest offset within a feed.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
meta:source	-(seen)>	*	The meta:source observed the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:timeline

A curated timeline of analytically relevant events.

The base type for the form can be found at *meta:timeline*.

Properties:

name	type	doc	opts
:title	*str*	A title for the timeline.	Example: The history of the Vertex Project
:summar	*str*	A prose summary of the timeline.	Display: {'hint': 'text'}
:type	*meta:timeline:taxo*	The type of timeline.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

meta:timeline:taxonomy

A taxonomy of timeline types for meta:timeline nodes.

The base type for the form can be found at *meta:timeline:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*meta:timeline:taxonom*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:asset

A node for tracking assets which belong to an organization.

The base type for the form can be found at *ou:asset*.

Properties:

name	type	doc
:org	*ou:org*	The organization which owns the asset.
:id	*str* strip: True	The ID of the asset.
:name	*str* lower: True onespace: True	The name of the assset.
:period	*ival*	The period of time when the asset was being tracked.
:status	*ou:asset:status:taxonomy*	The current status of the asset.
:type	*ou:asset:type:taxonomy*	The asset type.
:priority	*meta:priority*	The overall priority of protecting the asset.
:priority:confidentialit	*meta:priority*	The priority of protecting the confidentiality of the asset.
:priority:integrity	*meta:priority*	The priority of protecting the integrity of the asset.
:priority:availability	*meta:priority*	The priority of protecting the availability of the asset.
:node	*ndef*	The node which represents the asset.
:place	*geo:place*	The place where the asset is deployed.
:owner	*ps:contact*	The contact information of the owner or administrator of the asset.
:operator	*ps:contact*	The contact information of the user or operator of the asset.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 398 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:asset:status:taxonomy

An asset status taxonomy.

The base type for the form can be found at *ou:asset:status:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:asset:status:taxonon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 399 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:asset:type:taxonomy

An asset type taxonomy.

The base type for the form can be found at *ou:asset:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:asset:type:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:attendee

A node representing a person attending a meeting, conference, or event.

The base type for the form can be found at *ou:attendee*.

Properties:

name	type	doc
:person	*ps:contact*	The contact information for the person who attended the event.
:arrived	*time*	The time when the person arrived.
:departed	*time*	The time when the person departed.
:roles	*array* type: *ou:role* split: , uniq: True sorted: True	List of the roles the person had at the event.
:meet	*ou:meet*	The meeting that the person attended.
:conference	*ou:conference*	The conference that the person attended.
:conference:event	*ou:conference:event*	The conference event that the person attended.
:contest	*ou:contest*	The contest that the person attended.
:preso	*ou:preso*	The presentation that the person attended.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:award

An award issued by an organization.

The base type for the form can be found at *ou:award*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the award.	Example: Bachelors of Science
:type	*str* lower: True onespace: True	The type of award.	Example: certification
:org	*ou:org*	The organization which issues the award.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:campaign

Represents an org's activity in pursuit of a goal.

The base type for the form can be found at *ou:campaign*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org carrying out the campaign.	
:org:name	*ou:name*	The name of the org responsible for the campaign. Used for entity resolution.	
:org:fqdn	*inet:fqdn*	The FQDN of the org responsible for the campaign. Used for entity resolution.	
:goal	*ou:goal*	The assessed primary goal of the campaign.	alts: ('goals',)
:slogan	*lang:phrase*	The slogan used by the campaign.	
:actors	*array* type: *ps:contact* split: , uniq: True sorted: True	Actors who participated in the campaign.	
:goals	*array* type: *ou:goal* split: , uniq: True sorted: True	Additional assessed goals of the campaign.	
:success	*bool*	Records the success/failure status of the campaign if known.	
:name	*ou:campname*	A terse name of the campaign.	alts: ('names',) Example: operation overlord
:names	*array* type: *ou:campname* sorted: True uniq: True	An array of alternate names for the campaign.	
:reporter	*ou:org*	The organization reporting on the campaign.	

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name	type	doc	opts
:reporter:name	*ou:name*	The name of the organization reporting on the campaign.	
:type	*str*	Deprecated. Use the :camptype taxonomy.	Deprecated: True
:sophistication	*meta:sophistication*	The assessed sophistication of the campaign.	
:timeline	*meta:timeline*	A timeline of significant events related to the campaign.	
:camptype	*ou:camptype*	The campaign type taxonomy.	Display: {'hint': 'taxonomy'}
:desc	*str*	A description of the campaign.	Display: {'hint': 'text'}
:period	*ival*	The time interval when the organization was running the campaign.	
:cost	*econ:price*	The actual cost to the organization.	
:budget	*econ:price*	The budget allocated by the organization to execute the campaign.	
:currency	*econ:currency*	The currency used to record econ:price properties.	
:goal:revenue	*econ:price*	A goal for revenue resulting from the campaign.	
:result:revenue	*econ:price*	The revenue resulting from the campaign.	
:goal:pop	*int*	A goal for the number of people affected by the campaign.	
:result:pop	*int*	The count of people affected by the campaign.	
:team	*ou:team*	The org team responsible for carrying out the campaign.	
:conflict	*ou:conflict*	The conflict in which this campaign is a primary participant.	
:techniques	*array* type: *ou:technique* sorted: True uniq: True	Deprecated for scalability. Please use -(uses)> ou:technique.	Deprecated: True

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name	type	doc	opts
:tag	*syn:tag*	The tag used to annotate nodes that are associated with the campaign.	
:mitre:attack:camp	*it:mitre:attack:campaig*	A mapping to a MITRE ATT&CK campaign if applicable.	
:ext:id	*str* strip: True	An external identifier for the campaign.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	ou:technique	The campaign used the technique.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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Table 404 – continued from previous page

source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:campname

A campaign name.

The base type for the form can be found at *ou:campname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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Table 405 – continued from previous page

source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:camptype

An campaign type taxonomy.

The base type for the form can be found at *ou:camptype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:camptype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:candidate

A candidate being considered for a role within an organization.

The base type for the form can be found at *ou:candidate*.

Properties:

name	type	doc
:org	*ou:org*	The organization considering the candidate.
:contact	*ps:contact*	The contact information of the candidate.
:method	*ou:candidate:method:taxonomy*	The method by which the candidate came under consideration.
:submitted	*time*	The time the candidate was submitted for consideration.
:intro	*str* strip: True	An introduction or cover letter text submitted by the candidate.
:resume	*file:bytes*	The candidate's resume or CV.
:opening	*ou:opening*	The opening that the candidate is being considered for.
:agent	*ps:contact*	The contact information of an agent who advocates for the candidate.
:recruiter	*ps:contact*	The contact information of a recruiter who works on behalf of the organization.
:attachments	*array* type: *file:attachment* sorted: True uniq: True	An array of additional files submitted by the candidate.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 407 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:candidate:method:taxonomy

A taxonomy of methods by which a candidate came under consideration.

The base type for the form can be found at *ou:candidate:method:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:candidate:method:t*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conference

A conference with a name and sponsoring org.

The base type for the form can be found at *ou:conference*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org which created/managed the conference.	
:organizer	*ps:contact*	Contact information for the primary organizer of the conference.	
:sponsors	*array* type: *ps:contact* uniq: True sorted: True	An array of contacts which sponsored the conference.	
:name	*entity:name*	The full name of the conference.	alts: ('names',) Example: defcon 2017
:names	*array* type: *entity:name* uniq: True sorted: True	An array of alternate names for the conference.	
:desc	*str* lower: True	A description of the conference.	Example: annual cybersecurity conference Display: {'hint': 'text'}
:base	*str* lower: True strip: True	The base name which is shared by all conference instances.	Example: defcon
:start	*time*	The conference start date / time.	
:end	*time*	The conference end date / time.	
:place	*geo:place*	The geo:place node where the conference was held.	
:url	*inet:url*	The inet:url node for the conference website.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conference:attendee

Deprecated. Please use ou:attendee.

The base type for the form can be found at *ou:conference:attendee*.

Properties:

name	type	doc	opts
:conference	*ou:conference*	The conference which was attended.	Read Only: True
:person	*ps:person*	The person who attended the conference.	Read Only: True
:arrived	*time*	The time when a person arrived to the conference.	
:departed	*time*	The time when a person departed from the conference.	
:role:staff	*bool*	The person worked as staff at the conference.	
:role:speaker	*bool*	The person was a speaker or presenter at the conference.	
:roles	*array* type: *str* uniq: True sorted: True	List of the roles the person had at the conference.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conference:event

A conference event with a name and associated conference.

The base type for the form can be found at *ou:conference:event*.

Properties:

name	type	doc	opts
:conference	*ou:conference*	The conference to which the event is associated.	
:organizer	*ps:contact*	Contact information for the primary organizer of the event.	
:sponsors	*array* type: *ps:contact* uniq: True sorted: True	An array of contacts which sponsored the event.	
:place	*geo:place*	The geo:place where the event occurred.	
:name	*str* lower: True	The name of the conference event.	Example: foobar conference dinner
:desc	*str* lower: True	A description of the conference event.	Example: foobar conference networking dinner at ridge hotel Display: {'hint': 'text'}
:url	*inet:url*	The inet:url node for the conference event website.	
:contact	*ps:contact*	Contact info for the event.	
:start	*time*	The event start date / time.	
:end	*time*	The event end date / time.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conference:event:attendee

Deprecated. Please use ou:attendee.

The base type for the form can be found at *ou:conference:event:attendee*.

Properties:

name	type	doc	opts
:event	*ou:conference:event*	The conference event which was attended.	Read Only: True
:person	*ps:person*	The person who attended the conference event.	Read Only: True
:arrived	*time*	The time when a person arrived to the conference event.	
:departed	*time*	The time when a person departed from the conference event.	
:roles	*array* type: *str* uniq: True sorted: True	List of the roles the person had at the conference event.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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Table 412 – continued from previous page

source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conflict

Represents a conflict where two or more campaigns have mutually exclusive goals.

The base type for the form can be found at *ou:conflict*.

Properties:

name	type	doc
:name	*str* onespace: True	The name of the conflict.
:started	*time*	The time the conflict began.
:ended	*time*	The time the conflict ended.
:timeline	*meta:timeline*	A timeline of significant events related to the conflict.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:contest

A competitive event resulting in a ranked set of participants.

The base type for the form can be found at *ou:contest*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the contest.	Example: defcon ctf 2020
:type	*str* lower: True onespace: True	The type of contest.	Example: cyber ctf
:family	*str* lower: True onespace: True	A name for a series of recurring contests.	Example: defcon ctf
:desc	*str* lower: True	A description of the contest.	Example: the capture-the-flag event hosted at defcon 2020 Display: {'hint': 'text'}
:url	*inet:url*	The contest website URL.	
:start	*time*	The contest start date / time.	
:end	*time*	The contest end date / time.	
:loc	*loc*	The geopolitical affiliation of the contest.	
:place	*geo:place*	The geo:place where the contest was held.	
:latlong	*geo:latlong*	The latlong where the contest was held.	
:conference	*ou:conference*	The conference that the contest is associated with.	
:contests	*array* type: *ou:contest* split: , uniq: True sorted: True	An array of sub-contests that contributed to the rankings.	
:sponsors	*array* type: *ps:contact* split: , uniq: True sorted: True	Contact information for contest sponsors.	
:organizers		Contact information	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:contest:result

The results from a single contest participant.

The base type for the form can be found at *ou:contest:result*.

Properties:

name	type	doc	opts
:contest	*ou:contes*	The contest that the participant took part in.	Read Only: True
:participan	*ps:contac*	The participant in the contest.	Read Only: True
:rank	*int*	The participant's rank order in the contest.	
:score	*int*	The participant's final score in the contest.	
:period	*ival*	The period of time when the participant competed in the contest.	
:url	*inet:url*	The contest result website URL.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.

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source	verb	target	doc
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:contract

An contract between multiple entities.

The base type for the form can be found at *ou:contract*.

Properties:

name	type	doc	opts
:title	*str*	A terse title for the contract.	
:type	*ou:conttype*	The type of contract.	
:sponsor	*ps:contact*	The contract sponsor.	
:parties	*array* type: *ps:contact* uniq: True sorted: True	The non-sponsor entities bound by the contract.	
:document	*file:bytes*	The best/current contract document.	
:signed	*time*	The date that the contract signing was complete.	
:begins	*time*	The date that the contract goes into effect.	
:expires	*time*	The date that the contract expires.	
:completed	*time*	The date that the contract was completed.	
:terminated	*time*	The date that the contract was terminated.	
:award:price	*econ:price*	The value of the contract at time of award.	
:budget:price	*econ:price*	The amount of money budgeted for the contract.	
:currency	*econ:currency*	The currency of the econ:price values.	
:purchase	*econ:purchase*	Purchase details of the contract.	
:requirements	*array* type: *ou:goal* uniq: True sorted: True	The requirements levied upon the parties.	
:types	*array* type: *ou:contract:type* split: , uniq: True sorted: True	A list of types that apply to the contract.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:contribution

Represents a specific instance of contributing material support to a campaign.

The base type for the form can be found at *ou:contribution*.

Properties:

name	type	doc
:from	*ps:contact*	The contact information of the contributor.
:campaign	*ou:campaign*	The campaign receiving the contribution.
:value	*econ:price*	The assessed value of the contribution.
:currency	*econ:currency*	The currency used for the assessed value.
:time	*time*	The time the contribution occurred.
:material:spec	*mat:spec*	The specification of material items contributed.
:material:count	*int*	The number of material items contributed.
:monetary:payment	*econ:acct:payment*	Payment details for a monetary contribution.
:personnel:count	*int*	Number of personnel contributed to the campaign.
:personnel:jobtitle	*ou:jobtitle*	Title or designation for the contributed personnel.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ou:contributi	-(includes)	*	The contribution includes the specific node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.

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source	verb	target	doc
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:conttype

A contract type taxonomy.

The base type for the form can be found at *ou:conttype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:conttype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:employment

An employment type taxonomy.

The base type for the form can be found at *ou:employment*.

An example of `ou:employment`:

- `fulltime.salary`

  Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:employment*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:enacted

An organization enacting a document.

The base type for the form can be found at *ou:enacted*.

Properties:

name	type	doc
:org	*ou:org*	The organization which is enacting the document.
:doc	*ndef* forms: ('doc:policy', 'doc:standard', 'doc:requirement')	The document enacted by the organization.
:scope	*ndef*	The scope of responsbility for the assignee to enact the document.
:id	*str* strip: True	The ID of the adoption task.
:project	*proj:project*	The project containing the adoption task.
:status	*int*	The status of the adoption task.
:priority	*meta:priority*	The priority of the adoption task.
:created	*time*	The time the adoption task was created.
:updated	*time*	The time the adoption task was last updated.
:due	*time*	The time the adoption task must be complete.
:completed	*time*	The time the adoption task was completed.
:creator	*syn:user*	The user which created the adoption task.
:assignee	*syn:user*	The user assigned to complete the adoption task.
:ext:creator	*ps:contact*	The contact information of the creator from an external system.
:ext:assignee	*ps:contact*	The contact information of the assignee from an external system.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:enacted:status:taxonomy

A taxonomy of enacted statuses.

The base type for the form can be found at *ou:enacted:status:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:enacted:status:taxo*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:goal

An assessed or stated goal which may be abstract or org specific.

The base type for the form can be found at *ou:goal*.

Properties:

name	type	doc	opts
:name	*ou:goalname*	A terse name for the goal.	alts: ('names',)
:names	*array* type: *ou:goalname* sorted: True uniq: True	An array of alternate names for the goal. Used to merge/resolve goals.	
:type	*ou:goal:type:taxonomy*	A type taxonomy entry for the goal.	
:desc	*str*	A description of the goal.	Display: {'hint': 'text'}
:prev	*ou:goal*	Deprecated. Please use ou:goal:type taxonomy.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:goal:type:taxonomy

A taxonomy of goal types.

The base type for the form can be found at *ou:goal:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:goal:type:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:goalname

A goal name.

The base type for the form can be found at *ou:goalname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:hasalias

The knowledge that an organization has an alias.

The base type for the form can be found at *ou:hasalias*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org guid which has the alias.	Read Only: True
:alias	*ou:alias*	Alias for the organization.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:hasgoal

Deprecated. Please use ou:org:goals.

The base type for the form can be found at *ou:hasgoal*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org which has the goal.	Read Only: True
:goal	*ou:goal*	The goal which the org has.	Read Only: True
:stated	*bool*	Set to true/false if the goal is known to be self stated.	
:window	*ival*	Set if a goal has a limited time window.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:id:number

A unique id number issued by a specific organization.

The base type for the form can be found at *ou:id:number*.

Properties:

name	type	doc	opts
:type	*ou:id:type*	The type of org ID.	Read Only: True
:value	*ou:id:value*	The value of the org ID.	Read Only: True
:status	*str* lower: True strip: True	A freeform status such as valid, suspended, expired.	
:issued	*time*	The time at which the org issued the ID number.	
:expires	*time*	The time at which the ID number expires.	
:issuer	*ps:contact*	The contact information of the office which issued the ID number.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

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source	verb	target	doc
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:id:type

A type of id number issued by an org.

The base type for the form can be found at *ou:id:type*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org which issues id numbers of this type.	
:name	*str*	The friendly name of the ID number type.	alts: ('names',)
:names	*array* type: *str* sorted: True uniq: True	An array of alternate names for the ID number type.	
:url	*inet:url*	The official URL of the issuer.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:id:update

A status update to an org:id:number.

The base type for the form can be found at *ou:id:update*.

Properties:

name	type	doc
:number	*ou:id:number*	The id number that was updated.
:status	*str* strip: True lower: True	The updated status of the id number.
:time	*time*	The date/time that the id number was updated.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:industry

An industry classification type.

The base type for the form can be found at *ou:industry*.

Properties:

name	type	doc	opts
:name	*ou:industryname*	The name of the industry.	alts: ('names',)
:type	*ou:industry:type:taxono*	A taxonomy entry for the industry.	
:names	*array* type: *ou:industryname* uniq: True sorted: True	An array of alternative names for the industry.	
:reporter	*ou:org*	The organization reporting on the industry.	
:reporter:name	*ou:name*	The name of the organization reporting on the industry.	
:subs	*array* type: *ou:industry* split: , uniq: True sorted: True	Deprecated. Please use ou:industry:type taxonomy.	Deprecated: True
:sic	*array* type: *ou:sic* split: , uniq: True sorted: True	An array of SIC codes that map to the industry.	
:naics	*array* type: *ou:naics* split: , uniq: True sorted: True	An array of NAICS codes that map to the industry.	
:isic	*array* type: *ou:isic* split: , uniq: True sorted: True	An array of ISIC codes that map to the industry.	
:desc	*str*	A description of the industry.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target n
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target
it:exec:query	-(found)>	*	The target node was returned as a result of running the qu
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target nod
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	ou:industry	The attack targeted the industry.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the co
risk:compromise	-(targets)>	ou:industry	The compromise was assessed to be based on the victim'
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the ta
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target n
risk:threat	-(targets)>	ou:industry	The threat cluster targets the industry.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:industry:type:taxonomy

An industry type taxonomy.

The base type for the form can be found at *ou:industry:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:industry:type:taxon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:industryname

The name of an industry.

The base type for the form can be found at *ou:industryname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:jobtitle

A title for a position within an org.

The base type for the form can be found at *ou:jobtitle*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:jobtype

A taxonomy of job types.

The base type for the form can be found at *ou:jobtype*.

An example of `ou:jobtype`:

- `it.dev.python`

  Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:jobtype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:meet

An informal meeting of people which has no title or sponsor. See also: ou:conference.

The base type for the form can be found at *ou:meet*.

Properties:

name	type	doc
:name	*str* lower: True	A human friendly name for the meeting.
:start	*time*	The date / time the meet starts.
:end	*time*	The date / time the meet ends.
:place	*geo:place*	The geo:place node where the meet was held.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:meet:attendee

Deprecated. Please use ou:attendee.

The base type for the form can be found at *ou:meet:attendee*.

Properties:

name	type	doc	opts
:meet	*ou:meet*	The meeting which was attended.	Read Only: True
:person	*ps:person*	The person who attended the meeting.	Read Only: True
:arrived	*time*	The time when a person arrived to the meeting.	
:departed	*time*	The time when a person departed from the meeting.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:member

Deprecated. Please use ou:position.

The base type for the form can be found at *ou:member*.

Properties:

name	type	doc	opts
:org	*ou:org*	The GUID of the org the person is a member of.	Read Only: True
:person	*ps:person*	The GUID of the person that is a member of an org.	Read Only: True
:title	*str* lower: True strip: True	The persons normalized title.	
:start	*time* ismin: True	Earliest known association of the person with the org.	
:end	*time* ismax: True	Most recent known association of the person with the org.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.

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Table 437 – continued from previous page

source	verb	target	doc
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:name

The name of an organization. This may be a formal name or informal name of the organization.

The base type for the form can be found at *ou:name*.

An example of ou:name:

- acme corporation

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None

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Table 438 – continued from previous page

source	verb	target	doc
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:opening

A job/work opening within an org.

The base type for the form can be found at *ou:opening*.

Properties:

name	type	doc
:org	*ou:org*	The org which has the opening.
:orgname	*ou:name*	The name of the organization as listed in the opening.
:orgfqdn	*inet:fqdn*	The FQDN of the organization as listed in the opening.
:posted	*time*	The date/time that the job opening was posted.
:removed	*time*	The date/time that the job opening was removed.
:postings	*array* type: *inet:url* uniq: True sorted: True	URLs where the opening is listed.
:contact	*ps:contact*	The contact details to inquire about the opening.
:loc	*loc*	The geopolitical boundary of the opening.
:jobtype	*ou:jobtype*	The job type taxonomy.
:employment	*ou:employment*	The type of employment.
:jobtitle	*ou:jobtitle*	The title of the opening.
:remote	*bool*	Set to true if the opening will allow a fully remote worker.
:yearlypay	*econ:price*	The yearly income associated with the opening.
:paycurrency	*econ:currency*	The currency that the yearly pay was delivered in.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 439 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:org

A GUID for a human organization such as a company or military unit.

The base type for the form can be found at *ou:org*.

Properties:

name	type	doc	opts
:loc	*loc*	Location for an organization.	
:name	*ou:name*	The localized name of an organization.	alts: ('names',)
:type	*str* lower: True strip: True	The type of organization.	Deprecated: True
:motto	*lang:phrase*	The motto used by the organization.	
:orgtype	*ou:orgtype*	The type of organization.	Display: {'hint': 'taxonomy'}
:vitals	*ou:vitals*	The most recent/accurate ou:vitals for the org.	
:desc	*str*	A description of the org.	Display: {'hint': 'text'}
:logo	*file:bytes*	An image file representing the logo for the organization.	
:names	*array* type: *ou:name* uniq: True sorted: True	A list of alternate names for the organization.	
:alias	*ou:alias*	Deprecated. Please use ou:org:names.	Deprecated: True
:phone	*tel:phone*	The primary phone number for the organization.	
:sic	*ou:sic*	The Standard Industrial Classification code for the organization.	Deprecated: True
:naics	*ou:naics*	The North American Industry Classification System code for the organization.	Deprecated: True
:industries	*array* type: *ou:industry* uniq: True sorted: True	The industries associated with the org.	
:us:cage	*gov:us:cage*	The Commercial and Government Entity (CAGE) code for the organization.	
:founded	*time*	The date on which the org was founded.	
:dissolved	*time*	The date on which the org was dissolved.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	ou:technique	The org uses the technique.
ou:org	-(uses)>	*	The ou:org makes use of the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:org:has

An org owns, controls, or has exclusive use of an object or resource, potentially during a specific period of time.

The base type for the form can be found at *ou:org:has*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org who owns or controls the object or resource.	Read Only: True
:node	*ndef*	The object or resource that is owned or controlled by the org.	Read Only: True
:node:form	*str*	The form of the object or resource that is owned or controlled by the org.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.

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Table 441 – continued from previous page

source	verb	target	doc
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:orgnet4

An organization's IPv4 netblock.

The base type for the form can be found at *ou:orgnet4*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org guid which owns the netblock.	Read Only: True
:net	*inet:net4*	Netblock owned by the organization.	Read Only: True
:name	*str* lower: True strip: True	The name that the organization assigns to this netblock.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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Table 442 – continued from previous page

source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:orgnet6

An organization's IPv6 netblock.

The base type for the form can be found at *ou:orgnet6*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org guid which owns the netblock.	Read Only: True
:net	*inet:net6*	Netblock owned by the organization.	Read Only: True
:name	*str* lower: True strip: True	The name that the organization assigns to this netblock.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:orgtype

An org type taxonomy.

The base type for the form can be found at *ou:orgtype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:orgtype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:position

A position within an org. May be organized into an org chart.

The base type for the form can be found at *ou:position*.

Properties:

name	type	doc
:org	*ou:org*	The org which has the position.
:team	*ou:team*	The team that the position is a member of.
:contact	*ps:contact*	The contact info for the person who holds the position.
:title	*ou:jobtitle*	The title of the position.
:reports	*array* type: *ou:position* uniq: True sorted: True	An array of positions which report to this position.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:preso

A webinar, conference talk, or other type of presentation.

The base type for the form can be found at *ou:preso*.

Properties:

name	type	doc	opts
:organizer	*ps:contact*	Contact information for the primary organizer of the presentation.	
:sponsors	*array* type: *ps:contact* uniq: True sorted: True	A set of contacts which sponsored the presentation.	
:presenters	*array* type: *ps:contact* uniq: True sorted: True	A set of contacts which gave the presentation.	
:title	*str* lower: True	The full name of the presentation.	Example: Synapse 101 - 2021/06/22
:desc	*str* lower: True	A description of the presentation.	Display: {'hint': 'text'}
:time	*time*	The scheduled presentation start time.	
:duration	*duration*	The scheduled duration of the presentation.	
:loc	*loc*	The geopolitical location string for where the presentation was given.	
:place	*geo:place*	The geo:place node where the presentation was held.	
:deck:url	*inet:url*	The URL hosting a copy of the presentation materials.	
:deck:file	*file:bytes*	A file containing the presentation materials.	
:attendee:url	*inet:url*	The URL visited by live attendees of the presentation.	
:recording:url	*inet:url*	The URL hosting a recording of the presentation.	
:recording:file	*file:bytes*	A file containing a recording of the presentation.	
:conference	*ou:conference*	The conference which hosted the presentation.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:requirement

A specific requirement.

The base type for the form can be found at *ou:requirement*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A name for the requirement.	
:type	*ou:requirement:type:ta*	The type of requirement.	
:text	*str*	The text of the stated requirement.	Display: {'hint': 'text'}
:optional	*bool*	Set to true if the requirement is optional.	
:priority	*meta:priority*	The priority of the requirement.	
:goal	*ou:goal*	The goal that the requirement is designed to achieve.	
:active	*bool*	Set to true if the requirement is currently active.	
:issued	*time*	The time that the requirement was first issued.	
:period	*ival*	The time window where the goal must be met. Can be ongoing.	
:issuer	*ps:contact*	The contact information of the entity which issued the requirement.	
:assignee	*ps:contact*	The contact information of the entity which is assigned to meet the requirement.	
:deps	*array* type: *ou:requirement* sorted: True uniq: True	A list of sub-requirements which must be met to complete the requirement.	
:deps:min	*int* min: 0	The minimum number dependant requirements which must be met. If unset, assume all must be met.	

Source Edges:

source	verb	target	doc
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the targ
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the ta
it:exec:query	-(found)>	*	The target node was returned as a result of running th
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the ta
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target nod
ps:contact	-(has)>	*	The contact is or was in possession of the target node
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to t
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the targ
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target n
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was ru
sci:observation	-(has)>	*	The observations are summarized from the target noc

ou:requirement:type:taxonomy

A taxonomy of requirement types.

The base type for the form can be found at *ou:requirement:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:requirement:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:suborg

Any parent/child relationship between two orgs. May represent ownership, organizational structure, etc.

The base type for the form can be found at *ou:suborg*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org which owns the sub organization.	Read Only: True
:sub	*ou:org*	The sub org which owned by the org.	Read Only: True
:perc	*int* min: 0 max: 100	The optional percentage of sub which is owned by org.	
:founded	*time*	The date on which the suborg relationship was founded.	
:dissolved	*time*	The date on which the suborg relationship was dissolved.	
:current	*bool*	Bool indicating if the suborg relationship still current.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:team

A GUID for a team within an organization.

The base type for the form can be found at *ou:team*.

Properties:

name	type	doc
:org	*ou:org*	A GUID for a human organization such as a company or military unit.
:name	*ou:name*	The name of an organization. This may be a formal name or informal name of the organization.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.

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Table 450 – continued from previous page

source	verb	target	doc
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:technique

A specific technique used to achieve a goal.

The base type for the form can be found at *ou:technique*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The normalized name of the technique.	
:type	*ou:technique:taxonomy*	The taxonomy classification of the technique.	
:sophistication	*meta:sophistication*	The assessed sophistication of the technique.	
:desc	*str*	A description of the technique.	Display: {'hint': 'text'}
:tag	*syn:tag*	The tag used to annotate nodes where the technique was employed.	
:mitre:attack:tech	*it:mitre:attack:techniqu*	A mapping to a MITRE ATT&CK technique if applicable.	
:reporter	*ou:org*	The organization reporting on the technique.	
:reporter:name	*ou:name*	The name of the organization reporting on the technique.	
:ext:id	*str* strip: True	An external identifier for the technique.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ou:techniqu	-(uses)>	risk:vuln	The technique uses the vulnerability.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the targ
it:exec:query	-(found)>	*	The target node was returned as a result of running the
it:prod:soft	-(uses)>	ou:technique	The software uses the technique.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targ
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	ou:technique	The campaign used the technique.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target no
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	ou:technique	The org uses the technique.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	ou:technique	The attacker used the technique in the attack.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the c
risk:compromise	-(uses)>	ou:technique	The attacker used the technique in the compromise.
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the
risk:extortion	-(uses)>	ou:technique	The attacker used the technique to extort the victim.
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:mitigation	-(addresses)>	ou:technique	The mitigation addresses the technique.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	ou:technique	The threat cluster uses the technique.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	ou:technique	The tool uses the technique.

continues on

Table 451 – continued from previous page

source	verb	target	doc
risk:tool:software	-(uses)>	*	The tool uses the target node.
risk:vuln	-(uses)>	ou:technique	The vulnerability uses the technique.
sci:evidence	-(has)>	*	The evidence includes observations from the target node
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes

ou:technique:taxonomy

An analyst defined taxonomy to classify techniques in different disciplines.

The base type for the form can be found at *ou:technique:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ou:technique:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 452 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:user

A user name within an organization.

The base type for the form can be found at *ou:user*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org guid which owns the netblock.	Read Only: True
:user	*inet:user*	The username associated with the organization.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ou:vitals

Vital statistics about an org for a given time period.

The base type for the form can be found at *ou:vitals*.

Properties:

name	type	doc
:asof	*time*	The time that the vitals represent.
:org	*ou:org*	The resolved org.
:orgname	*ou:name*	The org name as reported by the source of the vitals.
:orgfqdn	*inet:fqdn*	The org FQDN as reported by the source of the vitals.
:currency	*econ:currency*	The currency of the econ:price values.
:costs	*econ:price*	The costs/expenditures over the period.
:budget	*econ:price*	The budget allocated for the period.
:revenue	*econ:price*	The gross revenue over the period.
:profit	*econ:price*	The net profit over the period.
:valuation	*econ:price*	The assessed value of the org.
:shares	*int*	The number of shares outstanding.
:population	*int*	The population of the org.
:delta:costs	*econ:price*	The change in costs over last period.
:delta:revenue	*econ:price*	The change in revenue over last period.
:delta:profit	*econ:price*	The change in profit over last period.
:delta:valuation	*econ:price*	The change in valuation over last period.
:delta:population	*int*	The change in population over last period.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

phys:contained

A node which represents a physical object containing another physical object.

The base type for the form can be found at *phys:contained*.

Properties:

name	type	doc
:type	*phys:contained:type:taxonomy*	The type of container relationship.
:period	*ival*	The period where the container held the object.
:object	*phys:object*	The object held within the container.
:container	*phys:object*	The container which held the object.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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Table 455 – continued from previous page

source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

phys:contained:type:taxonomy

A taxonomy for types of contained relationships.

The base type for the form can be found at *phys:contained:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*phys:contained:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:phase

A phase within a planning system which may be used to group steps within a procedure.

The base type for the form can be found at *plan:phase*.

Properties:

name	type	doc	opts
:title	*str*	The title of the phase.	Example: Reconnaissance Phase
:summar	*str*	A summary of the definition of the phase.	Display: {'hint': 'text'}
:index	*int*	The index of this phase within the phases of the system.	
:url	*inet:url*	A URL which links to the full documentation about the phase.	
:system	*plan:syste*	The planning system which defines this phase.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:procedure

A procedure consisting of steps.

The base type for the form can be found at *plan:procedure*.

Properties:

name	type	doc	opts
:title	*str*	The name of the procedure.	Example: Network Reconnaissance Procedure
:summary	*str*	A summary of the purpose and use cases for the procedure.	Display: {'hint': 'text'}
:author	*ps:contact*	The contact of the person or organization which authored the procedure.	
:created	*time*	The time the procedure was created.	
:updated	*time*	The time the procedure was last updated.	
:version	*it:semver*	The version of the procedure.	
:system	*plan:system*	The planning system which defines this procedure.	
:type	*plan:procedure:type:ta*	A type classification for the procedure.	
:inputs	*array* type: *plan:procedure:variabl* uniq: True sorted: True	An array of inputs required to execute the procedure.	
:firststep	*plan:procedure:step*	The first step in the procedure.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:procedure:link

A link between steps in a procedure.

The base type for the form can be found at *plan:procedure:link*.

Properties:

name	type	doc
:condition	*bool*	Set to true/false if this link is conditional based on a decision step.
:next	*plan:procedure:step*	The next step in the plan.
:procedure	*plan:procedure*	The procedure which defines the link.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:procedure:step

A step within a procedure.

The base type for the form can be found at *plan:procedure:step*.

Properties:

name	type	doc	opts
:phase	*plan:phase*	The phase that the step belongs within.	
:procedure	*plan:procedure*	The procedure which defines the step.	
:title	*str*	The title of the step.	Example: Scan the IPv4 address range for open ports
:summary	*str*	A summary of the tasks executed within the step.	
:outputs	*array* type: *plan:procedure:variabl* uniq: True sorted: True	An array of variables defined in this step.	
:techniques	*array* type: *ou:technique* uniq: True sorted: True	An array of techniques used when executing this step.	
:links	*array* type: *plan:procedure:link* uniq: True	An array of links to subsequent steps.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)	geo:telem	Deprecated. Please use geo:telem:node.
plan:procedure:s	-(uses)>	*	The step in the procedure makes use of the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None

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source	verb	target	doc
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromise
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target node
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:procedure:type:taxonomy

A taxonomy of procedure types.

The base type for the form can be found at *plan:procedure:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*plan:procedure:type:ta.*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:procedure:variable

A variable used by a procedure.

The base type for the form can be found at *plan:procedure:variable*.

Properties:

name	type	doc
:name	*str*	The name of the variable.
:type	*str*	The type for the input. Types are specific to the planning system.
:default	*data*	The optional default value if the procedure is invoked without the input.
:procedure	*plan:procedure*	The procedure which defines the variable.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.

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source	verb	target	doc
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

plan:system

A planning or behavioral analysis system that defines phases and procedures.

The base type for the form can be found at *plan:system*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the planning system.	Example: mitre att&ck flow
:summary	*str*	A summary of the purpose and use case for the planning system.	Display: {'hint': 'text'}
:author	*ps:contact*	The contact of the person or organization which authored the system.	
:created	*time*	The time the planning system was first created.	
:updated	*time*	The time the planning system was last updated.	
:version	*it:semver*	The version of the planning system.	
:url	*inet:url*	The primary URL which documents the planning system.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:candidate

A candidate for office in a specific race.

The base type for the form can be found at *pol:candidate*.

Properties:

name	type	doc
:id	*str* strip: True	A unique ID for the candidate issued by an election authority.
:contact	*ps:contact*	The contact information of the candidate.
:race	*pol:race*	The race the candidate is participating in.
:campaign	*ou:campaign*	The official campaign to elect the candidate.
:winner	*bool*	Records the outcome of the race.
:party	*ou:org*	The declared political party of the candidate.
:incumbent	*bool*	Set to true if the candidate is an incumbent in this race.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:country

A GUID for a country.

The base type for the form can be found at *pol:country*.

Properties:

name	type	doc	opts
:flag	*file:bytes*	A thumbnail image of the flag of the country.	
:iso2	*pol:iso2*	The 2 digit ISO 3166 country code.	
:iso3	*pol:iso3*	The 3 digit ISO 3166 country code.	
:isonum	*pol:isonum*	The ISO integer country code.	
:pop	*int*	Deprecated. Please use :vitals::population.	Deprecated: True
:tld	*inet:fqdn*	A Fully Qualified Domain Name (FQDN).	
:name	*geo:name*	The name of the country.	alts: ('names',)
:names	*array* type: *geo:name* uniq: True sorted: True	An array of alternate or localized names for the country.	
:government	*ou:org*	The ou:org node which represents the government of the country.	
:place	*geo:place*	A geo:place node representing the geospatial properties of the country.	
:founded	*time*	The date that the country was founded.	
:dissolved	*time*	The date that the country was dissolved.	
:vitals	*pol:vitals*	The most recent known vitals for the country.	
:currencies	*array* type: *econ:currency* sorted: True uniq: True	The official currencies used in the country.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:election

An election involving one or more races for office.

The base type for the form can be found at *pol:election*.

Properties:

name	type	doc	opts
:name	*str* onespace: True lower: True	The name of the election.	Example: 2022 united states congressional midterm election
:time	*time*	The date of the election.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:immigration:status

A node which tracks the immigration status of a contact.

The base type for the form can be found at *pol:immigration:status*.

Properties:

name	type	doc	opts
:contact	*ps:contact*	The contact information for the immigration status record.	
:country	*pol:country*	The country that the contact is/has immigrated to.	
:type	*pol:immigration:status.*	A taxonomy entry for the immigration status type.	Example: citizen.naturalized
:state	*str* enums: requested,active,rejected,revoked,renounced	The state of the immigration status.	
:began	*time*	The time when the status was granted to the contact.	
:ended	*time*	The time when the status no longer applied to the contact.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:immigration:status:type:taxonomy

A taxonomy of immigration types.

The base type for the form can be found at *pol:immigration:status:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*pol:immigration:status:*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:office

An elected or appointed office.

The base type for the form can be found at *pol:office*.

Properties:

name	type	doc	opts
:title	*ou:jobtitl*	The title of the political office.	Example: `united states senator`
:positic	*ou:positi*	The position this office holds in the org chart for the governing body.	
:termlim	*int*	The maximum number of times a single person may hold the office.	
:govbody	*ou:org*	The governmental body which contains the office.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.

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source	verb	target	doc
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:pollingplace

An official place where ballots may be cast for a specific election.

The base type for the form can be found at *pol:pollingplace*.

Properties:

name	type	doc
:electic	*pol:electi*	The election that the polling place is designated for.
:name	*geo:name*	The name of the polling place at the time of the election. This may differ from the official place name.
:place	*geo:place*	The place where votes were cast.
:opens	*time*	The time that the polling place is scheduled to open.
:closes	*time*	The time that the polling place is scheduled to close.
:opened	*time*	The time that the polling place opened.
:closed	*time*	The time that the polling place closed.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:race

An individual race for office.

The base type for the form can be found at *pol:race*.

Properties:

name	type	doc
:election	*pol:election*	The election that includes the race.
:office	*pol:office*	The political office that the candidates in the race are running for.
:voters	*int*	The number of eligible voters for this race.
:turnout	*int*	The number of individuals who voted in this race.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis

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source	verb	target	doc
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:term

A term in office held by a specific individual.

The base type for the form can be found at *pol:term*.

Properties:

name	type	doc
:office	*pol:office*	The office held for the term.
:start	*time*	The start of the term of office.
:end	*time*	The end of the term of office.
:race	*pol:race*	The race that determined who held office during the term.
:contact	*ps:contact*	The contact information of the person who held office during the term.
:party	*ou:org*	The political party of the person who held office during the term.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.

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source	verb	target	doc
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

pol:vitals

A set of vital statistics about a country.

The base type for the form can be found at *pol:vitals*.

Properties:

name	type	doc
:country	*pol:country*	The country that the statistics are about.
:asof	*time*	The time that the vitals were measured.
:area	*geo:area*	The area of the country.
:population	*int*	The total number of people living in the country.
:currency	*econ:currency*	The national currency.
:econ:currency	*econ:currency*	The currency used to record price properties.
:econ:gdp	*econ:price*	The gross domestic product of the country.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:attachment

A file attachment added to a ticket or comment.

The base type for the form can be found at *proj:attachment*.

Properties:

name	type	doc
:name	*file:base*	The name of the file that was attached.
:file	*file:bytes*	The file that was attached.
:creator	*syn:user*	The synapse user who added the attachment.
:created	*time*	The time the attachment was added.
:ticket	*proj:ticket*	The ticket the attachment was added to.
:comment	*proj:comment*	The comment the attachment was added to.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.

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source	verb	target	doc
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:comment

A user comment on a ticket.

The base type for the form can be found at *proj:comment*.

Properties:

name	type	doc
:creator	*syn:user*	The synapse user who added the comment.
:created	*time*	The time the comment was added.
:updated	*time* ismax: True	The last time the comment was updated.
:ticket	*proj:ticket*	The ticket the comment was added to.
:text	*str*	The text of the comment.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:epic

A collection of tickets related to a topic.

The base type for the form can be found at *proj:epic*.

Properties:

name	type	doc
:name	*str* onespace: True	The name of the epic.
:project	*proj:project*	The project containing the epic.
:creator	*syn:user*	The synapse user who created the epic.
:created	*time*	The time the epic was created.
:updated	*time* ismax: True	The last time the epic was updated.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:project

A project in a ticketing system.

The base type for the form can be found at *proj:project*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The project name.	
:type	*proj:project:type:taxon*	The project type.	
:desc	*str*	The project description.	Display: {'hint': 'text'}
:creator	*syn:user*	The synapse user who created the project.	
:created	*time*	The time the project was created.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:project:type:taxonomy

A type taxonomy for projects.

The base type for the form can be found at *proj:project:type:taxonomy*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:sprint

A timeboxed period to complete a set amount of work.

The base type for the form can be found at *proj:sprint*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the sprint.
:status	*str* enums: planned,current,completed	The sprint status.
:project	*proj:project*	The project containing the sprint.
:creator	*syn:user*	The synapse user who created the sprint.
:created	*time*	The date the sprint was created.
:period	*ival*	The interval for the sprint.
:desc	*str*	A description of the sprint.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

proj:ticket

A ticket in a ticketing system.

The base type for the form can be found at *proj:ticket*.

Properties:

name	type	doc	opts
:ext:id	*str* strip: True	Deprecated. Please use :id.	Deprecated: True
:ext:url	*inet:url*	A URL to the ticket in an external system.	
:epic	*proj:epic*	The epic that includes the ticket.	
:name	*str* onespace: True	The name of the ticket.	
:desc	*str*	A description of the ticket.	
:points	*int*	Optional SCRUM style story points value.	
:status	*int* enums: ((0, 'new'), (10, 'in validation'), (20, 'in backlog'), (30, 'in sprint'), (40, 'in progress'), (50, 'in review'), (60, 'completed'), (70, 'done'), (80, 'blocked'))	The ticket completion status.	
:sprint	*proj:sprint*	The sprint that contains the ticket.	
:type	*str* lower: True strip: True	The type of ticket.	Example: bug
:id	*str* strip: True	The ID of the ticket.	
:project	*proj:project*	The project containing the ticket.	
:priority	*meta:priority*	The priority of the ticket.	
:created	*time*	The time the ticket was created.	
:updated	*time*	The time the ticket was last updated.	
:due	*time*	The time the ticket must be complete.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:achievement

An instance of an individual receiving an award.

The base type for the form can be found at *ps:achievement*.

Properties:

name	type	doc
:awardee	*ps:contact*	The recipient of the award.
:award	*ou:award*	The award bestowed on the awardee.
:awarded	*time*	The date the award was granted to the awardee.
:expires	*time*	The date the award or certification expires.
:revoked	*time*	The date the award was revoked by the org.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

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source	verb	target	doc
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:contact

A GUID for a contact info record.

The base type for the form can be found at *ps:contact*.

Properties:

name	type	doc	opts
:org	*ou:org*	The org which this contact represents.	
:type	*ps:contact:type:taxonoi*	The type of contact which may be used for entity resolution.	
:asof	*time*	A date/time value.	date: The time this contact was created or modified.
:person	*ps:person*	The ps:person GUID which owns this contact.	
:vitals	*ps:vitals*	The most recent known vitals for the contact.	
:name	*ps:name*	The person name listed for the contact.	alts: ('names',)
:bio	*str*	A brief bio provided for the contact.	
:desc	*str*	A description of this contact.	
:title	*ou:jobtitle*	The job/org title listed for this contact.	alts: ('titles',)
:titles	*array* type: *ou:jobtitle* sorted: True uniq: True	An array of alternate titles for the contact.	

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name	type	doc	opts
:photo	*file:bytes*	The photo listed for this contact.	
:orgname	*ou:name*	The listed org/company name for this contact.	alts: ('orgnames',)
:orgfqdn	*inet:fqdn*	The listed org/company FQDN for this contact.	
:user	*inet:user*	The username or handle for this contact.	alts: ('users',)
:service:accounts	*array* type: *inet:service:account* sorted: True uniq: True	The service accounts associated with this contact.	
:web:acct	*inet:web:acct*	Deprecated. Use :service:accounts.	Deprecated: True
:web:group	*inet:web:group*	Deprecated. Use inet:service:group:profi to link to a group.	Deprecated: True
:birth:place	*geo:place*	A fully resolved place of birth for this contact.	
:birth:place:loc	*loc*	The loc of the place of birth of this contact.	
:birth:place:name	*geo:name*	The name of the place of birth of this contact.	
:death:place	*geo:place*	A fully resolved place of death for this contact.	
:death:place:loc	*loc*	The loc of the place of death of this contact.	
:death:place:name	*geo:name*	The name of the place of death of this contact.	
:dob	*time*	The date of birth for this contact.	
:dod	*time*	The date of death for this contact.	
:url	*inet:url*	The home or main site for this contact.	
:email	*inet:email*	The main email address for this contact.	alts: ('emails',)
:email:work	*inet:email*	The work email address for this contact.	
:loc	*loc*	Best known contact geopolitical location.	

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name	type	doc	opts
:address	*geo:address*	The street address listed for the contact.	Display: {'hint': 'text'}
:place	*geo:place*	The place associated with this contact.	
:place:name	*geo:name*	The reported name of the place associated with this contact.	
:phone	*tel:phone*	The main phone number for this contact.	
:phone:fax	*tel:phone*	The fax number for this contact.	
:phone:work	*tel:phone*	The work phone number for this contact.	
:id	*str* strip: True	A type or source specific unique ID for the contact.	
:id:number	*ou:id:number*	An ID number issued by an org and associated with this contact.	alts: ('id:numbers',)
:adid	*it:adid*	A Advertising ID associated with this contact.	
:imid	*tel:mob:imid*	An IMID associated with the contact.	
:imid:imei	*tel:mob:imei*	An IMEI associated with the contact.	
:imid:imsi	*tel:mob:imsi*	An IMSI associated with the contact.	
:names	*array* type: *ps:name* uniq: True sorted: True	An array of associated names/aliases for the person.	
:orgnames	*array* type: *ou:name* uniq: True sorted: True	An array of associated names/aliases for the organization.	
:emails	*array* type: *inet:email* uniq: True sorted: True	An array of secondary/associated email addresses.	

continues on next page

Table 482 – continued from previous page

name	type	doc	opts
:web:accts	*array* type: *inet:web:acct* uniq: True sorted: True	Deprecated. Use :service:accounts.	Deprecated: True
:id:numbers	*array* type: *ou:id:number* uniq: True sorted: True	An array of secondary/associated IDs.	
:users	*array* type: *inet:user* uniq: True sorted: True	An array of secondary/associated user names.	
:crypto:address	*crypto:currency:addres*	A crypto currency address associated with the contact.	
:lang	*lang:language*	The language specified for the contact.	alts: ('langs',)
:langs	*array* type: *lang:language*	An array of alternative languages specified for the contact.	
:banner	*file:bytes*	The file representing the banner for the contact.	
:passwd	*inet:passwd*	The current password for the contact.	
:website	*inet:url*	A related URL specified by the contact (e.g., a personal or company web page, blog, etc.).	
:websites	*array* type: *inet:url* uniq: True sorted: True	Alternative related URLs specified by the contact.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:contact:type:taxonomy

A taxonomy of contact types.

The base type for the form can be found at *ps:contact:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ps:contact:type:taxonor*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:contactlist

A GUID for a list of associated contacts.

The base type for the form can be found at *ps:contactlist*.

Properties:

name	type	doc	opts
:contacts	*array* type: *ps:contact* uniq: True split: , sorted: True	The array of contacts contained in the list.	
:source:host	*it:host*	The host from which the contact list was extracted.	
:source:file	*file:bytes*	The file from which the contact list was extracted.	
:source:acct	*inet:web:acct*	Deprecated. Use :source:account.	Deprecated: True
:source:account	*inet:service:account*	The service account from which the contact list was extracted.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:education

A period of education for an individual.

The base type for the form can be found at *ps:education*.

Properties:

name	type	doc
:student	*ps:contact*	The contact of the person being educated.
:institution	*ps:contact*	The contact info for the org providing educational services.
:attended:first	*time*	The first date the student attended a class.
:attended:last	*time*	The last date the student attended a class.
:classes	*array* type: *edu:class* uniq: True sorted: True	The classes attended by the student.
:achievement	*ps:achievement*	The achievement awarded to the individual.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:name

An arbitrary, lower spaced string with normalized whitespace.

The base type for the form can be found at *ps:name*.

An example of `ps:name`:

- `robert grey`

Properties:

name	type	doc
:sur	*ps:tokn*	The surname part of the name.
:middle	*ps:tokn*	The middle name part of the name.
:given	*ps:tokn*	The given name part of the name.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:person

A GUID for a person.

The base type for the form can be found at *ps:person*.

Properties:

name	type	doc	opts
:dob	*time*	The date on which the person was born.	
:dod	*time*	The date on which the person died.	
:img	*file:bytes*	Deprecated: use ps:person:photo.	Deprecated: True
:photo	*file:bytes*	The primary image of a person.	
:nick	*inet:user*	A username commonly used by the person.	
:vitals	*ps:vitals*	The most recent known vitals for the person.	
:name	*ps:name*	The localized name for the person.	alts: ('names',)
:name:sur	*ps:tokn*	The surname of the person.	
:name:middle	*ps:tokn*	The middle name of the person.	
:name:given	*ps:tokn*	The given name of the person.	
:names	*array* type: *ps:name* uniq: True sorted: True	Variations of the name for the person.	
:nicks	*array* type: *inet:user* uniq: True sorted: True	Usernames used by the person.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:person:has

Deprecated. Please use ps:person -(has)>.

The base type for the form can be found at *ps:person:has*.

Properties:

name	type	doc	opts
:person	*ps:perso*	The person who owns or controls the object or resource.	Read Only: True
:node	*ndef*	The object or resource that is owned or controlled by the person.	Read Only: True
:node:for	*str*	The form of the object or resource that is owned or controlled by the person.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:persona

Deprecated. Please use ps:contact.

The base type for the form can be found at *ps:persona*.

Properties:

name	type	doc
:person	*ps:person*	The real person behind the persona.
:dob	*time*	The Date of Birth (DOB) if known.
:img	*file:bytes*	The primary image of a suspected person.
:nick	*inet:user*	A username commonly used by the suspected person.
:name	*ps:name*	The localized name for the suspected person.
:name:sur	*ps:tokn*	The surname of the suspected person.
:name:middle	*ps:tokn*	The middle name of the suspected person.
:name:given	*ps:tokn*	The given name of the suspected person.
:names	*array* type: *ps:name* uniq: True sorted: True	Variations of the name for a persona.
:nicks	*array* type: *inet:user* uniq: True sorted: True	Usernames used by the persona.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 490 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:persona:has

Deprecated. Please use ps:contact -(has)>.

The base type for the form can be found at *ps:persona:has*.

Properties:

name	type	doc	opts
:persona	*ps:person*	The persona who owns or controls the object or resource.	Read Only: True
:node	*ndef*	The object or resource that is owned or controlled by the persona.	Read Only: True
:node:for	*str*	The form of the object or resource that is owned or controlled by the persona.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:proficiency

The assessment that a given contact possesses a specific skill.

The base type for the form can be found at *ps:proficiency*.

Properties:

name	type	doc
:skill	*ps:skill*	The skill in which the contact is proficient.
:contact	*ps:contact*	The contact which is proficient in the skill.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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Table 492 – continued from previous page

source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:skill

A specific skill which a person or organization may have.

The base type for the form can be found at *ps:skill*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the skill.
:type	*ps:skill:type:taxonomy*	The type of skill as a taxonomy.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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Table 493 – continued from previous page

source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:skill:type:taxonomy

A taxonomy of skill types.

The base type for the form can be found at *ps:skill:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*ps:skill:type:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:tokn

A single name element (potentially given or sur).

The base type for the form can be found at *ps:tokn*.

An example of `ps:tokn`:

- robert

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:vitals

Statistics and demographic data about a person or contact.

The base type for the form can be found at *ps:vitals*.

Properties:

name	type	doc
:asof	*time*	The time the vitals were gathered or computed.
:contact	*ps:contact*	The contact that the vitals are about.
:person	*ps:person*	The person that the vitals are about.
:height	*geo:dist*	The height of the person or contact.
:weight	*mass*	The weight of the person or contact.
:econ:currency	*econ:currency*	The currency that the price values are recorded using.
:econ:net:worth	*econ:price*	The net worth of the contact.
:econ:annual:income	*econ:price*	The yearly income of the contact.
:phys:mass	*mass*	The mass of the person.
:phys:volume	*geo:dist*	The cubed volume of the person.
:phys:length	*geo:dist*	The length of the person.
:phys:width	*geo:dist*	The width of the person.
:phys:height	*geo:dist*	The height of the person.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

ps:workhist

An entry in a contact's work history.

The base type for the form can be found at *ps:workhist*.

Properties:

name	type	doc
:contact	*ps:contact*	The contact which has the work history.
:org	*ou:org*	The org that this work history orgname refers to.
:orgname	*ou:name*	The reported name of the org the contact worked for.
:orgfqdn	*inet:fqdn*	The reported fqdn of the org the contact worked for.
:jobtype	*ou:jobtype*	The type of job.
:employment	*ou:employment*	The type of employment.
:jobtitle	*ou:jobtitle*	The job title.
:started	*time*	The date that the contact began working.
:ended	*time*	The date that the contact stopped working.
:duration	*duration*	The duration of the period of work.
:pay	*econ:price*	The estimated/average yearly pay for the work.
:currency	*econ:currency*	The currency that the yearly pay was delivered in.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:alert

An instance of an alert which indicates the presence of a risk.

The base type for the form can be found at *risk:alert*.

Properties:

name	type	doc	opts
:type	*risk:alert:taxonomy*	A type for the alert, as a taxonomy entry.	
:name	*str*	A brief name for the alert.	
:desc	*str*	A free-form description / overview of the alert.	Display: {'hint': 'text'}
:status	*int* enums: ((0, 'new'), (10, 'enrichment'), (20, 'todo'), (30, 'analysis'), (40, 'remediation'), (50, 'done'))	The status of the alert.	
:benign	*bool*	Set to true if the alert has been confirmed benign. Set to false if malicious.	
:priority	*meta:priority*	A priority rank for the alert.	
:severity	*meta:severity*	A severity rank for the alert.	
:verdict	*risk:alert:verdict:taxon*	A verdict about why the alert is malicious or benign, as a taxonomy entry.	Example: benign.false_positive
:assignee	*syn:user*	The Synapse user who is assigned to investigate the alert.	
:ext:assignee	*ps:contact*	The alert assignee contact information from an external system.	
:engine	*it:prod:softver*	The software that generated the alert.	
:detected	*time*	The time the alerted condition was detected.	
:vuln	*risk:vuln*	The optional vulnerability that the alert indicates.	
:attack	*risk:attack*	A confirmed attack that this alert indicates.	
:url	*inet:url*	A URL which documents the alert.	
:ext:id	*str*	An external identifier for the alert.	
:host	*it:host*	The host which generated the alert.	
:service:platform	*inet:service:platform*	The service platform which generated the	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:alert:taxonomy

A taxonomy of alert types.

The base type for the form can be found at *risk:alert:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:alert:taxonomy*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:alert:verdict:taxonomy

A taxonomy of verdicts for the origin and validity of the alert.

The base type for the form can be found at *risk:alert:verdict:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:alert:verdict:taxon*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:attack

An instance of an actor attacking a target.

The base type for the form can be found at *risk:attack*.

Properties:

name	type	doc	opts
:desc	*str*	A description of the attack.	Display: {'hint': 'text'}
:type	*risk:attacktype*	A type for the attack, as a taxonomy entry.	Example: cno.phishing
:reporter	*ou:org*	The organization reporting on the attack.	
:reporter:name	*ou:name*	The name of the organization reporting on the attack.	
:time	*time*	Set if the time of the attack is known.	
:detected	*time*	The first confirmed detection time of the attack.	
:success	*bool*	Set if the attack was known to have succeeded or not.	
:targeted	*bool*	Set if the attack was assessed to be targeted or not.	
:goal	*ou:goal*	The tactical goal of this specific attack.	
:campaign	*ou:campaign*	Set if the attack was part of a larger campaign.	
:compromise	*risk:compromise*	A compromise that this attack contributed to.	
:severity	*meta:severity*	A severity rank for the attack.	
:sophistication	*meta:sophistication*	The assessed sophistication of the attack.	
:prev	*risk:attack*	The previous/parent attack in a list or hierarchy.	
:actor:org	*ou:org*	Deprecated. Please use :attacker to allow entity resolution.	Deprecated: True
:actor:person	*ps:person*	Deprecated. Please use :attacker to allow entity resolution.	Deprecated: True
:attacker	*ps:contact*	Contact information representing the attacker.	
:target	*ps:contact*	Deprecated. Please use -(targets)> light weight edges.	Deprecated: True
:target:org	*ou:org*	Deprecated. Please use -(targets)> light weight edges.	Deprecated: True

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Table 501 – continued from previous page

name	type	doc	opts
:target:host	*it:host*	Deprecated. Please use -(targets)> light weight edges.	Deprecated: True
:target:person	*ps:person*	Deprecated. Please use -(targets)> light weight edges.	Deprecated: True
:target:place	*geo:place*	Deprecated. Please use -(targets)> light weight edges.	Deprecated: True
:via:ipv4	*inet:ipv4*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:via:ipv6	*inet:ipv6*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:via:email	*inet:email*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:via:phone	*tel:phone*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:vuln	*risk:vuln*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:url	*inet:url*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:host	*it:host*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:email	*inet:email*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:file	*file:bytes*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:server	*inet:server*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:used:software	*it:prod:softver*	Deprecated. Please use -(uses)> light weight edges.	Deprecated: True
:techniques	*array* type: *ou:technique* sorted: True uniq: True	Deprecated for scalability. Please use -(uses)> ou:technique.	Deprecated: True
:url	*inet:url*	A URL which documents the attack.	

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Table 501 – continued from previous page

name	type	doc	opts
:ext:id	*str*	An external unique ID for the attack.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:attack	-(caused)>	risk:outage	The attack caused the outage.
risk:attack	-(targets)>	ou:industry	The attack targeted the industry.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	ou:technique	The attacker used the technique in the attack.
risk:attack	-(uses)>	risk:vuln	The attack used the vulnerability.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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Table 502 – continued from previous page

source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:attacktype

A taxonomy of attack types.

The base type for the form can be found at *risk:attacktype*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:attacktype*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 503 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:availability

A taxonomy of availability status values.

The base type for the form can be found at *risk:availability*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:availability*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:compromise

A compromise and its aggregate impact. The compromise is the result of a successful attack.

The base type for the form can be found at *risk:compromise*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A brief name for the compromise event.	
:desc	*str*	A prose description of the compromise event.	Display: {'hint': 'text'}
:reporter	*ou:org*	The organization reporting on the compromise.	
:reporter:name	*ou:name*	The name of the organization reporting on the compromise.	
:ext:id	*str*	An external unique ID for the compromise.	
:url	*inet:url*	A URL which documents the compromise.	
:type	*risk:compromisetype*	A type for the compromise, as a taxonomy entry.	Example: cno.breach
:vector	*risk:attack*	The attack assessed to be the initial compromise vector.	
:target	*ps:contact*	Contact information representing the target.	
:attacker	*ps:contact*	Contact information representing the attacker.	
:campaign	*ou:campaign*	The campaign that this compromise is part of.	
:time	*time*	Earliest known evidence of compromise.	
:lasttime	*time*	Last known evidence of compromise.	
:duration	*duration*	The duration of the compromise.	
:detected	*time*	The first confirmed detection time of the compromise.	
:loss:pii	*int*	The number of records compromised which contain PII.	
:loss:econ	*econ:price*	The total economic cost of the compromise.	
:loss:life	*int*	The total loss of life due to the compromise.	
:loss:bytes	*int*	An estimate of the volume of data compromised.	
:ransom:paid	*econ:price*	The value of the ransom paid by the target.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiren	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:compro	-(stole)>	*	The target node was stolen or copied as a result of the compromise.
risk:compro	-(targets	ou:industry	The compromise was assessed to be based on the victim's role in the industry.
risk:compro	-(uses)>	ou:techniq	The attacker used the technique in the compromise.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:compromisetype

A taxonomy of compromise types.

The base type for the form can be found at *risk:compromisetype*.

An example of `risk:compromisetype`:

- `cno.breach`

Properties:

name	type	doc	opts
`:title`	*str*	A brief title of the definition.	
`:summary`	*str*	Deprecated. Please use title/desc.	Deprecated: `True` Display: `{'hint': 'text'}`
`:desc`	*str*	A definition of the taxonomy entry.	Display: `{'hint': 'text'}`
`:sort`	*int*	A display sort order for siblings.	
`:base`	*taxon*	The base taxon.	Read Only: `True`
`:depth`	*int*	The depth indexed from 0.	Read Only: `True`
`:parent`	*risk:compromisetype*	The taxonomy parent.	Read Only: `True`

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.

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Table 506 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:extortion

An event where an attacker attempted to extort a victim.

The base type for the form can be found at *risk:extortion*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A name for the extortion event.	
:desc	*str*	A description of the extortion event.	Display: {'hint': 'text'}
:reporter	*ou:org*	The organization reporting on the extortion event.	
:reporter:name	*ou:name*	The name of the organization reporting on the extortion event.	
:demanded	*time*	The time that the attacker made their demands.	
:deadline	*time*	The time that the demand must be met.	
:goal	*ou:goal*	The goal of the attacker in extorting the victim.	
:type	*risk:extortion:type:taxo*	A type taxonomy for the extortion event.	
:attacker	*ps:contact*	The extortion attacker identity.	
:target	*ps:contact*	The extortion target identity.	
:success	*bool*	Set to true if the victim met the attacker's demands.	
:enacted	*bool*	Set to true if attacker carried out the threat.	
:public	*bool*	Set to true if the attacker publicly announced the extortion.	
:public:url	*inet:url*	The URL where the attacker publicly announced the extortion.	
:compromise	*risk:compromise*	The compromise which allowed the attacker to extort the target.	
:demanded:payment:	*econ:price*	The payment price which was demanded.	
:demanded:payment:	*econ:currency*	The currency in which payment was demanded.	
:paid:price	*econ:price*	The total price paid by the target of the extortion.	
:payments	*array* type: *econ:acct:payment*	Payments made from the target to the attacker.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirem	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:extort	-(leverage	*	The extortion event was based on attacker access to the target node.
risk:extort	-(uses)>	ou:techniqu	The attacker used the technique to extort the victim.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:extortion:type:taxonomy

A taxonomy of extortion event types.

The base type for the form can be found at *risk:extortion:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:extortion:type:taxc*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:hasvuln

Deprecated. Please use risk:vulnerable.

The base type for the form can be found at *risk:hasvuln*.

Properties:

name	type	doc
:vuln	*risk:vuln*	The vulnerability present in the target.
:person	*ps:person*	The vulnerable person.
:org	*ou:org*	The vulnerable org.
:place	*geo:place*	The vulnerable place.
:software	*it:prod:softver*	The vulnerable software.
:hardware	*it:prod:hardware*	The vulnerable hardware.
:spec	*mat:spec*	The vulnerable material specification.
:item	*mat:item*	The vulnerable material item.
:host	*it:host*	The vulnerable host.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:leak

An event where information was disclosed without permission.

The base type for the form can be found at *risk:leak*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A simple name for the leak event.	
:desc	*str*	A description of the leak event.	Display: {'hint': 'text'}
:reporter	*ou:org*	The organization reporting on the leak event.	
:reporter:name	*ou:name*	The name of the organization reporting on the leak event.	
:disclosed	*time*	The time the leaked information was disclosed.	
:owner	*ps:contact*	The owner of the leaked information.	
:leaker	*ps:contact*	The identity which leaked the information.	
:recipient	*ps:contact*	The identity which received the leaked information.	
:type	*risk:leak:type:taxonom*	A type taxonomy for the leak.	
:goal	*ou:goal*	The goal of the leaker in disclosing the information.	
:compromise	*risk:compromise*	The compromise which allowed the leaker access to the information.	
:extortion	*risk:extortion*	The extortion event which used the threat of the leak as leverage.	
:public	*bool*	Set to true if the leaked information was made publicly available.	
:public:url	*inet:url*	The URL where the leaked information was made publicly available.	
:size:bytes	*int* min: 0	The total size of the leaked data in bytes.	
:size:count	*int* min: 0	The number of files included in the leaked data.	
:size:percent	*int*	The total percent of the data leaked.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:leak	-(enabled)>	risk:leak	The source leak enabled the target leak to occur.
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target nod
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the quer
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the comp
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targ
risk:leak	-(enabled)>	risk:leak	None
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:leak:type:taxonomy

A taxonomy of leak event types.

The base type for the form can be found at *risk:leak:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:leak:type:taxonom*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:mitigation

A mitigation for a specific risk:vuln.

The base type for the form can be found at *risk:mitigation*.

Properties:

name	type	doc	opts
:vuln	*risk:vuln*	The vulnerability that this mitigation addresses.	
:name	*str* lower: True onespace: True	A brief name for this risk mitigation.	
:type	*risk:mitigation:type:tax*	A taxonomy type entry for the mitigation.	
:desc	*str*	A description of the mitigation approach for the vulnerability.	Display: {'hint': 'text'}
:software	*it:prod:softver*	Deprecated. Please use risk:mitigation -(uses)> it:prod:softver.	Deprecated: True
:hardware	*it:prod:hardware*	Deprecated. Please use risk:mitigation -(uses)> it:prod:hardware.	Deprecated: True
:reporter	*ou:org*	The organization reporting on the mitigation.	
:reporter:name	*ou:name*	The name of the organization reporting on the mitigation.	
:mitre:attack:miti	*it:mitre:attack:mitigatic*	A mapping to a MITRE ATT&CK mitigation if applicable.	
:tag	*syn:tag*	The tag used to annotate nodes which have the mitigation in place.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:mitigati	-(addresses	ou:technique	The mitigation addresses the technique.
risk:mitigati	-(uses)>	meta:rule	The mitigation uses the rule.
risk:mitigati	-(uses)>	it:app:yara:ru	The mitigation uses the YARA rule.
risk:mitigati	-(uses)>	it:app:snort:r	The mitigation uses the Snort rule.
risk:mitigati	-(uses)>	inet:service:r	The mitigation uses the service rule.
risk:mitigati	-(uses)>	it:prod:softve	The mitigation uses the software version.
risk:mitigati	-(uses)>	it:prod:hardwa	The mitigation uses the hardware.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

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source	verb	target	doc
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:mitigation:type:taxonomy

A taxonomy of mitigation types.

The base type for the form can be found at *risk:mitigation:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:mitigation:type:tax*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:outage

An outage event which affected resource availability.

The base type for the form can be found at *risk:outage*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A name for the outage event.	
:period	*ival*	The time period where the outage impacted availability.	
:type	*risk:outage:type:taxonc*	The type of outage.	Example: service.power
:cause	*risk:outage:cause:taxo*	The outage cause type.	Example: nature.earthquake
:attack	*risk:attack*	An attack which caused the outage.	
:provider	*ou:org*	The organization which experienced the outage event.	
:provider:name	*ou:name*	The name of the organization which experienced the outage event.	
:reporter	*ou:org*	The organization reporting on the outage event.	
:reporter:name	*ou:name*	The name of the organization reporting on the outage event.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:outag	-(impacted)	*	The outage event impacted the availability of the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target n
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target
it:exec:query	-(found)>	*	The target node was returned as a result of running the qu
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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source	verb	target	doc
meta:event	-(caused)>	risk:outage	The event caused the outage.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the targe
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target nod
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(caused)>	risk:outage	The attack caused the outage.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the co
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the ta
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:outage:cause:taxonomy

An outage cause taxonomy.

The base type for the form can be found at *risk:outage:cause:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:outage:cause:taxo*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:outage:type:taxonomy

An outage type taxonomy.

The base type for the form can be found at *risk:outage:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:outage:type:taxonc*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:technique:masquerade

Represents the assessment that a node is designed to resemble another in order to mislead.

The base type for the form can be found at *risk:technique:masquerade*.

Properties:

name	type	doc
:node	*ndef*	The node masquerading as another.
:period	*ival*	The time period when the masquerading was active.
:target	*ndef*	The being masqueraded as.
:technique	*ou:technique*	The specific technique which describes the type of masquerading.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:threat

A threat cluster or subgraph of threat activity, as reported by a specific organization.

The base type for the form can be found at *risk:threat*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	A brief descriptive name for the threat cluster.	Example: apt1 (mandiant)
:type	*risk:threat:type:taxonoi*	A type for the threat, as a taxonomy entry.	
:desc	*str*	A description of the threat cluster.	
:tag	*syn:tag*	The tag used to annotate nodes that are associated with the threat cluster.	
:active	*ival*	An interval for when the threat cluster is assessed to have been active.	
:activity	*meta:activity*	The most recently assessed activity level of the threat cluster.	
:reporter	*ou:org*	The organization reporting on the threat cluster.	
:reporter:name	*ou:name*	The name of the organization reporting on the threat cluster.	
:reporter:discover	*time*	The time that the reporting organization first discovered the threat cluster.	
:reporter:publishe	*time*	The time that the reporting organization first publicly disclosed the threat cluster.	
:org	*ou:org*	The authoritative organization for the threat cluster.	
:org:loc	*loc*	The reporting organization's assessed location of the threat cluster.	
:org:name	*ou:name*	The reporting organization's name for the threat cluster.	alts: ('org:names',) Example: apt1
:org:names	*array* type: *ou:name* sorted: True uniq: True	An array of alternate names for the threat cluster, according to the reporting organization.	
:country	*pol:country*	The reporting organization's assessed	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:threat	-(targets)>	ou:industry	The threat cluster targets the industry.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	ou:technique	The threat cluster uses the technique.
risk:threat	-(uses)>	risk:vuln	The threat cluster uses the vulnerability.
risk:threat	-(uses)>	*	The threat cluster uses the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:threat:type:taxonomy

A taxonomy of threat types.

The base type for the form can be found at *risk:threat:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:threat:type:taxono*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:tool:software

A software tool used in threat activity, as reported by a specific organization.

The base type for the form can be found at *risk:tool:software*.

Properties:

name	type	doc	opts
:tag	*syn:tag*	The tag used to annotate nodes that are associated with the tool.	Example: rep.mandiant.tabcteng
:desc	*str*	A description of the tool.	
:type	*risk:tool:software:taxo*	A type for the tool, as a taxonomy entry.	
:used	*ival*	An interval for when the tool is assessed to have been deployed.	
:availability	*risk:availability*	The reporting organization's assessed availability of the tool.	
:sophistication	*meta:sophistication*	The reporting organization's assessed sophistication of the tool.	
:reporter	*ou:org*	The organization reporting on the tool.	
:reporter:name	*ou:name*	The name of the organization reporting on the tool.	
:reporter:discover	*time*	The time that the reporting organization first discovered the tool.	
:reporter:publishe	*time*	The time that the reporting organization first publicly disclosed the tool.	
:soft	*it:prod:soft*	The authoritative software family for the tool.	
:soft:name	*it:prod:softname*	The reporting organization's name for the tool.	alts: ('soft:names',)
:soft:names	*array* type: *it:prod:softname* uniq: True sorted: True	An array of alternate names for the tool, according to the reporting organization.	
:techniques	*array* type: *ou:technique* uniq: True sorted: True	Deprecated for scalability. Please use -(uses)> ou:technique.	Deprecated: True
:mitre:attack:soft	*it:mitre:attack:software*	A mapping to a MITRE ATT&CK software if applicable.	
:id	*str*	An ID for the tool.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requireme	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)	geo:telem	Deprecated. Please use geo:telem:node.
risk:tool:softw	-(uses)>	math:algorit	The tool uses the algorithm.
risk:tool:softw	-(uses)>	ou:technique	The tool uses the technique.
risk:tool:softw	-(uses)>	risk:vuln	The tool uses the vulnerability.
risk:tool:softw	-(uses)>	*	The tool uses the target node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:tool:software:taxonomy

A taxonomy of software / tool types.

The base type for the form can be found at *risk:tool:software:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:tool:software:taxo*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.

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Table 521 – continued from previous page

source	verb	target	doc
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:vuln

A unique vulnerability.

The base type for the form can be found at *risk:vuln*.

Properties:

name	type	doc	opts
:name	*risk:vulnname*	A user specified name for the vulnerability.	alts: ('names',)
:names	*array* type: *risk:vulnname* sorted: True uniq: True	An array of alternate names for the vulnerability.	
:type	*risk:vuln:type:taxonom*	A taxonomy type entry for the vulnerability.	
:desc	*str*	A description of the vulnerability.	Display: {'hint': 'text'}
:severity	*meta:severity*	The severity of the vulnerability.	
:priority	*meta:priority*	The priority of the vulnerability.	

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Table 522 – continued from previous page

name	type	doc	opts
:reporter	*ou:org*	The organization reporting on the vulnerability.	
:reporter:name	*ou:name*	The name of the organization reporting on the vulnerability.	
:mitigated	*bool*	Set to true if a mitigation/fix is available for the vulnerability.	
:exploited	*bool*	Set to true if the vulnerability has been exploited in the wild.	
:timeline:discover	*time* ismin: True	The earliest known discovery time for the vulnerability.	
:timeline:publishe	*time* ismin: True	The earliest known time the vulnerability was published.	
:timeline:vendor:n	*time* ismin: True	The earliest known vendor notification time for the vulnerability.	
:timeline:vendor:f	*time* ismin: True	The earliest known time the vendor issued a fix for the vulnerability.	
:timeline:exploite	*time* ismin: True	The earliest known time when the vulnerability was exploited in the wild.	
:id	*str* strip: True	An identifier for the vulnerability.	
:tag	*syn:tag*	A tag used to annotate the presence or use of the vulnerability.	
:cve	*it:sec:cve*	The CVE ID of the vulnerability.	
:cve:desc	*str*	The description of the vulnerability according to the CVE database.	Display: {'hint': 'text'}
:cve:url	*inet:url*	A URL linking this vulnerability to the CVE description.	

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Table 522 – continued from previous page

name	type	doc	opts
:cve:references	*array* type: *inet:url* uniq: True sorted: True	An array of documentation URLs provided by the CVE database.	
:nist:nvd:source	*ou:name*	Deprecated. Please use it:sec:cve:nist:nvd:sour	Deprecated: True
:nist:nvd:publishe	*time*	Deprecated. Please use it:sec:cve:nist:nvd:publ	Deprecated: True
:nist:nvd:modified	*time* ismax: True	Deprecated. Please use it:sec:cve:nist:nvd:mod	Deprecated: True
:cisa:kev:name	*str*	Deprecated. Please use it:sec:cve:cisa:kev:nam	Deprecated: True
:cisa:kev:desc	*str*	Deprecated. Please use it:sec:cve:cisa:kev:desc	Deprecated: True
:cisa:kev:action	*str*	Deprecated. Please use it:sec:cve:cisa:kev:actio	Deprecated: True
:cisa:kev:vendor	*ou:name*	Deprecated. Please use it:sec:cve:cisa:kev:vend	Deprecated: True
:cisa:kev:product	*it:prod:softname*	Deprecated. Please use it:sec:cve:cisa:kev:prod	Deprecated: True
:cisa:kev:added	*time*	Deprecated. Please use it:sec:cve:cisa:kev:adde	Deprecated: True
:cisa:kev:duedate	*time*	Deprecated. Please use it:sec:cve:cisa:kev:dued	Deprecated: True
:cvss:v2	*cvss:v2*	The CVSS v2 vector for the vulnerability.	
:cvss:v2_0:score	*float*	The CVSS v2.0 overall score for the vulnerability.	
:cvss:v2_0:score:b	*float*	The CVSS v2.0 base score for the vulnerability.	
:cvss:v2_0:score:t	*float*	The CVSS v2.0 temporal score for the vulnerability.	

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Table 522 – continued from previous page

name	type	doc	opts
:cvss:v2_0:score:e	*float*	The CVSS v2.0 environmental score for the vulnerability.	
:cvss:v3	*cvss:v3*	The CVSS v3 vector for the vulnerability.	
:cvss:v3_0:score	*float*	The CVSS v3.0 overall score for the vulnerability.	
:cvss:v3_0:score:b	*float*	The CVSS v3.0 base score for the vulnerability.	
:cvss:v3_0:score:t	*float*	The CVSS v3.0 temporal score for the vulnerability.	
:cvss:v3_0:score:e	*float*	The CVSS v3.0 environmental score for the vulnerability.	
:cvss:v3_1:score	*float*	The CVSS v3.1 overall score for the vulnerability.	
:cvss:v3_1:score:b	*float*	The CVSS v3.1 base score for the vulnerability.	
:cvss:v3_1:score:t	*float*	The CVSS v3.1 temporal score for the vulnerability.	
:cvss:v3_1:score:e	*float*	The CVSS v3.1 environmental score for the vulnerability.	
:cvss:av	*str* enums: `N,A,P,L`	Deprecated. Please use :cvss:v3.	Deprecated: `True`
:cvss:ac	*str* enums: `L,H`	Deprecated. Please use :cvss:v3.	Display: `{'enums': (('Low', 'L'), ('High', 'H'))}` Deprecated: `True`

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Table 522 – continued from previous page

name	type	doc	opts
:cvss:pr	*str* enums: N,L,H	Deprecated. Please use :cvss:v3.	Display: {'enums': ({'title': 'None', 'value': 'N', 'doc': 'FIXME privs stuff'}, {'title': 'Low', 'value': 'L', 'doc': 'FIXME privs stuff'}, {'title': 'High', 'value': 'H', 'doc': 'FIXME privs stuff'})} Deprecated: True
:cvss:ui	*str* enums: N,R	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:s	*str* enums: U,C	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:c	*str* enums: N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:i	*str* enums: N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:a	*str* enums: N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:e	*str* enums: X,U,P,F,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:rl	*str* enums: X,O,T,W,U	Deprecated. Please use :cvss:v3.	Deprecated: True

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Table 522 – continued from previous page

name	type	doc	opts
:cvss:rc	*str* enums: X,U,R,C	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mav	*str* enums: X,N,A,L,P	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mac	*str* enums: X,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mpr	*str* enums: X,N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mui	*str* enums: X,N,R	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:ms	*str* enums: X,U,C	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mc	*str* enums: X,N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:mi	*str* enums: X,N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:ma	*str* enums: X,N,L,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:cr	*str* enums: X,L,M,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:ir	*str* enums: X,L,M,H	Deprecated. Please use :cvss:v3.	Deprecated: True
:cvss:ar	*str* enums: X,L,M,H	Deprecated. Please use :cvss:v3.	Deprecated: True

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Table 522 – continued from previous page

name	type	doc	opts
:cvss:score	*float*	Deprecated. Please use version specific score properties.	Deprecated: True
:cvss:score:base	*float*	Deprecated. Please use version specific score properties.	Deprecated: True
:cvss:score:tempor	*float*	Deprecated. Please use version specific score properties.	Deprecated: True
:cvss:score:enviro	*float*	Deprecated. Please use version specific score properties.	Deprecated: True
:cwes	*array* type: *it:sec:cwe* uniq: True sorted: True	An array of MITRE CWE values that apply to the vulnerability.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
risk:vuln	-(uses)>	ou:technique	The vulnerability uses the technique.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target nod
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the quer
it:prod:soft	-(uses)>	risk:vuln	The software uses the vulnerability.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.

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Table 523 – continued from previous page

source	verb	target	doc
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
ou:technique	-(uses)>	risk:vuln	The technique uses the vulnerability.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	risk:vuln	The attack used the vulnerability.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the comp
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targ
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target nod
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	risk:vuln	The threat cluster uses the vulnerability.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	risk:vuln	The tool uses the vulnerability.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:vuln:soft:range

A contiguous range of software versions which contain a vulnerability.

The base type for the form can be found at *risk:vuln:soft:range*.

Properties:

name	type	doc
:vuln	*risk:vuln*	The vulnerability present in this software version range.
:version:min	*it:prod:softver*	The minimum version which is vulnerable in this range.
:version:max	*it:prod:softver*	The maximum version which is vulnerable in this range.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:vuln:type:taxonomy

A taxonomy of vulnerability types.

The base type for the form can be found at *risk:vuln:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*risk:vuln:type:taxonom*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:vulnerable

Indicates that a node is susceptible to a vulnerability.

The base type for the form can be found at *risk:vulnerable*.

Properties:

name	type	doc
:vuln	*risk:vuln*	The vulnerability that the node is susceptible to.
:technique	*ou:technique*	The technique that the node is susceptible to.
:period	*ival*	The time window where the node was vulnerable.
:node	*ndef*	The node which is vulnerable.
:mitigated	*bool*	Set to true if the vulnerable node has been mitigated.
:mitigations	*array* type: *risk:mitigation* sorted: True uniq: True	The mitigations which were used to address the vulnerable node.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

risk:vulnname

A vulnerability name such as log4j or rowhammer.

The base type for the form can be found at *risk:vulnname*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

rsa:key

An RSA keypair modulus and public exponent.

The base type for the form can be found at *rsa:key*.

Properties:

name	type	doc	opts
:mod	*hex*	The RSA key modulus.	Read Only: True
:pub:exp	*int*	The public exponent of the key.	Read Only: True
:bits	*int*	The length of the modulus in bits.	
:priv:exp	*hex*	The private exponent of the key.	
:priv:p	*hex*	One of the two private primes.	
:priv:q	*hex*	One of the two private primes.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.

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Table 528 – continued from previous page

source	verb	target	doc
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:evidence

An assessment of how an observation supports or refutes a hypothesis.

The base type for the form can be found at *sci:evidence*.

Properties:

name	type	doc	opts
:hypothe	*sci:experi*	The hypothesis which the evidence supports or refutes.	
:observa	*sci:observ*	The observation which supports or refutes the hypothesis.	
:summary	*str*	A summary of how the observation supports or refutes the hypothesis.	Display: {'hint': 'text'}
:refutes	*bool*	Set to true if the evidence refutes the hypothesis or false if it supports the hypothesis.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremen	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
sci:evidenc	-(has)>	*	The evidence includes observations from the target nodes.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:experiment

An instance of running an experiment.

The base type for the form can be found at *sci:experiment*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the experiment.	
:summary	*str*	A summary of the experiment.	Display: {'hint': 'text'}
:time	*time*	The time when the experiment was initiated.	
:type	*sci:experiment:type:tax*	The type of experiment as a user defined taxonomy.	
:window	*ival*	The time window where the experiment was run.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.
sci:experimen	-(uses)>	*	The experiment used the target nodes when it was run.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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Table 530 – continued from previous page

source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:experiment:type:taxonomy

A taxonomy of experiment types.

The base type for the form can be found at *sci:experiment:type:taxonomy*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:hypothesis

A hypothesis or theory.

The base type for the form can be found at *sci:hypothesis*.

Properties:

name	type	doc	opts
:name	*str* lower: True onespace: True	The name of the hypothesis.	
:type	*sci:hypothesis:type:taxo*	The type of hypothesis as a user defined taxonomy.	
:summary	*str*	A summary of the hypothesis.	Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:hypothesis:type:taxonomy

A taxonomy of hypothesis types.

The base type for the form can be found at *sci:hypothesis:type:taxonomy*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

sci:observation

An observation which may have resulted from an experiment.

The base type for the form can be found at *sci:observation*.

Properties:

name	type	doc	opts
:experimen	*sci:experimer*	The experiment which produced the observation.	
:summary	*str*	A summary of the observation.	Display: {'hint': 'text'}
:time	*time*	The time that the observation occurred.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.
sci:observati	-(has)>	*	The observations are summarized from the target nodes.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.

syn:cmd

A Synapse storm command.

The base type for the form can be found at *syn:cmd*.

Properties:

name	type	doc	opts
:doc	*str* strip: True	Description of the command.	Display: {'hint': 'text'}
:package	*str* strip: True	Storm package which provided the command.	
:svciden	*guid* strip: True	Storm service iden which provided the package.	
:input	*array* type: *syn:form*	The list of forms accepted by the command as input.	Deprecated: True uniq: True sorted: True Read Only: True
:output	*array* type: *syn:form*	The list of forms produced by the command as output.	Deprecated: True uniq: True sorted: True Read Only: True
:nodedata	*array* type: *syn:nodedata*	The list of nodedata that may be added by the command.	Deprecated: True uniq: True sorted: True Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:cron

A Cortex cron job.

The base type for the form can be found at *syn:cron*.

Properties:

name	type	doc	opts
:doc	*str*	A description of the cron job.	Display: {'hint': 'text'}
:name	*str*	A user friendly name/alias for the cron job.	
:storm	*str*	The storm query executed by the cron job.	Read Only: True Display: {'hint': 'text'}

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:form

A Synapse form used for representing nodes in the graph.

The base type for the form can be found at *syn:form*.

Properties:

name	type	doc	opts
:doc	*str* strip: True	The docstring for the form.	Read Only: True
:type	*syn:type*	Synapse type for this form.	Read Only: True
:runt	*bool*	Whether or not the form is runtime only.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:prop

A Synapse property.

The base type for the form can be found at *syn:prop*.

Properties:

name	type	doc	opts
:doc	*str* strip: True	Description of the property definition.	
:form	*syn:form*	The form of the property.	Read Only: True
:type	*syn:type*	The synapse type for this property.	Read Only: True
:relname	*str* strip: True	Relative property name.	Read Only: True
:univ	*bool*	Specifies if a prop is universal.	Read Only: True
:base	*str* strip: True	Base name of the property.	Read Only: True
:ro	*bool*	If the property is read-only after being set.	Read Only: True
:extmodel	*bool*	If the property is an extended model property or not.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.

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source	verb	target	doc
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:tag

The base type for a synapse tag.

The base type for the form can be found at *syn:tag*.

Properties:

name	type	doc	opts
:up	*syn:tag*	The parent tag for the tag.	Read Only: True
:isnow	*syn:tag*	Set to an updated tag if the tag has been renamed.	
:doc	*str*	A short definition for the tag.	Display: {'hint': 'text'}
:doc:url	*inet:url*	A URL link to additional documentation about the tag.	
:depth	*int*	How deep the tag is in the hierarchy.	Read Only: True
:title	*str*	A display title for the tag.	
:base	*str*	The tag base name. Eg baz for foo.bar.baz .	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:tagprop

A user defined tag property.

The base type for the form can be found at *syn:tagprop*.

Properties:

name	type	doc	opts
:doc	*str* strip: True	Description of the tagprop definition.	
:type	*syn:type*	The synapse type for this tagprop.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.

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source	verb	target	doc
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:trigger

A Cortex trigger.

The base type for the form can be found at *syn:trigger*.

Properties:

name	type	doc	opts
:vers	*int*	Trigger version.	Read Only: True
:doc	*str*	A documentation string describing the trigger.	Display: {'hint': 'text'}
:name	*str*	A user friendly name/alias for the trigger.	
:cond	*str* strip: True lower: True	The trigger condition.	Read Only: True
:user	*str*	User who owns the trigger.	Read Only: True
:storm	*str*	The Storm query for the trigger.	Read Only: True Display: {'hint': 'text'}
:enabled	*bool*	Trigger enabled status.	Read Only: True
:form	*str* lower: True strip: True	Form the trigger is watching for.	
:verb	*str* lower: True strip: True	Edge verb the trigger is watching for.	
:n2form	*str* lower: True strip: True	N2 form the trigger is watching for.	
:prop	*str* lower: True strip: True	Property the trigger is watching for.	
:tag	*str* lower: True strip: True	Tag the trigger is watching for.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

syn:type

A Synapse type used for normalizing nodes and properties.

The base type for the form can be found at *syn:type*.

Properties:

name	type	doc	opts
:doc	*str* strip: True	The docstring for the type.	Read Only: True
:ctor	*str* strip: True	The python ctor path for the type object.	Read Only: True
:subof	*syn:type*	Type which this inherits from.	Read Only: True
:opts	*data*	Arbitrary type options.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 542 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:call

A guid for a telephone call record.

The base type for the form can be found at *tel:call*.

Properties:

name	type	doc	opts
:src	*tel:phone*	The source phone number for a call.	
:dst	*tel:phone*	The destination phone number for a call.	
:time	*time*	The time the call was initiated.	
:duration	*int*	The duration of the call in seconds.	
:connected	*bool*	Indicator of whether the call was connected.	
:text	*str*	The text transcription of the call.	Display: {'hint': 'text'}
:file	*file:bytes*	A file containing related media.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:carrier

The fusion of a MCC/MNC.

The base type for the form can be found at *tel:mob:carrier*.

Properties:

name	type	doc	opts
:mcc	*tel:mob:mcc*	ITU Mobile Country Code.	Read Only: True
:mnc	*tel:mob:mnc*	ITU Mobile Network Code.	Read Only: True
:org	*ou:org*	Organization operating the carrier.	
:loc	*loc*	Location the carrier operates from.	
:tadig	*tel:mob:tadig*	The TADIG code issued to the carrier.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:cell

A mobile cell site which a phone may connect to.

The base type for the form can be found at *tel:mob:cell*.

Properties:

name	type	doc	opts
:carrier	*tel:mob:carrier*	Mobile carrier.	Read Only: True
:carrier:mcc	*tel:mob:mcc*	Mobile Country Code.	Read Only: True
:carrier:mnc	*tel:mob:mnc*	Mobile Network Code.	Read Only: True
:lac	*int*	Location Area Code. LTE networks may call this a TAC.	Read Only: True
:cid	*int*	The Cell ID.	Read Only: True
:radio	*str* lower: 1 onespace: 1	Cell radio type.	
:latlong	*geo:latlong*	Last known location of the cell site.	
:loc	*loc*	Location at which the cell is operated.	
:place	*geo:place*	The place associated with the latlong property.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:imei

An International Mobile Equipment Id.

The base type for the form can be found at *tel:mob:imei*.

An example of `tel:mob:imei`:

- `490154203237518`

Properties:

name	type	doc	opts
:tac	*tel:mob:tac*	The Type Allocate Code within the IMEI.	Read Only: True
:serial	*int*	The serial number within the IMEI.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:imid

Fused knowledge of an IMEI/IMSI used together.

The base type for the form can be found at *tel:mob:imid*.

An example of `tel:mob:imid`:

- `(490154203237518, 310150123456789)`

Properties:

name	type	doc	opts
:imei	*tel:mob:imei*	The IMEI for the phone hardware.	Read Only: True
:imsi	*tel:mob:imsi*	The IMSI for the phone subscriber.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:imsi

An International Mobile Subscriber Id.

The base type for the form can be found at *tel:mob:imsi*.

An example of `tel:mob:imsi`:

- 310150123456789

Properties:

name	type	doc	opts
:mcc	*tel:mob:mcc*	The Mobile Country Code.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.

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Table 548 – continued from previous page

source	verb	target	doc
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:imsiphone

Fused knowledge of an IMSI assigned phone number.

The base type for the form can be found at *tel:mob:imsiphone*.

An example of `tel:mob:imsiphone`:

- `(310150123456789, "+7(495) 124-59-83")`

Properties:

name	type	doc	opts
:phone	*tel:phone*	The phone number assigned to the IMSI.	Read Only: True
:imsi	*tel:mob:imsi*	The IMSI with the assigned phone number.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.

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Table 549 – continued from previous page

source	verb	target	doc
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:mcc

ITU Mobile Country Code.

The base type for the form can be found at *tel:mob:mcc*.

Properties:

name	type	doc
:loc	*loc*	Location assigned to the MCC.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.

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Table 550 – continued from previous page

source	verb	target	doc
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:tac

A mobile Type Allocation Code.

The base type for the form can be found at *tel:mob:tac*.

An example of `tel:mob:tac`:

- `49015420`

  Properties:

name	type	doc
:org	*ou:org*	The org guid for the manufacturer.
:manu	*str* lower: 1	The TAC manufacturer name.
:model	*str* lower: 1	The TAC model name.
:internal	*str* lower: 1	The TAC internal model name.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.

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Table 551 – continued from previous page

source	verb	target	doc
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:tadig

A Transferred Account Data Interchange Group number issued to a GSM carrier.

The base type for the form can be found at *tel:mob:tadig*.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.

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Table 552 – continued from previous page

source	verb	target	doc
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:mob:telem

A single mobile telemetry measurement.

The base type for the form can be found at *tel:mob:telem*.

Properties:

name	type	doc	opts
:time	*time*	A date/time value.	
:latlong	*geo:latlong*	A Lat/Long string specifying a point on Earth.	
:http:requ	*inet:http:reques*	The HTTP request that the telemetry was extracted from.	
:host	*it:host*	The host that generated the mobile telemetry data.	
:place	*geo:place*	The place representing the location of the mobile telemetry sample.	
:loc	*loc*	The geo-political location of the mobile telemetry sample.	
:accuracy	*geo:dist*	The reported accuracy of the latlong telemetry reading.	
:cell	*tel:mob:cell*	A mobile cell site which a phone may connect to.	
:cell:carr	*tel:mob:carrier*	The fusion of a MCC/MNC.	
:imsi	*tel:mob:imsi*	An International Mobile Subscriber Id.	
:imei	*tel:mob:imei*	An International Mobile Equipment Id.	
:phone	*tel:phone*	A phone number.	
:mac	*inet:mac*	A 48-bit Media Access Control (MAC) address.	
:ipv4	*inet:ipv4*	An IPv4 address.	
:ipv6	*inet:ipv6*	An IPv6 address.	
:wifi	*inet:wifi:ap*	An SSID/MAC address combination for a wireless access point.	
:wifi:ssid	*inet:wifi:ssid*	A WiFi service set identifier (SSID) name.	
:wifi:bssi	*inet:mac*	A 48-bit Media Access Control (MAC) address.	
:adid	*it:adid*	The advertising ID of the mobile telemetry sample.	
:aaid	*it:os:android:ac*	Deprecated. Please use :adid.	Deprecated: True
:idfa	*it:os:ios:idfa*	Deprecated. Please use :adid.	Deprecated: True
:name	*ps:name*	An arbitrary, lower spaced string with normalized whitespace.	
:email	*inet:email*	An e-mail address.	
:acct	*inet:web:acct*	Deprecated, use :account.	Deprecated: True
:account	*inet:service:acc*	The service account which is associated with the tracked device.	
:app	*it:prod:softver*	A specific version of a software product.	
:data	*data*	Arbitrary json compatible data.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:phone

A phone number.

The base type for the form can be found at *tel:phone*.

An example of `tel:phone`:

- `+15558675309`

Properties:

name	type	doc
:type	*tel:phone:type:taxonomy*	The type of phone number.
:loc	*loc*	The location associated with the number.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:phone:type:taxonomy

A taxonomy of phone number types.

The base type for the form can be found at *tel:phone:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*tel:phone:type:taxonom*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.

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Table 555 – continued from previous page

source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

tel:txtmesg

A guid for an individual text message.

The base type for the form can be found at *tel:txtmesg*.

Properties:

name	type	doc	opts
:from	*tel:phone*	The phone number assigned to the sender.	
:to	*tel:phone*	The phone number assigned to the primary recipient.	
:recipients	*array* type: *tel:phone* uniq: True sorted: True	An array of phone numbers for additional recipients of the message.	
:svctype	*str* enums: sms,mms,rcs strip: 1 lower: 1	The message service type (sms, mms, rcs).	
:time	*time*	The time the message was sent.	
:text	*str*	The text of the message.	Display: {'hint': 'text'}
:file	*file:bytes*	A file containing related media.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.

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Table 556 – continued from previous page

source	verb	target	doc
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:craft

An individual aircraft.

The base type for the form can be found at *transport:air:craft*.

Properties:

name	type	doc	opts
:tailnum	*transport:air:tailnum*	The aircraft tail number.	
:type	*str* lower: True strip: True	The type of aircraft.	
:make	*str* lower: True strip: True	Deprecated. Please use :manufacturer:name.	Deprecated: True
:operator	*ps:contact*	The contact information of the operator of the aircraft.	
:built	*time*	The date when the aircraft was built.	
:manufacturer	*ou:org*	The organization which manufactured the aircraft.	
:manufacturer:name	*ou:name*	The name of the organization which manufactured the aircraft.	
:model	*str* lower: True onespace: True	The model of the aircraft.	
:serial	*str* strip: True	The manufacturer assigned serial number of the aircraft.	
:max:occupants	*int* min: 0	The maximum number of occupants the aircraft can hold.	
:max:cargo:mass	*mass*	The maximum mass the aircraft can carry as cargo.	
:max:cargo:volume	*geo:dist*	The maximum volume the aircraft can carry as cargo.	
:owner	*ps:contact*	The contact information of the owner of the aircraft.	
:phys:mass	*mass*	The mass of the aircraft.	
:phys:volume	*geo:dist*	The cubed volume of the aircraft.	
:phys:length	*geo:dist*	The length of the aircraft.	
:phys:width	*geo:dist*	The width of the aircraft.	
:phys:height	*geo:dist*	The height of the air-	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:flight

An individual instance of a flight.

The base type for the form can be found at *transport:air:flight*.

Properties:

name	type	doc	opts
:num	*transport:air:flightnum*	The flight number of this flight.	
:tailnum	*transport:air:tailnum*	The tail/registration number at the time the aircraft flew this flight.	
:cancelled	*bool*	Deprecated. Please use :status.	Deprecated: True
:carrier	*ou:org*	Deprecated. Please use :operator.	Deprecated: True
:craft	*transport:air:craft*	Deprecated. Please use :vehicle.	Deprecated: True
:to:port	*transport:air:port*	Deprecated. Please use :arrival:place.	Deprecated: True
:from:port	*transport:air:port*	Deprecated. Please use :departure:place.	Deprecated: True
:stops	*array* type: *transport:air:port*	Deprecated. Please use transport:stop.	Deprecated: True
:status	*str* enums: scheduled, cancelled, in-progress, completed, aborted,failed, unknown	The status of the flight.	
:occupants	*int* min: 0	The number of occupants of the aircraft on this flight.	
:cargo:mass	*mass*	The cargo mass carried by the aircraft on this flight.	
:cargo:volume	*geo:dist*	The cargo volume carried by the aircraft on this flight.	
:operator	*ps:contact*	The contact information of the operator of the flight.	
:vehicle	*transport:vehicle*	The aircraft which traveled the flight.	
:duration	*duration*	The actual duration.	
:departed	*time*	The actual departure time.	
:departed:place	*geo:place*	The actual departure airport.	
:departed:point	*transport:point*	The actual departure gate.	
:arrived	*time*	The actual arrival time.	
:arrived:place	*geo:place*	The actual arrival airport.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:flightnum

A commercial flight designator including airline and serial.

The base type for the form can be found at *transport:air:flightnum*.

An example of `transport:air:flightnum`:

- `ua2437`

Properties:

name	type	doc
`:carrier`	*ou:org*	The org which operates the given flight number.
`:to:port`	*transport:air:port*	The most recently registered destination for the flight number.
`:from:port`	*transport:air:port*	The most recently registered origin for the flight number.
`:stops`	*array* type: *transport:air:port*	An ordered list of aiport codes for the flight segments.

Source Edges:

source	verb	target	doc
*	`-(meets)>`	`ou:requiremer`	The requirement is met by the source node.
*	`-(refs)>`	*	The source node contains a reference to the target node.
*	`-(seenat)`	`geo:telem`	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	`-(refs)>`	*	None
`econ:purchase`	`-(acquired)>`	*	The purchase was used to acquire the target node.
`it:app:snort:rule`	`-(detects)>`	*	The snort rule is intended for use in detecting the target node
`it:app:yara:rule`	`-(detects)>`	*	The YARA rule is intended for use in detecting the target no
`it:exec:query`	`-(found)>`	*	The target node was returned as a result of running the query
`math:algorithm`	`-(generates)>`	*	The target node was generated by the algorithm.
`meta:feed`	`-(found)>`	*	The meta:feed produced the target node.
`meta:note`	`-(about)>`	*	The meta:note is about the target node.
`meta:rule`	`-(detects)>`	*	The meta:rule is designed to detect instances of the target no
`meta:rule`	`-(matches)>`	*	The meta:rule has matched on target node.
`meta:source`	`-(seen)>`	*	The meta:source observed the target node.
`ou:campaign`	`-(targets)>`	*	The campaign targeted the target nodes.
`ou:campaign`	`-(uses)>`	*	The campaign made use of the target node.
`ou:contribution`	`-(includes)>`	*	The contribution includes the specific node.

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source	verb	target	doc
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:occupant

Deprecated. Please use transport:occupant.

The base type for the form can be found at *transport:air:occupant*.

Properties:

name	type	doc	opts
:type	*str* lower: True	Deprecated. Please use transport:occupant.	Deprecated: True
:flight	*transport:air:flight*	Deprecated. Please use transport:occupant.	Deprecated: True
:seat	*str* lower: True	Deprecated. Please use transport:occupant.	Deprecated: True
:contact	*ps:contact*	Deprecated. Please use transport:occupant.	Deprecated: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:port

An IATA assigned airport code.

The base type for the form can be found at *transport:air:port*.

Properties:

name	type	doc
:name	*str* lower: True onespace: True	The name of the airport.
:place	*geo:place*	The place where the IATA airport code is assigned.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.

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source	verb	target	doc
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:tailnum

An aircraft registration number or military aircraft serial number.

The base type for the form can be found at *transport:air:tailnum*.

An example of transport:air:tailnum:

- ff023

Properties:

name	type	doc
:loc	*loc*	The geopolitical location that the tailnumber is allocated to.
:type	*str* lower: True strip: True	A type which may be specific to the country prefix.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.

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Table 562 – continued from previous page

source	verb	target	doc
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:air:telem

A telemetry sample from an aircraft in transit.

The base type for the form can be found at *transport:air:telem*.

Properties:

name	type	doc
:flight	*transport:air:flight*	The flight being measured.
:latlong	*geo:latlong*	The lat/lon of the aircraft at the time.
:loc	*loc*	The location of the aircraft at the time.
:place	*geo:place*	The place that the lat/lon geocodes to.
:accuracy	*geo:dist*	The horizontal accuracy of the latlong sample.
:course	*transport:direction*	The direction, in degrees from true North, that the aircraft is traveling.
:heading	*transport:direction*	The direction, in degrees from true North, that the nose of the aircraft is pointed.
:speed	*velocity*	The ground speed of the aircraft at the time.
:airspeed	*velocity*	The air speed of the aircraft at the time.
:verticalspeed	*velocity* relative: True	The relative vertical speed of the aircraft at the time.
:altitude	*geo:altitude*	The altitude of the aircraft at the time.
:altitude:accuracy	*geo:dist*	The vertical accuracy of the altitude measurement.
:time	*time*	The time the telemetry sample was taken.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.

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Table 563 – continued from previous page

source	verb	target	doc
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:cargo

Cargo being carried by a vehicle on a trip.

The base type for the form can be found at *transport:cargo*.

Properties:

name	type	doc
:object	*phys:object*	The physical object being transported.
:trip	*transport:trip*	The trip being taken by the cargo.
:vehicle	*transport:vehicle*	The vehicle used to transport the cargo.
:container	*transport:container*	The container in which the cargo was shipped.
:loaded	*time*	The time when the cargo was loaded.
:loaded:place	*geo:place*	The place where the cargo was loaded.
:loaded:point	*transport:point*	The point where the cargo was loaded such as an airport gate or train platform.
:unloaded	*time*	The time when the cargo was unloaded.
:unloaded:place	*geo:place*	The place where the cargo was unloaded.
:unloaded:point	*transport:point*	The point where the cargo was unloaded such as an airport gate or train platform.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:land:drive

A drive taken by a land vehicle.

The base type for the form can be found at *transport:land:drive*.

Properties:

name	type	doc
:status	*str* enums: scheduled,cancelled, in-progress,completed, aborted,failed,unknown	The status of the drive.
:occupants	*int* min: 0	The number of occupants of the vehicle on this drive.
:cargo:mass	*mass*	The cargo mass carried by the vehicle on this drive.
:cargo:volume	*geo:dist*	The cargo volume carried by the vehicle on this drive.
:operator	*ps:contact*	The contact information of the operator of the drive.
:vehicle	*transport:vehicle*	The vehicle which traveled the drive.
:duration	*duration*	The actual duration.
:departed	*time*	The actual departure time.
:departed:place	*geo:place*	The actual departure place.
:departed:point	*transport:point*	The actual departure point.
:arrived	*time*	The actual arrival time.
:arrived:place	*geo:place*	The actual arrival place.
:arrived:point	*transport:point*	The actual arrival point.
:scheduled:duration	*duration*	The scheduled duration.
:scheduled:departure	*time*	The scheduled departure time.
:scheduled:departure:pla	*geo:place*	The scheduled departure place.
:scheduled:departure:poi	*transport:point*	The scheduled departure point.
:scheduled:arrival	*time*	The scheduled arrival time.
:scheduled:arrival:place	*geo:place*	The scheduled arrival place.
:scheduled:arrival:point	*transport:point*	The scheduled arrival point.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:land:license

A license to operate a land vehicle issued to a contact.

The base type for the form can be found at *transport:land:license*.

Properties:

name	type	doc
:id	*str* strip: True	The license ID.
:contact	*ps:contact*	The contact info of the licensee.
:issued	*time*	The time the license was issued.
:expires	*time*	The time the license expires.
:issuer	*ou:org*	The org which issued the license.
:issuer:name	*ou:name*	The name of the org which issued the license.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.

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source	verb	target	doc
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:land:registration

Registration issued to a contact for a land vehicle.

The base type for the form can be found at *transport:land:registration*.

Properties:

name	type	doc
:id	*str* strip: True	The vehicle registration ID or license plate.
:contact	*ps:contact*	The contact info of the registrant.
:license	*transport:land:license*	The license used to register the vehicle.
:issued	*time*	The time the vehicle registration was issued.
:expires	*time*	The time the vehicle registration expires.
:vehicle	*transport:land:vehicle*	The vehicle being registered.
:issuer	*ou:org*	The org which issued the registration.
:issuer:name	*ou:name*	The name of the org which issued the registration.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:land:vehicle

An individual land based vehicle.

The base type for the form can be found at *transport:land:vehicle*.

Properties:

name	type	doc	opts
:type	*transport:land:vehicle:type:*	The type of land vehicle.	
:desc	*str*	A description of the vehicle.	
:serial	*str* strip: True	The serial number or VIN of the vehicle.	
:make	*ou:name*	Deprecated. Please use :manufacturer:name.	Deprecated: True
:registration	*transport:land:registration*	The current vehicle registration information.	
:operator	*ps:contact*	The contact information of the operator of the vehicle.	
:built	*time*	The date when the vehicle was built.	
:manufacturer	*ou:org*	The organization which manufactured the vehicle.	
:manufacturer:name	*ou:name*	The name of the organization which manufactured the vehicle.	
:model	*str* lower: True onespace: True	The model of the vehicle.	
:max:occupants	*int* min: 0	The maximum number of occupants the vehicle can hold.	
:max:cargo:mass	*mass*	The maximum mass the vehicle can carry as cargo.	
:max:cargo:volume	*geo:dist*	The maximum volume the vehicle can carry as cargo.	
:owner	*ps:contact*	The contact information of the owner of the vehicle.	
:phys:mass	*mass*	The mass of the vehicle.	
:phys:volume	*geo:dist*	The cubed volume of the vehicle.	
:phys:length	*geo:dist*	The length of the vehicle.	
:phys:width	*geo:dist*	The width of the vehicle.	
:phys:height	*geo:dist*	The height of the vehicle.	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:land:vehicle:type:taxonomy

A type taxonomy for land vehicles.

The base type for the form can be found at *transport:land:vehicle:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*transport:land:vehicle:type:*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:occupant

An occupant of a vehicle on a trip.

The base type for the form can be found at *transport:occupant*.

Properties:

name	type	doc
:role	*transport:occupant:role:taxonomy*	The role of the occupant such as captain, crew, passenger.
:contact	*ps:contact*	Contact information of the occupant.
:trip	*transport:trip*	The trip, such as a flight or train ride, being taken by the occupant.
:vehicle	*transport:vehicle*	The vehicle that transported the occupant.
:seat	*str* strip: True	The seat which the occupant sat in. Likely in a vehicle specific format.
:boarded	*time*	The time when the occupant boarded the vehicle.
:boarded:place	*geo:place*	The place where the occupant boarded the vehicle.
:boarded:point	*transport:point*	The boarding point such as an airport gate or train platform.
:disembarked	*time*	The time when the occupant disembarked from the vehicle.
:disembarked:place	*geo:place*	The place where the occupant disembarked the vehicle.
:disembarked:point	*transport:point*	The disembarkation point such as an airport gate or train platform.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.

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source	verb	target	doc
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:occupant:role:taxonomy

A taxonomy of transportation occupant roles.

The base type for the form can be found at *transport:occupant:role:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*transport:occupant:role:taxo*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:rail:car

An individual train car.

The base type for the form can be found at *transport:rail:car*.

Properties:

name	type	doc
:type	*transport:rail:car:type:taxonomy*	The type of rail car.
:built	*time*	The date when the train car was built.
:manufacturer	*ou:org*	The organization which manufactured the train car.
:manufacturer:name	*ou:name*	The name of the organization which manufactured the train car.
:model	*str* lower: True onespace: True	The model of the train car.
:serial	*str* strip: True	The manufacturer assigned serial number of the train car.
:max:occupants	*int* min: 0	The maximum number of occupants the train car can hold.
:max:cargo:mass	*mass*	The maximum mass the train car can carry as cargo.
:max:cargo:volume	*geo:dist*	The maximum volume the train car can carry as cargo.
:owner	*ps:contact*	The contact information of the owner of the train car.
:phys:mass	*mass*	The mass of the train car.
:phys:volume	*geo:dist*	The cubed volume of the train car.
:phys:length	*geo:dist*	The length of the train car.
:phys:width	*geo:dist*	The width of the train car.
:phys:height	*geo:dist*	The height of the train car.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:rail:car:type:taxonomy

A hierarchical taxonomy of rail car types.

The base type for the form can be found at *transport:rail:car:type:taxonomy*.

An example of `transport:rail:car:type:taxonomy`:

- `engine.diesel`

  Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*transport:rail:car:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requiremer	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat):	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target no
it:exec:query	-(found)>	*	The target node was returned as a result of running the query
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target no
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.

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source	verb	target	doc
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compr
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the targe
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:rail:consist

A group of rail cars and locomotives connected together.

The base type for the form can be found at *transport:rail:consist*.

Properties:

name	type	doc
:cars	*array* type: *transport:rail:car* uniq: True	The rail cars, including locomotives, which compose the consist.
:operator	*ps:contact*	The contact information of the operator of the train.
:built	*time*	The date when the train was built.
:manufacturer	*ou:org*	The organization which manufactured the train.
:manufacturer:name	*ou:name*	The name of the organization which manufactured the train.
:model	*str* lower: True onespace: True	The model of the train.
:serial	*str* strip: True	The manufacturer assigned serial number of the train.
:max:occupants	*int* min: 0	The maximum number of occupants the train can hold.
:max:cargo:mass	*mass*	The maximum mass the train can carry as cargo.
:max:cargo:volume	*geo:dist*	The maximum volume the train can carry as cargo.
:owner	*ps:contact*	The contact information of the owner of the train.
:phys:mass	*mass*	The mass of the train.
:phys:volume	*geo:dist*	The cubed volume of the train.
:phys:length	*geo:dist*	The length of the train.
:phys:width	*geo:dist*	The width of the train.
:phys:height	*geo:dist*	The height of the train.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:rail:train

An individual instance of a consist of train cars running a route.

The base type for the form can be found at *transport:rail:train*.

Properties:

name	type	doc
:id	*str* strip: True	The ID assigned to the train.
:status	*str* enums: scheduled,cancelled, in-progress,completed, aborted,failed,unknown	The status of the train trip.
:occupants	*int* min: 0	The number of occupants of the train on this train trip.
:cargo:mass	*mass*	The cargo mass carried by the train on this train trip.
:cargo:volume	*geo:dist*	The cargo volume carried by the train on this train trip.
:operator	*ps:contact*	The contact information of the operator of the train trip.
:vehicle	*transport:vehicle*	The train which traveled the train trip.
:duration	*duration*	The actual duration.
:departed	*time*	The actual departure time.
:departed:place	*geo:place*	The actual departure station.
:departed:point	*transport:point*	The actual departure gate.
:arrived	*time*	The actual arrival time.
:arrived:place	*geo:place*	The actual arrival station.
:arrived:point	*transport:point*	The actual arrival gate.
:scheduled:duration	*duration*	The scheduled duration.
:scheduled:departure	*time*	The scheduled departure time.
:scheduled:departure:pla	*geo:place*	The scheduled departure station.
:scheduled:departure:poi	*transport:point*	The scheduled departure gate.
:scheduled:arrival	*time*	The scheduled arrival time.
:scheduled:arrival:place	*geo:place*	The scheduled arrival station.
:scheduled:arrival:point	*transport:point*	The scheduled arrival gate.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:sea:telem

A telemetry sample from a vessel in transit.

The base type for the form can be found at *transport:sea:telem*.

Properties:

name	type	doc
:vessel	*trans-port:sea:vessel*	The vessel being measured.
:time	*time*	The time the telemetry was sampled.
:latlong	*geo:latlong*	The lat/lon of the vessel at the time.
:loc	*loc*	The location of the vessel at the time.
:place	*geo:place*	The place that the lat/lon geocodes to.
:accuracy	*geo:dist*	The horizontal accuracy of the latlong sample.
:course	*trans-port:direction*	The direction, in degrees from true North, that the vessel is traveling.
:heading	*trans-port:direction*	The direction, in degrees from true North, that the bow of the vessel is pointed.
:speed	*velocity*	The speed of the vessel at the time.
:draft	*geo:dist*	The keel depth at the time.
:airdraft	*geo:dist*	The maximum height of the ship from the waterline.
:destination	*geo:place*	The fully resolved destination that the vessel has declared.
:destination:n	*geo:name*	The name of the destination that the vessel has declared.
:destination:e	*time*	The estimated time of arrival that the vessel has declared.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.

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source	verb	target	doc
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:sea:vessel

An individual sea vessel.

The base type for the form can be found at *transport:sea:vessel*.

Properties:

name	type	doc	opts
:imo	*transport:sea:imo*	The International Maritime Organization number for the vessel.	
:type	*transport:sea:vessel:type:ta*	The type of vessel.	
:name	*entity:name*	The name of the vessel.	
:length	*geo:dist*	Deprecated. Please use :phys:length.	Deprecated: True
:beam	*geo:dist*	The official overall vessel beam.	
:flag	*iso:3166:cc*	The country the vessel is flagged to.	
:mmsi	*transport:sea:mmsi*	The Maritime Mobile Service Identifier assigned to the vessel.	
:make	*str* lower: True strip: True	Deprecated. Please use :manufacturer:name.	Deprecated: True
:operator	*ps:contact*	The contact information of the operator.	
:built	*time*	The date when the vessel was built.	
:manufacturer	*ou:org*	The organization which manufactured the vessel.	
:manufacturer:name	*ou:name*	The name of the organization which manufactured the vessel.	
:model	*str* lower: True onespace: True	The model of the vessel.	
:serial	*str* strip: True	The manufacturer assigned serial number of the vessel.	
:max:occupants	*int* min: 0	The maximum number of occupants the vessel can hold.	
:max:cargo:mass	*mass*	The maximum mass the vessel can carry as cargo.	
:max:cargo:volume	*geo:dist*	The maximum volume the vessel can carry as cargo.	
:owner	*ps:contact*	The contact information of the owner of the vessel.	
:phys:mass	*mass*	The mass of the ves-	

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:sea:vessel:type:taxonomy

A hierarchical taxonomy of sea vessel types.

The base type for the form can be found at *transport:sea:vessel:type:taxonomy*.

Properties:

name	type	doc	opts
:title	*str*	A brief title of the definition.	
:summary	*str*	Deprecated. Please use title/desc.	Deprecated: True Display: {'hint': 'text'}
:desc	*str*	A definition of the taxonomy entry.	Display: {'hint': 'text'}
:sort	*int*	A display sort order for siblings.	
:base	*taxon*	The base taxon.	Read Only: True
:depth	*int*	The depth indexed from 0.	Read Only: True
:parent	*transport:sea:vessel:type:ta*	The taxonomy parent.	Read Only: True

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.

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source	verb	target	doc
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:shipping:container

An individual shipping container.

The base type for the form can be found at *transport:shipping:container*.

Properties:

name	type	doc
:built	*time*	The date when the shipping container was built.
:manufacturer	*ou:org*	The organization which manufactured the shipping container.
:manufacturer:name	*ou:name*	The name of the organization which manufactured the shipping container.
:model	*str* lower: True onespace: True	The model of the shipping container.
:serial	*str* strip: True	The manufacturer assigned serial number of the shipping container.
:max:occupants	*int* min: 0	The maximum number of occupants the shipping container can hold.
:max:cargo:mass	*mass*	The maximum mass the shipping container can carry as cargo.
:max:cargo:volume	*geo:dist*	The maximum volume the shipping container can carry as cargo.
:owner	*ps:contact*	The contact information of the owner of the shipping container.
:phys:mass	*mass*	The mass of the shipping container.
:phys:volume	*geo:dist*	The cubed volume of the shipping container.
:phys:length	*geo:dist*	The length of the shipping container.
:phys:width	*geo:dist*	The width of the shipping container.
:phys:height	*geo:dist*	The height of the shipping container.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

transport:stop

A stop made by a vehicle on a trip.

The base type for the form can be found at *transport:stop*.

Properties:

name	type	doc
:trip	*transport:trip*	The trip which contains the stop.
:duration	*duration*	The actual duration.
:departed	*time*	The actual departure time.
:departed:place	*geo:place*	The actual departure place.
:departed:point	*transport:point*	The actual departure point.
:arrived	*time*	The actual arrival time.
:arrived:place	*geo:place*	The actual arrival place.
:arrived:point	*transport:point*	The actual arrival point.
:scheduled:duration	*duration*	The scheduled duration.
:scheduled:departure	*time*	The scheduled departure time.
:scheduled:departure:place	*geo:place*	The scheduled departure place.
:scheduled:departure:point	*transport:point*	The scheduled departure point.
:scheduled:arrival	*time*	The scheduled arrival time.
:scheduled:arrival:place	*geo:place*	The scheduled arrival place.
:scheduled:arrival:point	*transport:point*	The scheduled arrival point.

Source Edges:

source	verb	target	doc
*	-(meets)>	ou:requirement	The requirement is met by the source node.
*	-(refs)>	*	The source node contains a reference to the target node.
*	-(seenat)>	geo:telem	Deprecated. Please use geo:telem:node.

Target Edges:

source	verb	target	doc
*	-(refs)>	*	None
econ:purchase	-(acquired)>	*	The purchase was used to acquire the target node.
it:app:snort:rule	-(detects)>	*	The snort rule is intended for use in detecting the target node.
it:app:yara:rule	-(detects)>	*	The YARA rule is intended for use in detecting the target node.
it:exec:query	-(found)>	*	The target node was returned as a result of running the query.
math:algorithm	-(generates)>	*	The target node was generated by the algorithm.
meta:feed	-(found)>	*	The meta:feed produced the target node.
meta:note	-(about)>	*	The meta:note is about the target node.
meta:rule	-(detects)>	*	The meta:rule is designed to detect instances of the target node.
meta:rule	-(matches)>	*	The meta:rule has matched on target node.
meta:source	-(seen)>	*	The meta:source observed the target node.
ou:campaign	-(targets)>	*	The campaign targeted the target nodes.
ou:campaign	-(uses)>	*	The campaign made use of the target node.
ou:contribution	-(includes)>	*	The contribution includes the specific node.
ou:org	-(has)>	*	The organization is or was in possession of the target node.
ou:org	-(owns)>	*	The organization owns or owned the target node.
ou:org	-(targets)>	*	The organization targets the target node.
ou:org	-(uses)>	*	The ou:org makes use of the target node.
plan:procedure:step	-(uses)>	*	The step in the procedure makes use of the target node.
ps:contact	-(has)>	*	The contact is or was in possession of the target node.
ps:contact	-(owns)>	*	The contact owns or owned the target node.

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source	verb	target	doc
ps:person	-(has)>	*	The person is or was in possession of the target node.
ps:person	-(owns)>	*	The person owns or owned the target node.
risk:attack	-(targets)>	*	The attack targeted the target node.
risk:attack	-(uses)>	*	The attack used the target node to facilitate the attack.
risk:compromise	-(stole)>	*	The target node was stolen or copied as a result of the compromis
risk:extortion	-(leveraged)>	*	The extortion event was based on attacker access to the target noc
risk:leak	-(leaked)>	*	The leak included the disclosure of the target node.
risk:outage	-(impacted)>	*	The outage event impacted the availability of the target node.
risk:threat	-(targets)>	*	The threat cluster targeted the target node.
risk:threat	-(uses)>	*	The threat cluster uses the target node.
risk:tool:software	-(uses)>	*	The tool uses the target node.
sci:evidence	-(has)>	*	The evidence includes observations from the target nodes.
sci:experiment	-(uses)>	*	The experiment used the target nodes when it was run.
sci:observation	-(has)>	*	The observations are summarized from the target nodes.

12.2.2 Universal Properties

Universal props are system level properties which may be present on every node.

These properties are not specific to a particular form and exist outside of a particular namespace.

.created

The time the node was created in the cortex. It has the following property options set:

- Read Only: `True`

The universal property type is *time*. Its type has the following options set:

- ismin: `True`

.seen

The time interval for first/last observation of the node.

The universal property type is *ival*.

12.3 Datamodel Deprecation Policy

As the Synapse Data Model has grown and evolved over time, Vertex has found the need to deprecate model elements which are no longer useful. These elements may represent relationships which are better captured with newer elements; concepts which are better represented by convention; or other issues. As such, model elements (types, forms, and properties) which are deprecated should no longer be used for new data modeling. Deprecated model elements will be removed in a future major version Synapse release.

For deprecated model elements, suggested alternatives will be provided and example Storm queries which can be used to migrate data in such a fashion.

12.3.1 Using Deprecated Model Elements

When Deprecated model elements are used in a Cortex, the following log events will be made:

- One startup, if a extended property definition uses a deprecated type to define it, a warning message will be logged.

- If a extended property is added which uses a deprecated type to define it, a warning message will be logged.
- Any Types or Forms, from a datamodel loaded by a custom CoreModule, which use a deprecated model component will cause a warning message to be logged. This includes any Array or Comp type model elements which utilize a deprecated Type.
- If a property or tag property is set on a node which is deprecated or using a deprecated type, that will cause a warning message to be logged and a `warn` message to be sent over the Storm runtime. This only occurs once per given runtime.
- If a node is made using deprecated form or using a deprecated type, that will cause a warning message to be logged and a `warn` message to be sent over the Storm runtime. This only occurs once per given runtime.

Deleting nodes which use deprecated model elements does not trigger warnings, since that would normally be done after an associated data migration and would be excessive in the event of a large migration.

CHAPTER

THIRTEEN

STORM LIBRARY DOCUMENTATION

This contains API documentation for Storm Libraries and Storm Types.

Storm Types (also called Storm Objects) are objects in the Storm Runtime that can represent values such as nodes in the runtime or objects in the Cortex. Storm Types encompass objects from strings of characters (*str*), to objects representing Cron Jobs in the Cortex (*cronjob*), to nodes in the Cortex (*node*). These objects each have their own properties and methods defined on them that can be used to inspect or edit that object. For instance, String Storm Types all have the `upper()` method defined on them that returns a new instance of that String, except with every letter turned uppercase (*upper()*). Storm Types help form the basis for programmatic manipulation of objects and data in the Cortex.

Storm Libraries are ready-made tools in the Storm query language for creating, updating, or fetching data using Storm Types. Storm libraries include functionality for making HTTP requests (via *$lib.inet.http*), scraping nodes from text (*$lib.scrape*), manipulating Cortex objects such as Queues (*$lib.queue*) and StormDmons (*$lib.dmon*), creating new Cron Jobs (*$lib.cron*), and more. Many of these libraries accept or return Storm Types as part of their usage. For instance, there is a library in Storm for interacting with OAuthv1 servers (*$lib.inet.http.oauth.v1.client(ckey, csecret, atoken, asecret, sigtype=QUERY)*), and it accepts several String Storm Types as parameters and returns an OAuthV1 client object for later usage (*inet:http:oauth:v1:client*).

Storm Libraries form a powerful bench of tools for usage within the Storm query language.

The current sections are:

13.1 Storm Libraries

Storm Libraries represent powerful tools available inside of the Storm query language.

13.1.1 $lib

The Base Storm Library. This mainly contains utility functionality.

$lib.cast(name, valu)

Normalize a value as a Synapse Data Model Type.

Args:

name (str): The name of the model type to normalize the value as.

valu (any): The value to normalize.

Returns:

The normalized value. The return type is `prim`.

$lib.copy(item)

Create and return a deep copy of the given storm object.

Note:
This is currently limited to msgpack compatible primitives.

Examples:
Make a copy of a list or dict:

```
$copy = $lib.copy($item)
```

Args:
item (prim): The item to make a copy of.

Returns:
A deep copy of the primitive object. The return type is `prim`.

$lib.debug

True if the current runtime has debugging enabled.

Note:
The debug state is inherited by sub-runtimes at instantiation time. Any changes to a runtime's debug state do not percolate automatically.

Examples:
Check if the runtime is in debug and print a message:

```
if $lib.debug {
    $lib.print('Doing stuff!')
}
```

Update the current runtime to enable debugging:

```
$lib.debug = (true)
```

Returns:
The return type is *boolean*. When this is used to set the value, it does not have a return type.

$lib.exit(mesg=(null), **kwargs)

Cause a Storm Runtime to stop running.

Args:
mesg (str): Optional string to warn.

**kwargs (any): Keyword arguments to substitute into the mesg.

Returns:
The return type is `null`.

$lib.false

This constant represents a value of False that can be used in Storm.

Examples:
Conditionally print a statement based on the constant value:

```
storm> if $lib.false { $lib.print('Is True') } else { $lib.print('Is False') }
Is False
```

Returns:
The type is *boolean*.

$lib.fire(name, **info)

Fire an event onto the runtime.

Notes:
This fires events as `storm:fire` event types. The name of the event is placed into a `type` key, and any additional keyword arguments are added to a dictionary under the `data` key.

Examples:
Fire an event called `demo` with some data:

```
storm> $foo='bar' $lib.fire('demo', foo=$foo, knight='ni')
...
('storm:fire', {'type': 'demo', 'data': {'foo': 'bar', 'knight': 'ni'}})
...
```

Args:
name (str): The name of the event to fire.

**info (any): Additional keyword arguments containing data to add to the event.

Returns:
The return type is `null`.

$lib.guid(*args, valu=$lib.undef)

Get a random guid, or generate a guid from the arguments.

Args:
*args (prim): Arguments which are hashed to create a guid.

valu (prim): Create a guid from a single value (no positional arguments can be specified).

Returns:
A guid. The return type is *str*.

$lib.import(name, debug=(false), reqvers=(null))

Import a Storm module.

Args:
name (str): Name of the module to import.

debug (boolean): Enable debugging in the module.

reqvers (str): Version requirement for the imported module.

Returns:
A `lib` instance representing the imported package. The return type is `lib`.

$lib.len(item)

Get the length of a item.

This could represent the size of a string, or the number of keys in a dictionary, or the number of elements in an array. It may also be used to iterate an emitter or yield function and count the total.

Args:
item (prim): The item to get the length of.

Returns:
The length of the item. The return type is `int`.

$lib.list(*vals)

> **Warning**
>
> `$lib.list` has been deprecated and will be removed in version v3.0.0.

Get a Storm List object. This is deprecated, use ([]) to declare a list instead.

Args:
*vals (any): Initial values to place in the list.

Returns:
A new list object. The return type is *list*.

$lib.max(*args)

Get the maximum value in a list of arguments.

Args:
*args (any): List of arguments to evaluate.

Returns:
The largest argument. The return type is `int`.

$lib.min(*args)

Get the minimum value in a list of arguments.

Args:
*args (any): List of arguments to evaluate.

Returns:
The smallest argument. The return type is `int`.

$lib.null

This constant represents a value of None that can be used in Storm.

Examples:
Create a dictionary object with a key whose value is null, and call `$lib.fire()` with it:

```
storm> $d=({"key": $lib.null}) $lib.fire('demo', d=$d)
('storm:fire', {'type': 'demo', 'data': {'d': {'key': None}}})
```

Returns:
The type is `null`.

$lib.pprint(item, prefix=, clamp=(null))

The pprint API should not be considered a stable interface.

Args:

item (any): Item to pprint

prefix (str): Line prefix.

clamp (int): Line clamping length.

Returns:

The return type is `null`.

$lib.print(mesg, **kwargs)

Print a message to the runtime.

Examples:

Print a simple string:

```
storm> $lib.print("Hello world!")
Hello world!
```

Format and print string based on variables:

```
storm> $d=({"key1": (1), "key2": "two"})
     for ($key, $value) in $d { $lib.print('{k} => {v}', k=$key, v=$value) }
key1 => 1
key2 => two
```

Use values off of a node to format and print string:

```
storm> inet:ipv4:asn
     $lib.print("node: {ndef}, asn: {asn}", ndef=$node.ndef(), asn=:asn) | spin
node: ('inet:ipv4', 16909060), asn: 1138
```

Notes:

Arbitrary objects can be printed as well. They will have their Python __repr()__ printed.

Args:

mesg (str): String to print.

**kwargs (any): Keyword arguments to substitute into the mesg.

Returns:

The return type is `null`.

$lib.raise(name, mesg, **info)

Raise an exception in the storm runtime.

Args:

name (str): The name of the error condition to raise.

mesg (str): A friendly description of the specific error.

**info (any): Additional metadata to include in the exception.

Returns:

This function does not return. The return type is `null`.

$lib.range(stop, start=(null), step=(null))

Generate a range of integers.

Examples:

Generate a sequence of integers based on the size of an array:

```
storm> $a=(foo,bar,(2)) for $i in $lib.range($lib.len($a)) {$lib.fire('test', indx=
↪$i, valu=$a.$i)}
Executing query at 2021/03/22 19:25:48.835
('storm:fire', {'type': 'test', 'data': {'index': 0, 'valu': 'foo'}})
('storm:fire', {'type': 'test', 'data': {'index': 1, 'valu': 'bar'}})
('storm:fire', {'type': 'test', 'data': {'index': 2, 'valu': 2}})
```

Notes:

The range behavior is the same as the Python3 `range()` builtin Sequence type.

Args:

stop (int): The value to stop at.

start (int): The value to start at.

step (int): The range step size.

Yields:

The sequence of integers. The return type is `int`.

$lib.repr(name, valu)

Attempt to convert a system mode value to a display mode string.

Examples:

Print the Synapse user name for an iden:

```
$lib.print($lib.repr(syn:user, $iden))
```

Args:

name (str): The name of the model type.

valu (any): The value to convert.

Returns:

A display mode representation of the value. The return type is *str*.

$lib.set(*vals)

Get a Storm Set object.

Args:

*vals (any): Initial values to place in the set.

Returns:

The new set. The return type is *set*.

$lib.sorted(valu, reverse=(false))

Yield sorted values.

Args:

valu (any): An iterable object to sort.

reverse (boolean): Reverse the sort order.

Yields:
Yields the sorted output. The return type is any.

$lib.text(*args)

> **Warning**
>
> `$lib.text` has been deprecated and will be removed in version 3.0.0.

Get a Storm Text object. This is deprecated; please use a list to append strings to, and then use `('.').join($listOfStr)` to join them on demand.

Args:
*args (str): An initial set of values to place in the Text. These values are joined together with an empty string.

Returns:
The new Text object. The return type is *text*.

$lib.true

This constant represents a value of True that can be used in Storm.

Examples:
Conditionally print a statement based on the constant value:

```
storm> if $lib.true { $lib.print('Is True') } else { $lib.print('Is False') }
Is True
```

Returns:
The type is *boolean*.

$lib.trycast(name, valu)

Attempt to normalize a value and return status and the normalized value.

Examples:
Do something if the value is a valid IPV4:

```
($ok, $ipv4) = $lib.trycast(inet:ipv4, 1.2.3.4)
if $ok { $dostuff($ipv4) }
```

Args:
name (str): The name of the model type to normalize the value as.

valu (any): The value to normalize.

Returns:
A list of (<bool>, <prim>) for status and normalized value. The return type is *list*.

$lib.undef

This constant can be used to unset variables and derefs.

Examples:
Unset the variable $foo:

```
$foo = $lib.undef
```

Remove a dictionary key bar:

```
$foo.bar = $lib.undef
```

Remove a list index of 0:

```
$foo.0 = $lib.undef
```

Returns:
The type is `undef`.

$lib.warn(mesg, **kwargs)

Print a warning message to the runtime.

Notes:
Arbitrary objects can be warned as well. They will have their Python __repr()__ printed.

Args:
mesg (str): String to warn.

**kwargs (any): Keyword arguments to substitute into the mesg.

Returns:
The return type is `null`.

13.1.2 $lib.aha

A Storm Library for interacting with AHA.

$lib.aha.callPeerApi(svcname, todo, timeout=(null), skiprun=(null))

Call an API on all peers (leader and mirrors) of an AHA service and yield the responses from each.

Examples:
Call getCellInfo on an AHA service:

```
$todo = $lib.utils.todo('getCellInfo')
for $info in $lib.aha.callPeerApi(cortex..., $todo) {
    $lib.print($info)
}
```

Call getCellInfo on an AHA service, skipping the invoking service:

```
$todo = $lib.utils.todo('getCellInfo')
for $info in $lib.aha.callPeerApi(cortex..., $todo, skiprun=$lib.cell.
↪getCellInfo().cell.run) {
    $lib.print($info)
}
```

Call method with arguments:

```
$todo = $lib.utils.todo(('method', ([1, 2]), ({'foo': 'bar'})))
for $info in $lib.aha.callPeerApi(cortex..., $todo) {
    $lib.print($info)
}
```

Args:

svcname (str): The name of the AHA service to call. It is easiest to use the relative name of a service, ending with "...".

todo (list): The todo tuple (name, args, kwargs).

timeout (int): Optional timeout in seconds.

skiprun (str): Optional run ID argument that allows skipping results from a specific service run ID.
This is most often used to omit the invoking service from the results, ensuring that only responses from other services are included.

Yields:

Yields the results of the API calls as tuples of (svcname, (ok, info)). The return type is *list*.

$lib.aha.callPeerGenr(svcname, todo, timeout=(null), skiprun=(null))

Call a generator API on all peers (leader and mirrors) of an AHA service and yield the responses from each.

Examples:

Call getNexusChanges on an AHA service:

```
$todo = $lib.utils.todo('getNexusChanges', (0), wait=(false))
for $info in $lib.aha.callPeerGenr(cortex..., $todo) {
    $lib.print($info)
}
```

Call getNexusChanges on an AHA service, skipping the invoking service:

```
$todo = $lib.utils.todo('getNexusChanges', (0), wait=(false))
for $info in $lib.aha.callPeerGenr(cortex..., $todo, skiprun=$lib.cell.
↪getCellInfo().cell.run) {
    $lib.print($info)
}
```

Args:

svcname (str): The name of the AHA service to call. It is easiest to use the relative name of a service, ending with "...".

todo (list): The todo tuple (name, args, kwargs).

timeout (int): Optional timeout in seconds.

skiprun (str): Optional run ID argument that allows skipping results from a specific service run ID.
This is most often used to omit the invoking service from the results, ensuring that only responses from other services are included.

Yields:

Yields the results of the API calls as tuples containing (svcname, (ok, info)). The return type is *list*.

$lib.aha.del(svcname)

Delete a service from AHA.

Examples:

Deleting a service with its relative name:

```
$lib.aha.del(00.mysvc...)
```

Deleting a service with its full name:

```
$lib.aha.del(00.mysvc.loop.vertex.link)
```

Args:

svcname (str): The name of the service to delete. It is easiest to use the relative name of a service, ending with "...".

Returns:

The return type is `null`.

$lib.aha.get(svcname, filters=(null))

Get information about an AHA service.

Examples:

Getting service information with a relative name:

```
$lib.aha.get(00.cortex...)
```

Getting service information with its full name:

```
$lib.aha.get(00.cortex.loop.vertex.link)
```

Args:

svcname (str): The name of the AHA service to look up. It is easiest to use the relative name of a service, ending with "...".

filters (dict): An optional dictionary of filters to use when resolving the AHA service.

Returns:

The AHA service information dictionary, or `(null))`. The return type may be one of the following: `null`, *dict*.

$lib.aha.list()

Enumerate all of the AHA services.

Yields:

The AHA service dictionaries. The return type is *list*.

13.1.3 $lib.aha.pool

A Storm Library for interacting with AHA service pools.

$lib.aha.pool.add(name)

Add a new AHA service pool.

Examples:

Add a pool via its relative name:

```
$lib.aha.pool.add(pool00.cortex...)
```

Args:

name (str): The name of the pool to add. It is easiest to use the relative name of a pool, ending with "...".

Returns:

The return type is *aha:pool*.

$lib.aha.pool.del(name)

Delete an existing AHA service pool.

Examples:

Delete a pool via its relative name:

```
$lib.aha.pool.del(pool00.cortex...)
```

Args:

name (str): The name of the pool to delete. It is easiest to use the relative name of a pool, ending with "...".

Returns:

The AHA pool definition that was deleted. The return type is *dict*.

$lib.aha.pool.get(name)

Get an existing AHA service pool.

Args:

name (str): The name of the pool to get. It is easiest to use the relative name of a pool, ending with "...".

Returns:

The pool if it exists, or `(null)`. The return type may be one of the following: `null`, *aha:pool*.

$lib.aha.pool.list()

Enumerate all of the AHA service pools.

Yields:

The return type is *aha:pool*.

13.1.4 $lib.auth

A Storm Library for interacting with Auth in the Cortex.

$lib.auth.getPermDef(perm)

Return a single permission definition.

Args:

perm (list): A permission tuple.

Returns:

A permission definition or null. The return type is *dict*.

$lib.auth.getPermDefs()

Return a list of permission definitions.

Returns:

The list of permission definitions. The return type is *list*.

$lib.auth.ruleFromText(text)

Get a rule tuple from a text string.

Args:

text (str): The string to process.

Returns:
A tuple containing a bool and a list of permission parts. The return type is *list*.

$lib.auth.textFromRule(rule)

Return a text string from a rule tuple.

Args:
rule (list): A rule tuple.

Returns:
The rule text. The return type is *str*.

13.1.5 $lib.auth.easyperm

A Storm Library for interacting with easy perm dictionaries.

$lib.auth.easyperm.allowed(edef, level)

Check if the current user has a permission level in an easy perm dictionary.

Args:
edef (dict): The easy perm dictionary to check.

level (int): The required permission level number.

Returns:
True if the user meets the requirement, false otherwise. The return type is *boolean*.

$lib.auth.easyperm.confirm(edef, level, mesg=(null))

Require that the current user has a permission level in an easy perm dictionary.

Args:
edef (dict): The easy perm dictionary to check.

level (int): The required permission level number.

mesg (str): Optional error message to present if user does not have required permission level.

Returns:
The return type is `null`.

$lib.auth.easyperm.init(edef=(null), default=(1))

Add the easy perm structure to a new or existing dictionary.

Note:
The current user will be given admin permission in the new easy perm structure.

Args:
edef (dict): A dictionary to add easy perms to.

default (int): Specify the default permission level for this item.

Returns:
Dictionary with the easy perm structure. The return type is *dict*.

$lib.auth.easyperm.level.admin

Constant for admin permission.

Returns:
The type is `int`.

$lib.auth.easyperm.level.deny

Constant for deny permission.

Returns:
The type is `int`.

$lib.auth.easyperm.level.edit

Constant for edit permission.

Returns:
The type is `int`.

$lib.auth.easyperm.level.read

Constant for read permission.

Returns:
The type is `int`.

$lib.auth.easyperm.set(edef, scope, iden, level)

Set the permission level for a user or role in an easy perm dictionary.

Args:
edef (dict): The easy perm dictionary to modify.

scope (str): The scope, either "users" or "roles".

iden (str): The user/role iden depending on scope.

level (int): The permission level number, or None to remove the permission.

Returns:
Dictionary with the updated easy perm structure. The return type is *dict*.

13.1.6 $lib.auth.gates

A Storm Library for interacting with Auth Gates in the Cortex.

$lib.auth.gates.get(iden)

Get a specific Gate by iden.

Args:
iden (str): The iden of the gate to retrieve.

Returns:
The `auth:gate` if it exists, otherwise null. The return type may be one of the following: `null`, *auth:gate*.

$lib.auth.gates.list()

Get a list of Gates in the Cortex.

Returns:
A list of `auth:gate` objects. The return type is *list*.

13.1.7 $lib.auth.roles

A Storm Library for interacting with Auth Roles in the Cortex.

$lib.auth.roles.add(name, iden=(null))

Add a Role to the Cortex.

Args:
name (str): The name of the role.

iden (str): The iden to assign to the new role.

Returns:
The new role object. The return type is *auth:role*.

$lib.auth.roles.byname(name)

Get a specific Role by name.

Args:
name (str): The name of the role to retrieve.

Returns:
The role by name, or null if it does not exist. The return type may be one of the following: `null`, *auth:role*.

$lib.auth.roles.del(iden)

Delete a Role from the Cortex.

Args:
iden (str): The iden of the role to delete.

Returns:
The return type is `null`.

$lib.auth.roles.get(iden)

Get a specific Role by iden.

Args:
iden (str): The iden of the role to retrieve.

Returns:
The `auth:role` object; or null if the role does not exist. The return type may be one of the following: `null`, *auth:role*.

$lib.auth.roles.list()

Get a list of Roles in the Cortex.

Returns:
A list of `auth:role` objects. The return type is *list*.

13.1.8 $lib.auth.users

A Storm Library for interacting with Auth Users in the Cortex.

$lib.auth.users.add(name, passwd=(null), email=(null), iden=(null))

Add a User to the Cortex.

Args:

name (str): The name of the user.

passwd (str): The user's password.

email (str): The user's email address.

iden (str): The iden to use to create the user.

Returns:

The `auth:user` object for the new user. The return type is *auth:user*.

$lib.auth.users.byname(name)

Get a specific user by name.

Args:

name (str): The name of the user to retrieve.

Returns:

The `auth:user` object, or none if the user does not exist. The return type may be one of the following: `null`, *auth:user*.

$lib.auth.users.del(iden)

Delete a User from the Cortex.

Args:

iden (str): The iden of the user to delete.

Returns:

The return type is `null`.

$lib.auth.users.get(iden)

Get a specific User by iden.

Args:

iden (str): The iden of the user to retrieve.

Returns:

The `auth:user` object, or none if the user does not exist. The return type may be one of the following: `null`, *auth:user*.

$lib.auth.users.list()

Get a list of Users in the Cortex.

Returns:

A list of `auth:user` objects. The return type is *list*.

13.1.9 $lib.axon

A Storm library for interacting with the Cortex's Axon.

For APIs that accept an ssl_opts argument, the dictionary may contain the following values:

```
({
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can be␣
↪included in client_cert.
})
```

For APIs that accept a proxy argument, the following values are supported:

```
``(null)``: Deprecated - Use the proxy defined by the http:proxy configuration option if␣
↪set.
``(true)``: Use the proxy defined by the http:proxy configuration option if set.
``(false)``: Do not use the proxy defined by the http:proxy configuration option if set.
<str>: A proxy URL string.
```

$lib.axon.csvrows(sha256, dialect=excel, errors=ignore, **fmtparams)

Yields CSV rows from a CSV file stored in the Axon.

Notes:

The dialect and fmtparams expose the Python csv.reader() parameters.

Example:

Get the rows from a given csv file:

```
for $row in $lib.axon.csvrows($sha256) {
    $dostuff($row)
}
```

Get the rows from a given tab separated file:

```
for $row in $lib.axon.csvrows($sha256, delimiter="\t") {
    $dostuff($row)
}
```

Args:

sha256 (str): The SHA256 hash of the file.

dialect (str): The default CSV dialect to use.

errors (str): Specify how encoding errors should handled.

**fmtparams (any): Format arguments.

Yields:

A list of strings from the CSV file. The return type is *list*.

$lib.axon.del(sha256)

Remove the bytes from the Cortex's Axon by sha256.

Example:

Delete files from the axon based on a tag:

```
file:bytes#foo +:sha256 $lib.axon.del(:sha256)
```

Args:
sha256 (hash:sha256): The sha256 of the bytes to remove from the Axon.

Returns:
True if the bytes were found and removed. The return type is *boolean*.

$lib.axon.dels(sha256s)

Remove multiple byte blobs from the Cortex's Axon by a list of sha256 hashes.

Example:
Delete a list of files (by hash) from the Axon:

```
$list = ($hash0, $hash1, $hash2)
$lib.axon.dels($list)
```

Args:
sha256s (list): A list of sha256 hashes to remove from the Axon.

Returns:
A list of boolean values that are True if the bytes were found. The return type is *list*.

$lib.axon.has(sha256)

Check if the Axon the Cortex is configured to use has a given sha256 value.

Examples:
Check if the Axon has a given file:

```
# This example assumes the Axon does have the bytes
storm> if $lib.axon.
↪has(9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08) {
        $lib.print("Has bytes")
    } else {
        $lib.print("Does not have bytes")
    }

Has bytes
```

Args:
sha256 (str): The sha256 value to check.

Returns:
True if the Axon has the file, false if it does not. The return type is *boolean*.

$lib.axon.hashset(sha256)

Return additional hashes of the bytes stored in the Axon for the given sha256.

Examples:
Get the md5 hash for a file given a variable named `$sha256`:

```
$hashset = $lib.axon.hashset($sha256)
$md5 = $hashset.md5
```

Args:
sha256 (str): The sha256 value to calculate hashes for.

Returns:
A dictionary of additional hashes. The return type is *dict*.

$lib.axon.jsonlines(sha256, errors=ignore)

Yields JSON objects from a JSON-lines file stored in the Axon.

Example:
Get the JSON objects from a given JSONL file:

```
for $item in $lib.axon.jsonlines($sha256) {
    $dostuff($item)
}
```

Args:
sha256 (str): The SHA256 hash of the file.

errors (str): Specify how encoding errors should handled.

Yields:
A JSON object parsed from a line of text. The return type is `any`.

$lib.axon.list(offs=(0), wait=(false), timeout=(null))

List (offset, sha256, size) tuples for files in the Axon in added order.

Example:
List files:

```
for ($offs, $sha256, $size) in $lib.axon.list() {
    $lib.print($sha256)
}
```

Start list from offset 10:

```
for ($offs, $sha256, $size) in $lib.axon.list(10) {
    $lib.print($sha256)
}
```

Args:
offs (int): The offset to start from.

wait (boolean): Wait for new results and yield them in realtime.

timeout (int): The maximum time to wait for a new result before returning.

Yields:
Tuple of (offset, sha256, size) in added order. The return type is *list*.

$lib.axon.metrics()

Get runtime metrics of the Axon.

Example:
Print the total number of files stored in the Axon:

```
$data = $lib.axon.metrics()
$lib.print("The Axon has {n} files", n=$data."file:count")
```

Returns:
A dictionary containing runtime data about the Axon. The return type is *dict*.

$lib.axon.put(byts)

Save the given bytes variable to the Axon the Cortex is configured to use.

Examples:
Save a base64 encoded buffer to the Axon:

```
storm> $s='dGVzdA==' $buf=$lib.base64.decode($s) ($size, $sha256)=$lib.axon.put(
↪$buf)
    $lib.print('size={size} sha256={sha256}', size=$size, sha256=$sha256)

size=4 sha256=9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08
```

Args:
byts (bytes): The bytes to save.

Returns:
A tuple of the file size and sha256 value. The return type is *list*.

$lib.axon.read(sha256, offs=(0), size=(1048576))

Read bytes from a file stored in the Axon by its SHA256 hash.

Examples:
Read 100 bytes starting at offset 0:

```
$byts = $lib.axon.read($sha256, size=100)
```

Read 50 bytes starting at offset 200:

```
$byts = $lib.axon.read($sha256, offs=200, size=50)
```

Args:
sha256 (str): The SHA256 hash of the file to read.

offs (int): The offset to start reading from.

size (int): The number of bytes to read. Max is 1 MiB.

Returns:
The requested bytes from the file. The return type is *bytes*.

$lib.axon.readlines(sha256, errors=ignore)

Yields lines of text from a plain-text file stored in the Axon.

Examples:

// Get the lines for a given file. for $line in $lib.axon.readlines($sha256) {

$dostuff($line)

}

Args:
sha256 (str): The SHA256 hash of the file.

errors (str): Specify how encoding errors should handled.

Yields:
A line of text from the file. The return type is *str*.

$lib.axon.size(sha256)

Return the size of the bytes stored in the Axon for the given sha256.

Examples:
Get the size for a file given a variable named `$sha256`:

```
$size = $lib.axon.size($sha256)
```

Args:
sha256 (str): The sha256 value to check.

Returns:
The size of the file or `null` if the file is not found. The return type may be one of the following: `int`, `null`.

$lib.axon.unpack(sha256, fmt, offs=(0))

Unpack bytes from a file stored in the Axon into a struct using the specified format.

Examples:
Unpack two 32-bit integers from the start of a file:

```
$nums = $lib.axon.unpack($sha256, '<II')
```

Unpack a 64-bit float starting at offset 100:

```
$float = $lib.axon.unpack($sha256, '<d', offs=100)
```

Args:
sha256 (str): The SHA256 hash of the file to read.

fmt (str): The struct format string.

offs (int): The offset to start reading from.

Returns:
The unpacked values as a tuple. The return type is *list*.

$lib.axon.upload(genr)

Upload a stream of bytes to the Axon as a file.

Examples:
Upload bytes from a generator:

```
($size, $sha256) = $lib.axon.upload($getBytesChunks())
```

Args:
genr (generator): A generator which yields bytes.

Returns:
A tuple of the file size and sha256 value. The return type is *list*.

$lib.axon.urlfile(*args, **kwargs)

Retrieve the target URL using the wget() function and construct an inet:urlfile node from the response.

Notes:

This accepts the same arguments as `$lib.axon.wget()`.

Args:

*args (any): Args from `$lib.axon.wget()`.

**kwargs (any): Args from `$lib.axon.wget()`.

Returns:

The `inet:urlfile` node on success, `null` on error. The return type may be one of the following: *node*, `null`.

$lib.axon.wget(url, headers=(null), params=(null), method=GET, json=(null), body=(null), ssl=(true), timeout=(null), proxy=(true), ssl_opts=(null))

A method to download an HTTP(S) resource into the Cortex's Axon.

Notes:

The response body will be stored regardless of the status code. See the `Axon.wget()` API documentation to see the complete structure of the response dictionary.

Example:

Get the Vertex Project website:

```
$headers = ({})
$headers."User-Agent" = Foo/Bar

$resp = $lib.axon.wget("http://vertex.link", method=GET, headers=$headers)
if $resp.ok { $lib.print("Downloaded: {size} bytes", size=$resp.size) }
```

Args:

url (str): The URL to download

headers (dict): An optional dictionary of HTTP headers to send.

params (dict): An optional dictionary of URL parameters to add.

method (str): The HTTP method to use.

json (dict): A JSON object to send as the body.

body (bytes): Bytes to send as the body.

ssl (boolean): Set to False to disable SSL/TLS certificate verification.

timeout (int): Timeout for the download operation.

proxy: Configure proxy usage. See $lib.axon help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.axon help for additional details.

Returns:

A status dictionary of metadata. The return type is *dict*.

$lib.axon.wput(sha256, url, headers=(null), params=(null), method=PUT, ssl=(true), timeout=(null), proxy=(true), ssl_opts=(null))

A method to upload a blob from the axon to an HTTP(S) endpoint.

Args:

sha256 (str): The sha256 of the file blob to upload.

url (str): The URL to upload the file to.

headers (dict): An optional dictionary of HTTP headers to send.

params (dict): An optional dictionary of URL parameters to add.

method (str): The HTTP method to use.

ssl (boolean): Set to False to disable SSL/TLS certificate verification.

timeout (int): Timeout for the download operation.

proxy: Configure proxy usage. See $lib.axon help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.axon help for additional details.

Returns:

A status dictionary of metadata. The return type is *dict*.

13.1.10 $lib.backup

A Storm Library for interacting with the backup APIs in the Cortex.

$lib.backup.del(name)

Remove a backup by name.

Args:

name (str): The name of the backup to remove.

Returns:

The return type is `null`.

$lib.backup.list()

Get a list of backup names.

Returns:

A list of backup names. The return type is *list*.

$lib.backup.run(name=(null), wait=(true))

Run a Cortex backup.

Args:

name (str): The name of the backup to generate.

wait (boolean): If true, wait for the backup to complete before returning.

Returns:

The name of the newly created backup. The return type is *str*.

13.1.11 $lib.base64

A Storm Library for encoding and decoding base64 data.

$lib.base64.decode(valu, urlsafe=(true))

Decode a base64 string into a bytes object.

Args:
valu (str): The string to decode.

urlsafe (boolean): Perform the decoding in a urlsafe manner if true.

Returns:
A bytes object for the decoded data. The return type is *bytes*.

$lib.base64.encode(valu, urlsafe=(true))

Encode a bytes object to a base64 encoded string.

Args:
valu (bytes): The object to encode.

urlsafe (boolean): Perform the encoding in a urlsafe manner if true.

Returns:
A base64 encoded string. The return type is *str*.

13.1.12 $lib.basex

A Storm library which implements helpers for encoding and decoding strings using an arbitrary charset.

$lib.basex.decode(text, charset)

Decode a baseX string into bytes.

Args:
text (str): The hex string to be decoded into bytes.

charset (str): The charset used to decode the string.

Returns:
The decoded bytes. The return type is *bytes*.

$lib.basex.encode(byts, charset)

Encode bytes into a baseX string.

Args:
byts (bytes): The bytes to be encoded into a string.

charset (str): The charset used to encode the bytes.

Returns:
The encoded string. The return type is *str*.

13.1.13 $lib.bytes

A Storm Library for interacting with bytes storage. This Library is deprecated; use `$lib.axon.*` instead.

$lib.bytes.has(sha256)

Warning

`$lib.bytes.has` has been deprecated and will be removed in version v3.0.0. Use the corresponding `$lib.axon` function.

Check if the Axon the Cortex is configured to use has a given sha256 value.

Examples:

Check if the Axon has a given file:

```
# This example assumes the Axon does have the bytes
storm> if $lib.bytes.
↪has(9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08) {
        $lib.print("Has bytes")
    } else {
        $lib.print("Does not have bytes")
    }

Has bytes
```

Args:

sha256 (str): The sha256 value to check.

Returns:

True if the Axon has the file, false if it does not. The return type is *boolean*.

$lib.bytes.hashset(sha256)

Warning

`$lib.bytes.hashset` has been deprecated and will be removed in version v3.0.0. Use the corresponding `$lib.axon` function.

Return additional hashes of the bytes stored in the Axon for the given sha256.

Examples:

Get the md5 hash for a file given a variable named `$sha256`:

```
$hashset = $lib.bytes.hashset($sha256)
$md5 = $hashset.md5
```

Args:

sha256 (str): The sha256 value to calculate hashes for.

Returns:

A dictionary of additional hashes. The return type is *dict*.

$lib.bytes.put(byts)

Warning

`$lib.bytes.put` has been deprecated and will be removed in version v3.0.0. Use the corresponding `$lib.axon` function.

Save the given bytes variable to the Axon the Cortex is configured to use.

Examples:

Save a base64 encoded buffer to the Axon:

```
storm> $s='dGVzdA==' $buf=$lib.base64.decode($s) ($size, $sha256)=$lib.bytes.put(
↪$buf)
    $lib.print('size={size} sha256={sha256}', size=$size, sha256=$sha256)

size=4 sha256=9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08
```

Args:

byts (bytes): The bytes to save.

Returns:

A tuple of the file size and sha256 value. The return type is *list*.

$lib.bytes.size(sha256)

Warning

`$lib.bytes.size` has been deprecated and will be removed in version v3.0.0. Use the corresponding `$lib.axon` function.

Return the size of the bytes stored in the Axon for the given sha256.

Examples:

Get the size for a file given a variable named `$sha256`:

```
$size = $lib.bytes.size($sha256)
```

Args:

sha256 (str): The sha256 value to check.

Returns:

The size of the file or `null` if the file is not found. The return type may be one of the following: `int`, `null`.

$lib.bytes.upload(genr)

Warning

`$lib.bytes.upload` has been deprecated and will be removed in version v3.0.0. Use the corresponding `$lib.axon` function.

Upload a stream of bytes to the Axon as a file.

Examples:

Upload bytes from a generator:

```
($size, $sha256) = $lib.bytes.upload($getBytesChunks())
```

Args:
genr (generator): A generator which yields bytes.

Returns:
A tuple of the file size and sha256 value. The return type is *list*.

13.1.14 $lib.cache

A Storm Library for interacting with Cache Objects.

$lib.cache.fixed(callback, size=(10000))

Get a new Fixed Cache object.

On a cache-miss when calling .get(), the callback Storm query is executed in a sub-runtime in the current execution context. A special variable, $cache_key, will be set to the key argument provided to .get().

The callback Storm query must contain a return statement, and if it does not return a value when executed with the input, `(null)` will be set as the value.

The fixed cache uses FIFO to evict items once the maximum size is reached.

Examples:

// Use a callback query with a function that modifies the outer runtime, // since it will run in the scope where it was defined. $test = foo

function callback(key) {
$test = $key // this will modify $test in the outer runtime return(*{$key}-val*)

}

$cache = $lib.cache.fixed(${ return($callback($cache_key)) }) $value = $cache.get(bar) $lib.print($test) // this will equal “bar”

// Use a callback query that will not modify the outer runtime, // except for variables accessible as references. $test = foo $tests = ([])

$cache = $lib.cache.fixed(${
$test = $cache_key // this will *not* modify $test in the outer runtime $tests.append($cache_key) // this will modify $tests in the outer runtime return(*{$cache_key}-val*)

})

$value = $cache.get(bar) $lib.print($test) // this will equal “foo” $lib.print($tests) // this will equal (foo,)

Args:
callback: A Storm query that will return a value for $cache_key on a cache miss. The input type may be one of the following: `str`, `storm:query`.

size (int): The maximum size of the cache.

Returns:
A new `cache:fixed` object. The return type is *cache:fixed*.

13.1.15 $lib.cell

A Storm Library for interacting with the Cortex.

$lib.cell.getBackupInfo()

Get information about recent backup activity.

Returns:
A dictionary containing backup information. The return type is *dict*.

$lib.cell.getCellInfo()

Return metadata specific for the Cortex.

Returns:
A dictionary containing metadata. The return type is *dict*.

$lib.cell.getHealthCheck()

Get healthcheck information about the Cortex.

Returns:
A dictionary containing healthcheck information. The return type is *dict*.

$lib.cell.getMirrorUrls(name=(null))

Get mirror Telepath URLs for an AHA configured service.

Args:
name (str): The name, or iden, of the service to get mirror URLs for (defaults to the Cortex if not provided).

Returns:
A list of Telepath URLs. The return type is *list*.

$lib.cell.getSystemInfo()

Get info about the system in which the Cortex is running.

Returns:
A dictionary containing system information. The return type is *dict*.

$lib.cell.hotFixesApply()

Apply known data migrations and fixes via storm.

Returns:
Tuple containing the current version after applying the fixes. The return type is *list*.

$lib.cell.hotFixesCheck()

Check to see if there are known hot fixes to apply.

Returns:
Bool indicating if there are hot fixes to apply or not. The return type is *boolean*.

$lib.cell.iden

The Cortex service identifier.

Returns:
The Cortex service identifier. The return type is *str*.

$lib.cell.trimNexsLog(consumers=(null), timeout=(30))

Rotate and cull the Nexus log (and any consumers) at the current offset.

If the consumers argument is provided they will first be checked if online before rotating and raise otherwise. After rotation, all consumers provided must catch-up to the offset to cull at within the specified timeout before executing the cull, and will raise otherwise.

Args:
consumers (array): List of Telepath URLs for consumers of the Nexus log.

timeout (int): Time (in seconds) to wait for consumers to catch-up before culling.

Returns:
The offset that was culled (up to and including). The return type is `int`.

$lib.cell.uptime(name=(null))

Get update data for the Cortex or a connected Service.

Args:
name (str): The name, or iden, of the service to get uptime data for (defaults to the Cortex if not provided).

Returns:
A dictionary containing uptime data. The return type is *dict*.

13.1.16 $lib.compression.bzip2

A Storm library which implements helpers for bzip2 compression.

$lib.compression.bzip2.en(valu)

Compress bytes using bzip2 and return them.

Example:
Compress bytes with bzip2:

```
$foo = $lib.compression.bzip2.en($mybytez)
```

Args:
valu (bytes): The bytes to be compressed.

Returns:
The bzip2 compressed bytes. The return type is *bytes*.

$lib.compression.bzip2.un(valu)

Decompress bytes using bzip2 and return them.

Example:
Decompress bytes with bzip2:

```
$foo = $lib.compression.bzip2.un($mybytez)
```

Args:
valu (bytes): The bytes to be decompressed.

Returns:
Decompressed bytes. The return type is *bytes*.

13.1.17 $lib.compression.gzip

A Storm library which implements helpers for gzip compression.

$lib.compression.gzip.en(valu)

Compress bytes using gzip and return them.

Example:
Compress bytes with gzip:

```
$foo = $lib.compression.gzip.en($mybytez)
```

Args:
valu (bytes): The bytes to be compressed.

Returns:
The gzip compressed bytes. The return type is *bytes*.

$lib.compression.gzip.un(valu)

Decompress bytes using gzip and return them.

Example:
Decompress bytes with gzip:

```
$foo = $lib.compression.gzip.un($mybytez)
```

Args:
valu (bytes): The bytes to be decompressed.

Returns:
Decompressed bytes. The return type is *bytes*.

13.1.18 $lib.compression.zlib

A Storm library which implements helpers for zlib compression.

$lib.compression.zlib.en(valu)

Compress bytes using zlib and return them.

Example:
Compress bytes with zlib:

```
$foo = $lib.compression.zlib.en($mybytez)
```

Args:
valu (bytes): The bytes to be compressed.

Returns:
The zlib compressed bytes. The return type is *bytes*.

$lib.compression.zlib.un(valu)

Decompress bytes using zlib and return them.

Example:
Decompress bytes with zlib:

```
$foo = $lib.compression.zlib.un($mybytez)
```

Args:
valu (bytes): The bytes to be decompressed.

Returns:
Decompressed bytes. The return type is *bytes*.

13.1.19 $lib.cortex.httpapi

Library for interacting with the Extended HTTP API.

$lib.cortex.httpapi.add(path, name=, desc=, runas=owner, authenticated=(true), readonly=(false), iden=(null))

Add an Extended HTTP API endpoint to the Cortex.

This can be used to add an API endpoint which will be resolved under the API path "/api/ext/". New API endpoint objects are appended to a list of APIs to resolve in order.

Notes:
The Cortex does not make any attempt to do any inspection of path values which may conflict between one another. This is because the paths for a given endpoint may be changed, they can contain regular expressions, and they may have their resolution order changed. Cortex administrators are responsible for configuring their Extended HTTP API endpoints with correct paths and order to meet their use cases.

Example:
Add a simple API handler:

```
// Create an endpoint for /api/ext/foo/bar
$api = $lib.cortex.httpapi.add('foo/bar')

// Define a GET response handler via storm that makes a simple reply.
$api.methods.get = ${ $request.reply(200, body=({"some": "data}) }
```

Add a wildcard handler:

```
// Create a wildcard endpoint for /api/ext/some/thing([a-zA-Z0-9]*)/([a-zA-Z0-9]*)
$api = $lib.cortex.httpapi.add('some/thing([a-zA-Z0-9]*)/([a-zA-Z0-9]*)')

// The capture groups are exposed as request arguments.
// Echo them back to the caller.
$api.methods.get = ${
    $request.reply(200, body=({"args": $request.args})
}
```

Args:
path (string): The extended HTTP API path.

name (string): Friendly name for the Extended HTTP API.

desc (string): Description for the Extended HTTP API.

runas (string): Run the storm query as the API "owner" or as the authenticated "user".

authenticated (boolean): Require the API endpoint to be authenticated.

readonly (boolean): Run the Extended HTTP Storm methods in readonly mode.

iden (str): An iden for the new Extended HTTP API.

Returns:
A new `http:api` object. The return type is *http:api*.

$lib.cortex.httpapi.del(iden)

Delete an Extended HTTP API endpoint.

Args:
iden (string): The iden of the API to delete.

Returns:
The return type is `null`.

$lib.cortex.httpapi.get(iden)

Get an Extended `http:api` object.

Args:
iden (string): The iden of the API to retrieve.

Returns:
The `http:api` object. The return type is *http:api*.

$lib.cortex.httpapi.getByPath(path)

Get an Extended `http:api` object by path.

Notes:
The path argument is evaluated as a regular expression input, and will be used to get the first HTTP API handler whose path value has a match.

Args:
path (string): Path to use to retrieve an object.

Returns:
The `http:api` object or `(null)` if there is no match. The return type may be one of the following: *http:api*, `null`.

$lib.cortex.httpapi.index(iden, index=(0))

Set the index for a given Extended HTTP API.

Args:
iden (string): The iden of the API to modify.

index (int): The new index of the API. Uses zero based indexing.

Returns:
The new index location of the API. The return type is `int`.

$lib.cortex.httpapi.list()

Get all the Extended HTTP APIs on the Cortex

Returns:
A list of `http:api` objects The return type is *list*.

$lib.cortex.httpapi.response(requestinfo)

Make a response object. Used by API handlers automatically.

Args:
requestinfo (dict): Request info dictionary. This is an opaque data structure which may change.

Returns:
The return type is *http:api:request*.

13.1.20 $lib.cron

A Storm Library for interacting with Cron Jobs in the Cortex.

$lib.cron.add(**kwargs)

Add a recurring Cron Job to the Cortex.

Args:
**kwargs (any): Key-value parameters used to add the cron job.

Returns:
The new Cron Job. The return type is *cronjob*.

$lib.cron.at(**kwargs)

Add a non-recurring Cron Job to the Cortex.

Args:
**kwargs (any): Key-value parameters used to add the cron job.

Returns:
The new Cron Job. The return type is *cronjob*.

$lib.cron.del(prefix)

Delete a CronJob from the Cortex.

Args:
prefix (str): A prefix to match in order to identify a cron job to delete. Only a single matching prefix will be deleted.

Returns:
The return type is `null`.

$lib.cron.disable(prefix)

Disable a CronJob in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a cron job to disable. Only a single matching prefix will be disabled.

Returns:
The iden of the CronJob which was disabled. The return type is *str*.

$lib.cron.enable(prefix)

Enable a CronJob in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a cron job to enable. Only a single matching prefix will be enabled.

Returns:
The iden of the CronJob which was enabled. The return type is *str*.

$lib.cron.get(prefix)

Get a CronJob in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a cron job to get. Only a single matching prefix will be retrieved.

Returns:
The requested cron job. The return type is *cronjob*.

$lib.cron.list()

List CronJobs in the Cortex.

Returns:
A list of `cronjob` objects. The return type is *list*.

$lib.cron.mod(prefix, query)

Modify the Storm query for a CronJob in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a cron job to modify. Only a single matching prefix will be modified.

query: The new Storm query for the Cron Job. The input type may be one of the following: `str`, `query`.

Returns:
The iden of the CronJob which was modified. The return type is *str*.

$lib.cron.move(prefix, view)

Move a cron job to a new view.

Args:
prefix (str): A prefix to match in order to identify a cron job to move. Only a single matching prefix will be modified.

view (str): The iden of the view to move the CrobJob to

Returns:
The iden of the CronJob which was moved. The return type is *str*.

13.1.21 $lib.crypto.coin.ethereum

A Storm library which implements helpers for Ethereum.

$lib.crypto.coin.ethereum.eip55(addr)

Convert an Ethereum address to a checksummed address.

Args:
addr (str): The Ethereum address to be converted.

Returns:
A list of (<bool>, <addr>) for status and checksummed address. The return type is *list*.

13.1.22 $lib.crypto.hashes

A Storm Library for hashing bytes

$lib.crypto.hashes.md5(byts)

Retrieve an MD5 hash of a byte string.

Args:
byts (bytes): The bytes to hash.

Returns:
The hex digest of the MD5 hash of the input bytes. The return type is *str*.

$lib.crypto.hashes.sha1(byts)

Retrieve a SHA1 hash of a byte string.

Args:
byts (bytes): The bytes to hash.

Returns:
The hex digest of the SHA1 hash of the input bytes. The return type is *str*.

$lib.crypto.hashes.sha256(byts)

Retrieve a SHA256 hash of a byte string.

Args:
byts (bytes): The bytes to hash.

Returns:
The hex digest of the SHA256 hash of the input bytes. The return type is *str*.

$lib.crypto.hashes.sha512(byts)

Retrieve a SHA512 hash of a byte string.

Args:
byts (bytes): The bytes to hash.

Returns:
The hex digest of the SHA512 hash of the input bytes. The return type is *str*.

13.1.23 $lib.crypto.hmac

A Storm library for computing RFC2104 HMAC values.

$lib.crypto.hmac.digest(key, mesg, alg=sha256)

Compute the digest value of a message using RFC2104 HMAC.

Examples:

Compute the HMAC-SHA256 digest for a message with a secret key:

```
$digest = $lib.crypto.hmac.digest(key=$secretKey.encode(), mesg=$mesg.encode())
```

Args:

key (bytes): The key to use for the HMAC calculation.

mesg (bytes): The message to use for the HMAC calculation.

alg (str): The digest algorithm to use.

Returns:

The binary digest of the HMAC value. The return type is *bytes*.

13.1.24 $lib.csv

A Storm Library for interacting with csvtool.

$lib.csv.emit(*args, table=(null))

Emit a `csv:row` event to the Storm runtime for the given args.

Args:

*args (any): Items which are emitted as a `csv:row` event.

table (str): The name of the table to emit data too. Optional.

Returns:

The return type is `null`.

13.1.25 $lib.dict

A Storm Library for interacting with dictionaries.

$lib.dict.has(valu, key)

Check a dictionary has a specific key.

Args:

valu (dict): The dictionary being checked.

key (any): The key to check.

Returns:

True if the key is present, false if the key is not present. The return type is *boolean*.

$lib.dict.keys(valu)

Retrieve a list of keys in the specified dictionary.

Args:

valu (dict): The dictionary to operate on.

Returns:

List of keys in the specified dictionary. The return type is *list*.

$lib.dict.pop(valu, key, default=$lib.undef)

Remove specified key and return the corresponding value.

Args:

valu (dict): The dictionary to operate on.

key (any): The key to pop.

default (any): Optional default value to return if the key does not exist in the dictionary.

Returns:

The popped value. The return type is `any`.

$lib.dict.update(valu, other)

Update the specified dictionary with keys/values from another dictionary.

Args:

valu (dict): The target dictionary (update to).

other (dict): The source dictionary (update from).

Returns:

The return type is `null`.

$lib.dict.values(valu)

Retrieve a list of values in the specified dictionary.

Args:

valu (dict): The dictionary to operate on.

Returns:

List of values in the specified dictionary. The return type is *list*.

13.1.26 $lib.dmon

A Storm Library for interacting with StormDmons.

$lib.dmon.add(text, name=noname, ddef=(null))

Add a Storm Dmon to the Cortex.

Examples:

Add a dmon that executes a query:

```
$lib.dmon.add(${ myquery }, name='example dmon')
```

Args:

text: The Storm query to execute in the Dmon loop. The input type may be one of the following: `str`, `storm:query`.

name (str): The name of the Dmon.

ddef (dict): Additional daemon definition fields.

Returns:

The iden of the newly created Storm Dmon. The return type is *str*.

$lib.dmon.bump(iden)

Restart the Dmon.

Args:
iden (str): The GUID of the dmon to restart.

Returns:
True if the Dmon is restarted; False if the iden does not exist. The return type is *boolean*.

$lib.dmon.del(iden)

Delete a Storm Dmon by iden.

Args:
iden (str): The iden of the Storm Dmon to delete.

Returns:
The return type is `null`.

$lib.dmon.get(iden)

Get a Storm Dmon definition by iden.

Args:
iden (str): The iden of the Storm Dmon to get.

Returns:
A Storm Dmon definition dict. The return type is *dict*.

$lib.dmon.list()

Get a list of Storm Dmons.

Returns:
A list of Storm Dmon definitions. The return type is *list*.

$lib.dmon.log(iden)

Get the messages from a Storm Dmon.

Args:
iden (str): The iden of the Storm Dmon to get logs for.

Returns:
A list of messages from the StormDmon. The return type is *list*.

$lib.dmon.start(iden)

Start a storm dmon.

Args:
iden (str): The GUID of the dmon to start.

Returns:
`(true)` unless the dmon does not exist or was already started. The return type is *boolean*.

$lib.dmon.stop(iden)

Stop a Storm Dmon.

Args:
iden (str): The GUID of the Dmon to stop.

Returns:
`(true)` unless the dmon does not exist or was already stopped. The return type is *boolean*.

13.1.27 $lib.env

A Storm Library for accessing environment vars.

$lib.env.get(name, default=(null))

Retrieve an environment variable.

Notes:
Environment variables must begin with `SYN_STORM_ENV_` in order to be accessed by this API.

Args:
name (str): The name of the environment variable.

default (obj): The value to return if the environment variable is not set.

Returns:
The environment variable string. The return type is *str*.

13.1.28 $lib.export

A Storm Library for exporting data.

$lib.export.toaxon(query, opts=(null))

Run a query as an export (fully resolving relationships between nodes in the output set) and save the resulting stream of packed nodes to the axon.

Args:
query (str): A query to run as an export.

opts (dict): Storm runtime query option params.

Returns:
Returns a tuple of (size, sha256). The return type is *list*.

13.1.29 $lib.feed

A Storm Library for interacting with Cortex feed functions.

$lib.feed.genr(name, data)

Yield nodes being added to the graph by adding data with a given ingest type.

Notes:
This is using the Runtimes's Snap to call addFeedNodes(). This only yields nodes if the feed function yields nodes. If the generator is not entirely consumed there is no guarantee that all of the nodes which should be made by the feed function will be made.

Args:
name (str): Name of the ingest function to send data too.

data (prim): Data to send to the ingest function.

Yields:
Yields Nodes as they are created by the ingest function. The return type is *node*.

$lib.feed.ingest(name, data)

Add nodes to the graph with a given ingest type.

Notes:
This is using the Runtimes's Snap to call addFeedData(), after setting the snap.strict mode to False. This will cause node creation and property setting to produce warning messages, instead of causing the Storm Runtime to be torn down.

Args:
name (str): Name of the ingest function to send data too.

data (prim): Data to send to the ingest function.

Returns:
The return type is `null`.

$lib.feed.list()

Get a list of feed functions.

Returns:
A list of feed functions. The return type is *list*.

13.1.30 $lib.gen

A Storm Library for secondary property based deconfliction.

$lib.gen.campaign(name, reporter)

Returns an ou:campaign node based on the campaign and reporter names, adding the node if it does not exist.

Args:
name (str): The reported name of the campaign.

reporter (str): The name of the organization which reported the campaign.

Returns:
An ou:campaign node. The return type is *node*.

$lib.gen.cryptoX509CertBySha256(sha256, try=(false))

Returns a crypto:x509:cert node by SHA256, adding the node if it does not exist.

Args:
sha256: The SHA256 fingerprint for the certificate. The input type may be one of the following: `str`, `hash:sha256`.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
A crypto:x509:cert node with the given SHA256. The return type is *node*.

$lib.gen.fileBytesBySha256(sha256, try=(false))

Returns a file:bytes node by SHA256, adding the node if it does not exist.

Args:

sha256: The SHA256 fingerprint for the file:bytes node. The input type may be one of the following: `str`, `hash:sha256`.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:

A file:bytes node with the given SHA256. The return type is *node*.

$lib.gen.geoPlaceByName(name)

Returns a geo:place node by name, adding the node if it does not exist.

Args:

name (str): The name of the place.

Returns:

A geo:place node with the given name. The return type is *node*.

$lib.gen.industryByName(name)

Returns an ou:industry by name, adding the node if it does not exist.

Args:

name (str): The name of the industry.

Returns:

An ou:industry node with the given name. The return type is *node*.

$lib.gen.inetTlsServerCertByServerAndSha256(server, sha256, try=(false))

Returns an inet:tls:servercert node by server and SHA256, adding the node if it does not exist.

Args:

server: The server associated with the x509 certificate. The input type may be one of the following: `str`, `inet:server`.

sha256: The SHA256 fingerprint for the certificate. The input type may be one of the following: `str`, `hash:sha256`.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:

An inet:tls:servercert node with the given server and SHA256. The return type is *node*.

$lib.gen.itAvScanResultByTarget(form, value, signame, scanner=(null), time=(null), try=(false))

Returns an it:av:scan:result node by deconflicting with a target and signature name, adding the node if it does not exist.

Args:

form (str): The target form.

value (str): The target value.

signame (str): The signature name.

scanner (str): An optional scanner software name to include in deconfliction.

time (time): An optional time when the scan was run to include in the deconfliction.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
An it:av:scan:result node. The return type is *node*.

$lib.gen.langByCode(name, try=(false))

Returns a lang:language node by language code, adding the node if it does not exist.

Args:
name (str): The language code for the language.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
A lang:language node with the given code. The return type is *node*.

$lib.gen.langByName(name)

Returns a lang:language node by name, adding the node if it does not exist.

Args:
name (str): The name of the language.

Returns:
A lang:language node with the given name. The return type is *node*.

$lib.gen.newsByUrl(url, try=(false))

Returns a media:news node by URL, adding the node if it does not exist.

Args:
url (inet:url): The URL where the news is published.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
A media:news node with the given URL. The return type is *node*.

$lib.gen.orgByFqdn(fqdn, try=(false))

Returns an ou:org node by FQDN, adding the node if it does not exist.

Args:
fqdn (str): The FQDN of the org.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
An ou:org node with the given FQDN. The return type is *node*.

$lib.gen.orgByName(name)

Returns an ou:org by name, adding the node if it does not exist.

Args:
name (str): The name of the org.

Returns:
An ou:org node with the given name. The return type is *node*.

$lib.gen.orgHqByName(name)

Returns a ps:contact node for the ou:org, adding the node if it does not exist.

Args:
name (str): The name of the org.

Returns:
A ps:contact node for the ou:org with the given name. The return type is *node*.

$lib.gen.polCountryByIso2(iso2, try=(false))

Returns a pol:country node by deconflicting the :iso2 property.

Args:
iso2 (str): The pol:country:iso2 property.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
A pol:country node. The return type is *node*.

$lib.gen.psContactByEmail(type, email, try=(false))

Returns a ps:contact by deconflicting the type and email address.

Args:
type (str): The ps:contact:type property.

email (str): The ps:contact:email property.

try (boolean): Type normalization will fail silently instead of raising an exception.

Returns:
A ps:contact node. The return type is *node*.

$lib.gen.riskThreat(name, reporter)

Returns a risk:threat node based on the threat and reporter names, adding the node if it does not exist.

Args:
name (str): The reported name of the threat cluster.

reporter (str): The name of the organization which reported the threat cluster.

Returns:
A risk:threat node. The return type is *node*.

$lib.gen.riskToolSoftware(name, reporter)

Returns a risk:tool:software node based on the tool and reporter names, adding the node if it does not exist.

Args:
name (str): The reported name of the tool.

reporter (str): The name of the organization which reported the tool.

Returns:
A risk:tool:software node. The return type is *node*.

$lib.gen.softByName(name)

Returns it:prod:soft node by name, adding the node if it does not exist.

Args:
name (str): The name of the software.

Returns:
An it:prod:soft node with the given name. The return type is *node*.

$lib.gen.vulnByCve(cve, try=(false), reporter=(null))

Returns risk:vuln node by CVE and reporter, adding the node if it does not exist.

Args:
cve (str): The CVE id.

try (boolean): Type normalization will fail silently instead of raising an exception.

reporter (str): The name of the organization which reported the vulnerability.

Returns:
A risk:vuln node with the given CVE. The return type is *node*.

13.1.31 $lib.gis

A Storm library which implements helpers for earth based geospatial calculations.

$lib.gis.bbox(lon, lat, dist)

Calculate a min/max bounding box for the specified circle.

Args:
lon (float): The longitude in degrees.

lat (float): The latitude in degrees.

dist (int): A distance in geo:dist base units (mm).

Returns:
A tuple of (lonmin, lonmax, latmin, latmax). The return type is *list*.

13.1.32 $lib.globals

A Storm Library for interacting with global variables which are persistent across the Cortex.

$lib.globals.get(name, default=(null))

Get a Cortex global variables.

Args:
name (str): Name of the variable.

default (prim): Default value to return if the variable is not set.

Returns:
The variable value. The return type is `prim`.

$lib.globals.list()

Get a list of variable names and values.

Returns:
A list of tuples with variable names and values that the user can access. The return type is *list*.

$lib.globals.pop(name, default=(null))

Delete a variable value from the Cortex.

Args:
name (str): Name of the variable.

default (prim): Default value to return if the variable is not set.

Returns:
The variable value. The return type is `prim`.

$lib.globals.set(name, valu)

Set a variable value in the Cortex.

Args:
name (str): The name of the variable to set.

valu (prim): The value to set.

Returns:
The variable value. The return type is `prim`.

13.1.33 $lib.graph

A Storm Library for interacting with graph projections in the Cortex.

$lib.graph.activate(iden)

Set the graph projection to use for the top level Storm Runtime.

Args:
iden (str): The iden of the graph projection to use.

Returns:
The return type is `null`.

$lib.graph.add(gdef)

Add a graph projection to the Cortex.

Example:
Add a graph projection named "Test Projection":

```
$rules = ({
    "name": "Test Projection",
    "desc": "My test projection",
    "degrees": 2,
    "pivots": [" <(seen)- meta:source "],
    "filters": ["-#nope"],
    "forms": {
        "inet:fqdn": {
```

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```
            "pivots": ["<- *", "-> *"],
            "filters": ["-inet:fqdn:issuffix=1"]
        },
        "*": {
            "pivots": ["-> #"],
        }
    }
})
$lib.graph.add($rules)
```

Args:
gdef (dict): A graph projection definition.

Returns:
The return type is `null`.

$lib.graph.del(iden)

Delete a graph projection from the Cortex.

Args:
iden (str): The iden of the graph projection to delete.

Returns:
The return type is `null`.

$lib.graph.get(iden=(null))

Get a graph projection definition from the Cortex.

Args:
iden (str): The iden of the graph projection to get. If not specified, returns the current graph projection.

Returns:
A graph projection definition, or None if no iden was specified and there is currently no graph projection set. The return type is *dict*.

$lib.graph.grant(gden, scope, iden, level)

Modify permissions granted to users/roles on a graph projection.

Args:
gden (str): Iden of the graph projection to modify.

scope (str): The scope, either "users" or "roles".

iden (str): The user/role iden depending on scope.

level (int): The permission level number.

Returns:
The return type is `null`.

$lib.graph.list()

List the graph projections available in the Cortex.

Returns:
A list of graph projection definitions. The return type is *list*.

$lib.graph.mod(iden, info)

Modify user editable properties of a graph projection.

Args:
iden (str): The iden of the graph projection to modify.

info (dict): A dictionary of the properties to edit.

Returns:
The return type is `null`.

$lib.graph.revoke(gden, scope, iden)

Revoke permissions granted to users/roles on a graph projection.

Args:
gden (str): Iden of the graph projection to modify.

scope (str): The scope, either "users" or "roles".

iden (str): The user/role iden depending on scope.

Returns:
The return type is `null`.

13.1.34 $lib.hex

A Storm library which implements helpers for hexadecimal encoded strings.

$lib.hex.decode(valu)

Decode a hexadecimal string into bytes.

Args:
valu (str): The hex string to be decoded into bytes.

Returns:
The decoded bytes. The return type is *bytes*.

$lib.hex.encode(valu)

Encode bytes into a hexadecimal string.

Args:
valu (bytes): The bytes to be encoded into a hex string.

Returns:
The hex encoded string. The return type is *str*.

$lib.hex.fromint(valu, length, signed=(false))

Convert an integer to a big endian hexadecimal string.

Args:
valu (int): The integer to be converted.

length (int): The number of bytes to use to represent the integer.

signed (bool): If true, convert as a signed value.

Returns:
The resulting hex string. The return type is *str*.

$lib.hex.signext(valu, length)

Sign extension pad a hexadecimal encoded signed integer.

Args:
valu (str): The hex string to pad.

length (int): The number of characters to pad the string to.

Returns:
The sign extended hex string. The return type is *str*.

$lib.hex.toint(valu, signed=(false))

Convert a big endian hexadecimal string to an integer.

Args:
valu (str): The hex string to be converted.

signed (bool): If true, convert to a signed integer.

Returns:
The resulting integer. The return type is `int`.

$lib.hex.trimext(valu)

Trim sign extension bytes from a hexadecimal encoded signed integer.

Args:
valu (str): The hex string to trim.

Returns:
The trimmed hex string. The return type is *str*.

13.1.35 $lib.inet.http

A Storm Library exposing an HTTP client API.

For APIs that accept an ssl_opts argument, the dictionary may contain the following values:

```
({
    'verify': <bool> - Perform SSL/TLS verification. Is overridden by the ssl_verify␣
↪argument.
    'client_cert': <str> - PEM encoded full chain certificate for use in mTLS.
    'client_key': <str> - PEM encoded key for use in mTLS. Alternatively, can be␣
↪included in client_cert.
    'ca_cert': <str> - A PEM encoded full chain CA certificate for use when verifying␣
↪the request.
})
```

For APIs that accept a proxy argument, the following values are supported:

```
(null): Deprecated - Use the proxy defined by the http:proxy configuration option if set.
(true): Use the proxy defined by the http:proxy configuration option if set.
(false): Do not use the proxy defined by the http:proxy configuration option if set.
<str>: A proxy URL string.
```

$lib.inet.http.codereason(code)

Get the reason phrase for an HTTP status code.

Examples:

Get the reason for a 404 status code:

```
$str=$lib.inet.http.codereason(404)
```

Args:

code (int): The HTTP status code.

Returns:

The reason phrase for the status code. The return type is *str*.

$lib.inet.http.connect(url, headers=(null), ssl_verify=(true), timeout=(300), params=(null), proxy=(true), ssl_opts=(null))

Connect a web socket to tx/rx JSON messages.

Args:

url (str): The URL to retrieve.

headers (dict): HTTP headers to send with the request.

ssl_verify (boolean): Perform SSL/TLS verification.

timeout (int): Total timeout for the request in seconds.

params (dict): Optional parameters which may be passed to the connection request.

proxy: Configure proxy usage. See $lib.inet.http help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.inet.http help for additional details.

Returns:

A websocket object. The return type is *inet:http:socket*.

$lib.inet.http.get(url, headers=(null), ssl_verify=(true), params=(null), timeout=(300), allow_redirects=(true), proxy=(true), ssl_opts=(null))

Get the contents of a given URL.

Args:

url (str): The URL to retrieve.

headers (dict): HTTP headers to send with the request.

ssl_verify (boolean): Perform SSL/TLS verification.

params (dict): Optional parameters which may be passed to the request.

timeout (int): Total timeout for the request in seconds.

allow_redirects (bool): If set to false, do not follow redirects.

proxy: Configure proxy usage. See $lib.inet.http help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.inet.http help for additional details.

Returns:

The response object. The return type is *inet:http:resp*.

$lib.inet.http.head(url, headers=(null), ssl_verify=(true), params=(null), timeout=(300), allow_redirects=(false), proxy=(true), ssl_opts=(null))

Get the HEAD response for a URL.

Args:

url (str): The URL to retrieve.

headers (dict): HTTP headers to send with the request.

ssl_verify (boolean): Perform SSL/TLS verification.

params (dict): Optional parameters which may be passed to the request.

timeout (int): Total timeout for the request in seconds.

allow_redirects (bool): If set to true, follow redirects.

proxy: Configure proxy usage. See $lib.inet.http help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.inet.http help for additional details.

Returns:

The response object. The return type is *inet:http:resp*.

$lib.inet.http.post(url, headers=(null), json=(null), body=(null), ssl_verify=(true), params=(null), timeout=(300), allow_redirects=(true), fields=(null), proxy=(true), ssl_opts=(null))

Post data to a given URL.

Args:

url (str): The URL to post to.

headers (dict): HTTP headers to send with the request.

json (prim): The data to post, as JSON object.

body (bytes): The data to post, as binary object.

ssl_verify (boolean): Perform SSL/TLS verification.

params (dict): Optional parameters which may be passed to the request.

timeout (int): Total timeout for the request in seconds.

allow_redirects (bool): If set to false, do not follow redirects.

fields (list): A list of info dictionaries containing the name, value or sha256, and additional parameters for fields to post, as multipart/form-data. If a sha256 is specified, the request will be sent from the axon and the corresponding file will be uploaded as the value for the field.

proxy: Configure proxy usage. See $lib.inet.http help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.inet.http help for additional details.

Returns:

The response object. The return type is *inet:http:resp*.

$lib.inet.http.request(meth, url, headers=(null), json=(null), body=(null), ssl_verify=(true), params=(null), timeout=(300), allow_redirects=(true), fields=(null), proxy=(true), ssl_opts=(null))

Make an HTTP request using the given HTTP method to the url.

Args:

meth (str): The HTTP method. (ex. PUT)

url (str): The URL to send the request to.

headers (dict): HTTP headers to send with the request.

json (prim): The data to include in the body, as JSON object.

body (bytes): The data to include in the body, as binary object.

ssl_verify (boolean): Perform SSL/TLS verification.

params (dict): Optional parameters which may be passed to the request.

timeout (int): Total timeout for the request in seconds.

allow_redirects (bool): If set to false, do not follow redirects.

fields (list): A list of info dictionaries containing the name, value or sha256, and additional parameters for fields to post, as multipart/form-data. If a sha256 is specified, the request will be sent from the axon and the corresponding file will be uploaded as the value for the field.

proxy: Configure proxy usage. See $lib.inet.http help for additional details. The input type may be one of the following: `bool`, `str`.

ssl_opts (dict): Optional SSL/TLS options. See $lib.inet.http help for additional details.

Returns:

The response object. The return type is *inet:http:resp*.

$lib.inet.http.urldecode(text)

Urldecode a text string.

This will replace %xx escape characters with the special characters they represent and replace plus signs with spaces.

Examples:

Urlencode a string:

```
$str=$lib.inet.http.urldecode("http%3A%2F%2Fgo+ogle.com")
```

Args:

text (str): The text string.

Returns:

The urldecoded string. The return type is *str*.

$lib.inet.http.urlencode(text)

Urlencode a text string.

This will replace special characters in a string using the %xx escape and replace spaces with plus signs.

Examples:

Urlencode a string:

```
$str=$lib.inet.http.urlencode("http://google.com")
```

Args:
text (str): The text string.

Returns:
The urlencoded string. The return type is *str*.

13.1.36 $lib.inet.http.oauth.v1

A Storm library to handle OAuth v1 authentication.

$lib.inet.http.oauth.v1.client(ckey, csecret, atoken, asecret, sigtype=QUERY)

Initialize an OAuthV1 Client to use for signing/authentication.

Args:
ckey (str): The OAuthV1 Consumer Key to store and use for signing requests.

csecret (str): The OAuthV1 Consumer Secret used to sign requests.

atoken (str): The OAuthV1 Access Token (or resource owner key) to use to sign requests.)

asecret (str): The OAuthV1 Access Token Secret (or resource owner secret) to use to sign requests.

sigtype (str): Where to populate the signature (in the HTTP body, in the query parameters, or in the header)

Returns:
An OAuthV1 client to be used to sign requests. The return type is *inet:http:oauth:v1:client*.

13.1.37 $lib.inet.http.oauth.v2

A Storm library for managing OAuth V2 clients.

$lib.inet.http.oauth.v2.addProvider(conf)

Add a new provider configuration.

Example:
Add a new provider which uses the authorization code flow:

```
$iden = $lib.guid(example, provider, oauth)
$conf = ({
    "iden": $iden,
    "name": "example_provider",
    "client_id": "yourclientid",
    "client_secret": "yourclientsecret",
    "scope": "first_scope second_scope",
    "auth_uri": "https://provider.com/auth",
    "token_uri": "https://provider.com/token",
    "redirect_uri": "https://local.redirect.com/oauth",
})

// Optionally enable PKCE
$conf.extensions = ({"pkce": true})

// Optionally disable SSL verification
$conf.ssl_verify = (false)

// Optionally provide additional key-val parameters
```

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```
// to include when calling the auth URI
$conf.extra_auth_params = ({"customparam": "foo"})

$lib.inet.http.oauth.v2.addProvider($conf)
```

Add a new provider which uses the Microsoft Azure Federated Workflow Identify token credentials. This resolves the client_assertion from the AZURE_FEDERATED_TOKEN_FILE environment variable:

```
$iden = $lib.guid(azureexample, provider, oauth)
$authority_id = '4b70ee6f-d47b-3262-baa1-41cd7faed71b'
$conf = ({
    "iden": $iden,
    "name": "example_provider",
    "auth_scheme": "client_assertion",
    "client_id": "yourclientid",
    "client_assertion": {
        "msft:azure:workloadidentity": {
            "token": true,
        },
    },
    "scope": "first_scope second_scope",
    "auth_uri": `https://login.microsoftonline.com/{$authority_id}/oauth2/v2.0/
↪authorize`,
    "token_uri": `https://login.microsoftonline.com/{$authority_id}/oauth2/v2.0/
↪token`,
    "redirect_uri": "https://local.redirect.com/oauth",
})

// Optionally enable PKCE
$conf.extensions = ({"pkce": true})

// Optionally disable SSL verification
$conf.ssl_verify = (false)

// Optionally provide additional key-val parameters
// to include when calling the auth URI
$conf.extra_auth_params = ({"customparam": "foo"})

$lib.inet.http.oauth.v2.addProvider($conf)
```

If the `client_id` value should come from the AZURE_CLIENT_ID environment variable, use the following configuration:

```
$conf = ({
    "iden": $iden,
    "name": "example_provider",
    "auth_scheme": "client_assertion",
    "client_assertion": {
        "msft:azure:workloadidentity": {
            "token": true,
            "client_id": true,
        },
```

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```
    },
    "scope": "first_scope second_scope",
    "auth_uri": `https://login.microsoftonline.com/{$authority_id}/oauth2/v2.0/
↪authorize`,
    "token_uri": `https://login.microsoftonline.com/{$authority_id}/oauth2/v2.0/
↪token`,
    "redirect_uri": "https://local.redirect.com/oauth",
})
```

Add a new provider which uses a custom Storm callback to obtain the client_assertion data. These callbacks are executed as the user who is performing the authorization_code workflow. The Storm callback must return data in a tuple of `bool` and a dictionary containing the assertion in the key `token`. Error messages should be in the key `error`:

```
$iden = $lib.guid(callstormexample, provider, oauth)

// Example callback
$callbackQuery = ${
    $url = `{$baseurl}/api/oauth/getAssertion`
    $resp = $lib.inet.http.get($url, ssl_verify=$ssl_verify)
    if ($resp.code = 200) {
        $resp = ([true, {'token': $resp.json().assertion}])
    } else {
        $resp = ([false, {"error": `Failed to get assertion from {$url}`}])
    }
    return ( $resp )
}

// Specify any variables that need to be provided to $callbackQuery
$myCallbackVars = ({
    'baseurl': 'https://local.assertion.provider.corp',
    'ssl_verify': true,
})

// Specify the view the callback is run in.
$view = $lib.view.get().iden

$conf = ({
    "iden": $iden,
    "name": "example_provider",
    "auth_scheme": "client_assertion",
    "client_id": "yourclientid",
    "client_assertion": {
        "cortex:callstorm": {
            "query": $callbackQuery,
            "view": $view,
            "vars": $myCallbackVars,
        },
    },
    "scope": "first_scope second_scope",
    "auth_uri": "https://provider.com/auth",
    "token_uri": "https://provider.com/token",
```

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```
    "redirect_uri": "https://local.redirect.com/oauth",
})

// Optionally enable PKCE
$conf.extensions = ({"pkce": true})

$lib.inet.http.oauth.v2.addProvider($conf)
```

Args:
conf (dict): A provider configuration.

Returns:
The return type is `null`.

$lib.inet.http.oauth.v2.clearUserAccessToken(iden)

Clear the stored refresh data for the current user's provider access token.

Args:
iden (str): The provider iden.

Returns:
The existing token state data or None if it did not exist. The return type is *dict*.

$lib.inet.http.oauth.v2.delProvider(iden)

Delete a provider configuration.

Args:
iden (str): The provider iden.

Returns:
The deleted provider configuration or None if it does not exist. The return type is *dict*.

$lib.inet.http.oauth.v2.getProvider(iden)

Get a provider configuration

Args:
iden (str): The provider iden.

Returns:
The provider configuration or None if it does not exist. The return type is *dict*.

$lib.inet.http.oauth.v2.getUserAccessToken(iden)

Get the provider access token for the current user.

Example:

Retrieve the token and handle needing an auth code:

```
$provideriden = $lib.globals.get("oauth:myprovider")

($ok, $data) = $lib.inet.http.oauth.v2.getUserAccessToken($provideriden)

if $ok {
    // $data is the token to be used in a request
```

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```
else {
    // $data is a message stating why the token is not available
    // caller should now handle retrieving a new auth code for the user
}
```

Args:
iden (str): The provider iden.

Returns:
List of (<bool>, <token/mesg>) for status and data. The return type is *list*.

$lib.inet.http.oauth.v2.listProviders()

List provider configurations

Returns:
List of (iden, conf) tuples. The return type is *list*.

$lib.inet.http.oauth.v2.setUserAuthCode(iden, authcode, code_verifier=(null))

Set the auth code for the current user.

Args:
iden (str): The provider iden.

authcode (str): The auth code for the user.

code_verifier (str): Optional PKCE code verifier.

Returns:
The return type is `null`.

13.1.38 $lib.inet.imap

A Storm library to connect to an IMAP server.

$lib.inet.imap.connect(host, port=(993), timeout=(30), ssl=(true), ssl_verify=(true))

Open a connection to an IMAP server.

This method will wait for a "hello" response from the server before returning the `inet:imap:server` instance.

Args:
host (str): The IMAP hostname.

port (int): The IMAP server port.

timeout (int): The time to wait for all commands on the server to execute.

ssl (bool): Use SSL to connect to the IMAP server.

ssl_verify (bool): Perform SSL/TLS verification.

Returns:
A new `inet:imap:server` instance. The return type is *inet:imap:server*.

13.1.39 $lib.inet.ipv6

A Storm Library for providing ipv6 helpers.

$lib.inet.ipv6.expand(valu)

Convert a IPv6 address to its expanded form.'

Notes:
The expanded form is also sometimes called the "long form" address.

Examples:
Expand a ipv6 address to its long form:

```
$expandedvalu = $lib.inet.ipv6.expand('2001:4860:4860::8888')
```

Args:
valu (str): IPv6 Address to expand

Returns:
The expanded form. The return type is *str*.

13.1.40 $lib.inet.smtp

A Storm Library for sending email messages via SMTP.

$lib.inet.smtp.message()

Construct a new email message.

Returns:
The newly constructed inet:smtp:message. The return type is *inet:smtp:message*.

13.1.41 $lib.inet.whois

A Storm Library for providing a consistent way to generate guids for WHOIS / Registration Data in Storm.

$lib.inet.whois.guid(props, form)

Warning

`$lib.inet.whois.guid` has been deprecated and will be removed in version v3.0.0. Please use the GUID constructor syntax.

Provides standard patterns for creating guids for certain inet:whois forms.

Raises:
StormRuntimeError: If form is not supported in this method.

Args:
props (dict): Dictionary of properties used to create the form.

form (str): The `inet:whois` form to create the guid for.

Returns:
A guid for creating a the node for. The return type is *str*.

13.1.42 $lib.infosec.cvss

A Storm library which implements CVSS score calculations.

$lib.infosec.cvss.calculate(node, save=(true), vers=3.1)

Warning

`$lib.infosec.cvss.calculate` has been deprecated and will be removed in version v3.0.0.

Calculate the CVSS score values for an input risk:vuln node.

Args:

node (node): A risk:vuln node from the Storm runtime.

save (boolean): If true, save the computed scores to the node properties.

vers (str): The version of CVSS calculations to execute.

Returns:

A dictionary containing the computed score and subscores. The return type is *dict*.

$lib.infosec.cvss.calculateFromProps(props, vers=3.1)

Warning

`$lib.infosec.cvss.calculateFromProps` has been deprecated and will be removed in version v3.0.0.

Calculate the CVSS score values from a props dict.

Args:

props (dict): A props dictionary.

vers (str): The version of CVSS calculations to execute.

Returns:

A dictionary containing the computed score and subscores. The return type is *dict*.

$lib.infosec.cvss.saveVectToNode(node, text)

Warning

`$lib.infosec.cvss.saveVectToNode` has been deprecated and will be removed in version v3.0.0.

Parse a CVSS v3.1 vector and record properties on a risk:vuln node.

Args:

node (node): A risk:vuln node to record the CVSS properties on.

text (str): A CVSS vector string.

Returns:

The return type is `null`.

$lib.infosec.cvss.vectToProps(text)

Warning

`$lib.infosec.cvss.vectToProps` has been deprecated and will be removed in version v3.0.0.

Parse a CVSS v3.1 vector and return a dictionary of risk:vuln props.

Args:
text (str): A CVSS vector string.

Returns:
A dictionary of risk:vuln secondary props. The return type is *dict*.

$lib.infosec.cvss.vectToScore(vect, vers=(null))

Compute CVSS scores from a vector string.

Takes a CVSS vector string, attempts to automatically detect the version (defaults to CVSS3.1 if it cannot), and calculates the base, temporal, and environmental scores.

Raises:

- BadArg: An invalid *vers* string is provided
- BadDataValu: The vector string is invalid in some way. Possible reasons are malformed string, duplicated metrics, missing mandatory metrics, and invalid metric values.

Args:

vect (str):
A valid CVSS vector string.

The following examples are valid formats:

- CVSS 2 with version: *CVSS2#AV:L/AC:L/Au:M/C:P/I:C/A:N*
- CVSS 2 with parentheses: *(AV:L/AC:L/Au:M/C:P/I:C/A:N)*
- CVSS 2 without parentheses: *AV:L/AC:L/Au:M/C:P/I:C/A:N*
- CVSS 3.0 with version: *CVSS:3.0/AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L*
- CVSS 3.1 with version: *CVSS:3.1/AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L*
- CVSS 3.0/3.1 with parentheses: *(AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L)*
- CVSS 3.0/3.1 without parentheses: *AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L*

vers (str):
A valid version string or None to autodetect the version from the vector string. Accepted values are: 2, 3.0, 3.1, None.

Returns:

A dictionary with the detected version, base score, temporal score, environmental score, overall score, and normalized vector string. The normalized vector string will have metrics ordered in specification order and metrics with undefined values will be removed. Example:

```
{
    'version': '3.1',
    'score': 4.3,
```

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```
    'base': 5.0,
    'temporal': 4.4,
    'environmental': 4.3,
    'normalized': 'AV:N/AC:H/PR:L/UI:R/S:U/C:L/I:L/A:L'
}
```

The return type is *dict*.

13.1.43 $lib.infosec.mitre.attack.flow

A Storm library which implements modeling MITRE ATT&CK Flow diagrams.

$lib.infosec.mitre.attack.flow.ingest(flow)

Ingest a MITRE ATT&CK Flow diagram in JSON format.

Args:
flow (data): The JSON data to ingest.

Returns:
The it:mitre:attack:flow node representing the ingested attack flow diagram. The return type may be one of the following: *node*, `null`.

$lib.infosec.mitre.attack.flow.norm(flow)

Normalize a MITRE ATT&CK Flow diagram in JSON format.

Args:
flow (data): The MITRE ATT&CK Flow diagram in JSON format to normalize (flatten and sort).

Returns:
The normalized MITRE ATT&CK Flow diagram. The return type is *dict*.

13.1.44 $lib.iters

A Storm library for providing iterator helpers.

$lib.iters.enum(genr)

Yield (<indx>, <item>) tuples from an iterable or generator.

Args:
genr (iter): An iterable or generator.

Yields:
Yields (<indx>, <item>) tuples. The return type is *list*.

$lib.iters.zip(*args)

Yield tuples created by iterating multiple iterables in parallel.

Args:
*args (iter): Iterables or generators.

Yields:
Yields tuples with an item from each iterable or generator. The return type is *list*.

13.1.45 $lib.json

A Storm Library for interacting with Json data.

$lib.json.load(text)

Parse a JSON string and return the deserialized data.

Args:
text (str): The string to be deserialized.

Returns:
The JSON deserialized object. The return type is `prim`.

$lib.json.save(item, indent=(false))

Save an object as a JSON string.

Args:
item (any): The item to be serialized as a JSON string.

indent (boolean): Indent serialized data with two spaces.

Returns:
The JSON serialized object. The return type is *str*.

$lib.json.schema(schema, use_default=(true))

Get a JS schema validation object.

Args:
schema (dict): The JsonSchema to use.

use_default (boolean): Whether to insert default schema values into the validated data structure.

Returns:
A validation object that can be used to validate data structures. The return type is *json:schema*.

13.1.46 $lib.jsonstor

Implements cortex JSON storage.

$lib.jsonstor.cachedel(path, key)

Remove cached data set with cacheset.

Args:
path (str|list): The base path to use for the cache key.

key (prim): The value to use for the GUID cache key.

Returns:
True if the del operation was successful. The return type is *boolean*.

$lib.jsonstor.cacheget(path, key, asof=now, envl=(false))

Retrieve data stored with cacheset() if it was stored more recently than the asof argument.

Args:
path (str|list): The base path to use for the cache key.

key (prim): The value to use for the GUID cache key.

asof (time): The max cache age.

envl (boolean): Return the full cache envelope.

Returns:
The cached value (or envelope) or null. The return type is `prim`.

$lib.jsonstor.cacheset(path, key, valu)

Set cache data with an envelope that tracks time for cacheget() use.

Args:
path (str|list): The base path to use for the cache key.

key (prim): The value to use for the GUID cache key.

valu (prim): The data to store.

Returns:
The cached asof time and path. The return type is *dict*.

$lib.jsonstor.del(path, prop=(null))

Delete a stored JSON object or object.

Args:
path (str|list): A path string or list of path parts.

prop (str|list): A property name or list of name parts.

Returns:
True if the del operation was successful. The return type is *boolean*.

$lib.jsonstor.get(path, prop=(null))

Return a stored JSON object or object property.

Args:
path (str|list): A path string or list of path parts.

prop (str|list): A property name or list of name parts.

Returns:
The previously stored value or `(null)`. The return type is `prim`.

$lib.jsonstor.iter(path=(null))

Yield (<path>, <valu>) tuples for the JSON objects.

Args:
path (str|list): A path string or list of path parts.

Yields:
(<path>, <item>) tuples. The return type is *list*.

$lib.jsonstor.set(path, valu, prop=(null))

Set a JSON object or object property.

Args:
path (str|list): A path string or list of path elements.

valu (prim): The value to set as the JSON object or object property.

prop (str|list): A property name or list of name parts.

Returns:
True if the set operation was successful. The return type is *boolean*.

13.1.47 $lib.layer

A Storm Library for interacting with Layers in the Cortex.

$lib.layer.add(ldef=(null))

Add a layer to the Cortex.

Args:
ldef (dict): The layer definition dictionary.

Returns:
A `layer` object representing the new layer. The return type is *layer*.

$lib.layer.del(iden)

Delete a layer from the Cortex.

Args:
iden (str): The iden of the layer to delete.

Returns:
The return type is `null`.

$lib.layer.get(iden=(null))

Get a Layer from the Cortex.

Args:
iden (str): The iden of the layer to get. If not set, this defaults to the top layer of the current View.

Returns:
The storm layer object. The return type is *layer*.

$lib.layer.list()

List the layers in a Cortex

Returns:
List of `layer` objects. The return type is *list*.

13.1.48 $lib.lift

A Storm Library for interacting with lift helpers.

$lib.lift.byNodeData(name)

Lift nodes which have a given nodedata name set on them.

Args:
name (str): The name to of the nodedata key to lift by.

Yields:
Yields nodes to the pipeline. This must be used in conjunction with the `yield` keyword. The return type is *node*.

13.1.49 $lib.log

A Storm library which implements server side logging. These messages are logged to the `synapse.storm.log` logger.

$lib.log.debug(mesg, extra=(null))

Log a message to the Cortex at the debug log level.

Notes:
This requires the `storm.lib.log.debug` permission to use.

Examples:
Log a debug message:

```
$lib.log.debug('I am a debug message!')
```

Log a debug message with extra information:

```
$lib.log.debug('Extra information included here.', extra={"key": $valu})
```

Args:
mesg (str): The message to log.

extra (dict): Extra key / value pairs to include when structured logging is enabled on the Cortex.

Returns:
The return type is `null`.

$lib.log.error(mesg, extra=(null))

Log a message to the Cortex at the error log level.

Notes:
This requires the `storm.lib.log.error` permission to use.

Examples:
Log an error message:

```
$lib.log.error('I am a error message!')
```

Log an error message with extra information:

```
$lib.log.error('Extra information included here.', extra={"key": $valu})
```

Args:
mesg (str): The message to log.

extra (dict): Extra key / value pairs to include when structured logging is enabled on the Cortex.

Returns:
The return type is `null`.

$lib.log.info(mesg, extra=(null))

Log a message to the Cortex at the info log level.

Notes:
This requires the `storm.lib.log.info` permission to use.

Examples:
Log an info message:

```
$lib.log.info('I am a info message!')
```

Log an info message with extra information:

```
$lib.log.info('Extra information included here.', extra={"key": $valu})
```

Args:
mesg (str): The message to log.

extra (dict): Extra key / value pairs to include when structured logging is enabled on the Cortex.

Returns:
The return type is `null`.

$lib.log.warning(mesg, extra=(null))

Log a message to the Cortex at the warning log level.

Notes:
This requires the `storm.lib.log.warning` permission to use.

Examples:
Log a warning message:

```
$lib.log.warning('I am a warning message!')
```

Log a warning message with extra information:

```
$lib.log.warning('Extra information included here.', extra={"key": $valu})
```

Args:
mesg (str): The message to log.

extra (dict): Extra key / value pairs to include when structured logging is enabled on the Cortex.

Returns:
The return type is `null`.

13.1.50 $lib.macro

A Storm Library for interacting with the Storm Macros in the Cortex.

$lib.macro.del(name)

Delete a Storm Macro by name from the Cortex.

Args:
name (str): The name of the macro to delete.

Returns:
The return type is `null`.

$lib.macro.get(name)

Get a Storm Macro definition by name from the Cortex.

Args:
name (str): The name of the macro to get.

Returns:
A macro definition. The return type is *dict*.

$lib.macro.grant(name, scope, iden, level)

Modify permissions granted to users/roles on a Storm Macro.

Args:
name (str): Name of the Storm Macro to modify.

scope (str): The scope, either "users" or "roles".

iden (str): The user/role iden depending on scope.

level (int): The permission level number.

Returns:
The return type is `null`.

$lib.macro.list()

Get a list of Storm Macros in the Cortex.

Returns:
A list of `dict` objects containing Macro definitions. The return type is *list*.

$lib.macro.mod(name, info)

Modify user editable properties of a Storm Macro.

Args:
name (str): Name of the Storm Macro to modify.

info (dict): A dictionary of the properties to edit.

Returns:
The return type is `null`.

$lib.macro.set(name, storm)

Add or modify an existing Storm Macro in the Cortex.

Args:
name (str): Name of the Storm Macro to add or modify.

storm: The Storm query to add to the macro. The input type may be one of the following: `str`, `storm:query`.

Returns:
The return type is `null`.

13.1.51 $lib.math

A Storm library for performing math operations.

$lib.math.number(value)

Convert a value to a Storm Number object.

Storm Numbers are high precision fixed point decimals corresponding to the hugenum storage type.

This is not to be used for converting a string to an integer.

Args:
value (any): Value to convert.

Returns:
A Number object. The return type is *number*.

13.1.52 $lib.mime.html

A Storm library for manipulating HTML text.

$lib.mime.html.totext(html)

Return inner text from all tags within an HTML document.

Args:
html (str): The HTML text to be parsed.

Returns:
The newline-joined inner HTML text. The return type is *str*.

13.1.53 $lib.model

A Storm Library for interacting with the Data Model in the Cortex.

$lib.model.form(name)

Get a form object by name.

Args:
name (str): The name of the form to retrieve.

Returns:
The `model:form` instance if the form is present or null. The return type may be one of the following: *model:form*, `null`.

$lib.model.prop(name)

Get a prop object by name.

Args:
name (str): The name of the prop to retrieve.

Returns:
The `model:property` instance if the type if present or null. The return type may be one of the following: *model:property*, `null`.

$lib.model.tagprop(name)

Get a tag property object by name.

Args:
name (str): The name of the tag prop to retrieve.

Returns:
The `model:tagprop` instance of the tag prop if present or null. The return type may be one of the following: *model:tagprop*, `null`.

$lib.model.type(name)

Get a type object by name.

Args:
name (str): The name of the type to retrieve.

Returns:
The `model:type` instance if the type if present on the form or null. The return type may be one of the following: *model:type*, `null`.

13.1.54 $lib.model.deprecated

A storm library for interacting with the model deprecation mechanism.

$lib.model.deprecated.lock(name, locked)

Set the locked property for a deprecated model element.

Args:
name (str): The full path of the model element to lock.

locked (boolean): The lock status.

Returns:
The return type is `null`.

$lib.model.deprecated.locks()

Get a dictionary of the data model elements which are deprecated and their lock status in the Cortex.

Returns:
A dictionary of named elements to their boolean lock values. The return type is *dict*.

13.1.55 $lib.model.edge

A Storm Library for interacting with light edges and manipulating their key-value attributes. This Library is deprecated.

$lib.model.edge.del(verb, key)

Warning

`$lib.model.edge.del` has been deprecated and will be removed in version v3.0.0.

Delete a key from the key-value store for a verb.

Args:
verb (str): The name of the Edge verb to remove a key from.

key (str): The name of the key to remove from the key-value store.

Returns:
The return type is `null`.

$lib.model.edge.get(verb)

Warning

`$lib.model.edge.get` has been deprecated and will be removed in version v3.0.0.

Get the key-value data for a given Edge verb.

Args:
verb (str): The Edge verb to look up.

Returns:
A dictionary representing the key-value data set on a verb. The return type is *dict*.

$lib.model.edge.list()

Warning

`$lib.model.edge.list` has been deprecated and will be removed in version v3.0.0.

Get a list of (verb, key-value dictionary) pairs for Edge verbs in the current Cortex View.

Returns:
A list of (str, dict) tuples for each verb in the current Cortex View. The return type is *list*.

$lib.model.edge.set(verb, key, valu)

Warning

`$lib.model.edge.set` has been deprecated and will be removed in version v3.0.0.

Set a key-value for a given Edge verb.

Args:
verb (str): The Edge verb to set a value for.

key (str): The key to set.

valu (str): The value to set.

Returns:
The return type is `null`.

$lib.model.edge.validkeys()

Warning

`$lib.model.edge.validkeys` has been deprecated and will be removed in version v3.0.0.

Get a list of the valid keys that can be set on an Edge verb.

Returns:
A list of the valid keys. The return type is *list*.

13.1.56 $lib.model.ext

A Storm library for manipulating extended model elements.

$lib.model.ext.addEdge(n1form, verb, n2form, edgeinfo)

Add an extended edge definition to the data model.

Args:

n1form (str): The form of the n1 node. May be "*" or null to specify "any".

verb (str): The edge verb, which must begin with "_".

n2form (str): The form of the n2 node. May be "*" or null to specify "any".

edgeinfo (dict): A Synapse edge info dictionary.

Returns:

The return type is `null`.

$lib.model.ext.addExtModel(model)

Add extended model elements to the Cortex from getExtModel().

Args:

model (dict): A model dictionary from getExtModel().

Returns:

The return type is *boolean*.

$lib.model.ext.addForm(formname, basetype, typeopts, typeinfo)

Add an extended form definition to the data model.

Args:

formname (str): The name of the form to add.

basetype (str): The base type the form is derived from.

typeopts (dict): A Synapse type opts dictionary.

typeinfo (dict): A Synapse form info dictionary.

Returns:

The return type is `null`.

$lib.model.ext.addFormProp(formname, propname, typedef, propinfo)

Add an extended property definition to the data model.

Args:

formname (str): The name of the form to add the property to.

propname (str): The name of the extended property.

typedef (list): A Synapse type definition tuple.

propinfo (dict): A synapse property definition dictionary.

Returns:

The return type is `null`.

$lib.model.ext.addTagProp(propname, typedef, propinfo)

Add an extended tag property definition to the data model.

Args:

propname (str): The name of the tag property.

typedef (list): A Synapse type definition tuple.

propinfo (dict): A synapse property definition dictionary.

Returns:

The return type is `null`.

$lib.model.ext.addType(typename, basetype, typeopts, typeinfo)

Add an extended type definition to the data model.

Args:

typename (str): The name of the type to add.

basetype (str): The base type the type is derived from.

typeopts (dict): A Synapse type opts dictionary.

typeinfo (dict): A Synapse type info dictionary.

Returns:

The return type is `null`.

$lib.model.ext.addUnivProp(propname, typedef, propinfo)

Add an extended universal property definition to the data model.

Args:

propname (str): The name of the universal property.

typedef (list): A Synapse type definition tuple.

propinfo (dict): A synapse property definition dictionary.

Returns:

The return type is `null`.

$lib.model.ext.delEdge(n1form, verb, n2form)

Remove an extended edge definition from the data model.

Args:

n1form (str): The form of the n1 node. May be “*” or null to specify “any”.

verb (str): The edge verb, which must begin with “_”.

n2form (str): The form of the n2 node. May be “*” or null to specify “any”.

Returns:

The return type is `null`.

$lib.model.ext.delForm(formname)

Remove an extended form definition from the model.

Args:

formname (str): The extended form to remove.

Returns:
The return type is `null`.

$lib.model.ext.delFormProp(formname, propname, force=(false))

Remove an extended property definition from the model.

Args:
formname (str): The form with the extended property.

propname (str): The extended property to remove.

force (boolean): Delete the property from all nodes before removing the definition.

Returns:
The return type is `null`.

$lib.model.ext.delTagProp(propname, force=(false))

Remove an extended tag property definition from the model.

Args:
propname (str): Name of the tag property to remove.

force (boolean): Delete the tag property from all nodes before removing the definition.

Returns:
The return type is `null`.

$lib.model.ext.delType(typename)

Remove an extended type definition from the model.

Args:
typename (str): The extended type to remove.

Returns:
The return type is `null`.

$lib.model.ext.delUnivProp(propname, force=(false))

Remove an extended universal property definition from the model.

Args:
propname (str): Name of the universal property to remove.

force (boolean): Delete the property from all nodes before removing the definition.

Returns:
The return type is `null`.

$lib.model.ext.getExtModel()

Get all extended model elements.

Returns:
The return type is *dict*.

13.1.57 $lib.model.migration

A Storm library containing migration tools.

$lib.model.migration.copyData(src, dst, overwrite=(false))

Copy node data from the src node to the dst node.

Args:

src (node): The node to copy data from.

dst (node): The node to copy data to.

overwrite (boolean): Copy data even if the key exists on the destination node.

Returns:

The return type is `null`.

$lib.model.migration.copyEdges(src, dst)

Copy edges from the src node to the dst node.

Args:

src (node): The node to copy edges from.

dst (node): The node to copy edges to.

Returns:

The return type is `null`.

$lib.model.migration.copyExtProps(src, dst)

Copy extended properties from the src node to the dst node.

Args:

src (node): The node to copy extended props from.

dst (node): The node to copy extended props to.

Returns:

The return type is `null`.

$lib.model.migration.copyTags(src, dst, overwrite=(false))

Copy tags, tag timestamps, and tag props from the src node to the dst node.

Args:

src (node): The node to copy tags from.

dst (node): The node to copy tags to.

overwrite (boolean): Copy tag property value even if the property exists on the destination node.

Returns:

The return type is `null`.

13.1.58 $lib.model.migration.s

A Storm library for selectively migrating nodes in the current view.

$lib.model.migration.s.inetServiceMessageClientAddress(n)

Migrate the :client:address property to :client on inet:service:message nodes.

Edits will be made to the inet:service:message node in the current write layer.

If the :client:address property is set and the :client property is not set, the :client property will be set with the :client:address value. If both properties are set, the value will be moved into nodedata under the key 'migration:inet:service:message:address'.

Args:
n (node): The inet:sevice:message node to migrate.

Returns:
The return type is `null`.

$lib.model.migration.s.inetSslCertToTlsServerCert(n, nodata=(false))

Create a inet:tls:servercert node from the provided inet:ssl:cert node.

Edits will be made to the inet:tls:servercert node in the current write layer.

Tags, tag properties, edges, and node data will be copied to the inet:tls:servercert node. However, existing tag properties and node data will not be overwritten.

Args:
n (node): The inet:ssl:cert node to migrate.

nodata (bool): Do not copy nodedata to the inet:tls:servercert node.

Returns:
The newly created inet:tls:servercert node. The return type is *node*.

$lib.model.migration.s.riskHasVulnToVulnerable(n, nodata=(false))

Create a risk:vulnerable node from the provided risk:hasvuln node.

Edits will be made to the risk:vulnerable node in the current write layer.

If multiple vulnerable properties are set on the risk:hasvuln node multiple risk:vulnerable nodes will be created (each with a unique guid). Otherwise, a single risk:vulnerable node will be created with the same guid as the provided risk:hasvuln node. Extended properties will not be migrated.

Tags, tag properties, edges, and node data will be copied to the risk:vulnerable node. However, existing tag properties and node data will not be overwritten.

Args:
n (node): The risk:hasvuln node to migrate.

nodata (bool): Do not copy nodedata to the risk:vulnerable node.

Returns:
A list of idens for the risk:vulnerable nodes. The return type is *list*.

13.1.59 $lib.model.migration.s.model_0_2_31

A Storm library with helper functions for the 0.2.31 model it:sec:cpe migration.

$lib.model.migration.s.model_0_2_31.listNodes(form=(null), source=(null), offset=(0), size=(null))

Yield queued nodes.

Args:
form (form): Only yield entries matching the specified form.

source (str): Only yield entries that were seen by the specified source.

offset (int): Skip this many entries.

size (int): Only yield up to this many entries.

Yields:
A tuple of (offset, form, valu, sources) values for the specified node. The return type is *list*.

$lib.model.migration.s.model_0_2_31.printNode(offset)

Print detailed queued node information.

Args:
offset (into): The offset of the queued node to print.

Returns:
The return type is `null`.

$lib.model.migration.s.model_0_2_31.repairNode(offset, newvalu, remove=(false))

Repair a queued node.

Args:
offset (str): The node queue offset to repair.

newvalu (any): The new (corrected) node value.

remove (boolean): Specify whether to delete the repaired node from the queue.

Returns:
The queue node information The return type is *dict*.

13.1.60 $lib.model.tags

A Storm Library for interacting with tag specifications in the Cortex Data Model.

$lib.model.tags.del(tagname)

Delete a tag model specification.

Examples:
Delete the tag model specification for `cno.threat`:

```
$lib.model.tags.del(cno.threat)
```

Args:
tagname (str): The name of the tag.

Returns:
The return type is `null`.

$lib.model.tags.get(tagname)

Retrieve a tag model specification.

Examples:

Get the tag model specification for `cno.threat`:

```
$dict = $lib.model.tags.get(cno.threat)
```

Args:

tagname (str): The name of the tag.

Returns:

The tag model definition. The return type is *dict*.

$lib.model.tags.list()

List all tag model specifications.

Examples:

Iterate over the tag model specifications in the Cortex:

```
for ($name, $info) in $lib.model.tags.list() {
    ...
}
```

Returns:

List of tuples containing the tag name and model definition The return type is *list*.

$lib.model.tags.pop(tagname, propname)

Pop and return a tag model property.

Examples:

Remove the regex list from the `cno.threat` tag model:

```
$regxlist = $lib.model.tags.pop(cno.threat, regex)
```

Args:

tagname (str): The name of the tag.

propname (str): The name of the tag model property.

Returns:

The value of the property. The return type is `prim`.

$lib.model.tags.set(tagname, propname, propvalu)

Set a tag model property for a tag.

Examples:

Create a tag model for the `cno.cve` tag:

```
$regx = ([null, null, "[0-9]{4}", "[0-9]{5}"])
$lib.model.tags.set(cno.cve, regex, $regx)
```

Args:

tagname (str): The name of the tag.

propname (str): The name of the tag model property.

propvalu (prim): The value to set.

Returns:
The return type is `null`.

13.1.61 $lib.notifications

A Storm library for a user interacting with their notifications.

$lib.notifications.del(indx)

> **Warning**
>
> `$lib.notifications.del` has been deprecated and will be removed in version v3.0.0.

Delete a previously delivered notification.

Args:
indx (int): The index number of the notification to delete.

Retn:
Returns an ($ok, $valu) tuple. The return type is *list*.

$lib.notifications.get(indx)

> **Warning**
>
> `$lib.notifications.get` has been deprecated and will be removed in version v3.0.0.

Return a notification by ID (or `(null)`).

Args:
indx (int): The index number of the notification to return.

Retn:
The requested notification or `(null)`. The return type is *dict*.

$lib.notifications.list(size=(null))

> **Warning**
>
> `$lib.notifications.list` has been deprecated and will be removed in version v3.0.0.

Yield (<indx>, <mesg>) tuples for a user's notifications.

Args:
size (int): The max number of notifications to yield.

Yields:
Yields (useriden, time, mesgtype, msgdata) tuples. The return type is *list*.

13.1.62 $lib.pack

Packing / unpacking structured bytes.

$lib.pack.en(fmt, items)

Pack a sequence of items into an array of bytes.

Args:

fmt (str): A python struct.pack() format string.

items (list): A list of values to be packed.

Returns:

The packed byte structure. The return type is *bytes*.

$lib.pack.un(fmt, byts, offs=(0))

Unpack a sequence of items from an array of bytes.

Args:

fmt (str): A python struct.unpack() format string.

byts (bytes): Bytes to be unpacked

offs (int): The offset to begin unpacking from.

Returns:

The unpacked items. The return type is *list*.

13.1.63 $lib.pipe

A Storm library for interacting with non-persistent queues.

$lib.pipe.gen(filler, size=(10000))

Generate and return a Storm Pipe.

Notes:

The filler query is run in parallel with $pipe. This requires the permission `storm.pipe.gen` to use.

Examples:

Fill a pipe with a query and consume it with another:

```
$pipe = $lib.pipe.gen(${ $pipe.puts((1, 2, 3)) })

for $items in $pipe.slices(size=2) {
    $dostuff($items)
}
```

Args:

filler: A Storm query to fill the Pipe. The input type may be one of the following: `str`, `storm:query`.

size (int): Maximum size of the pipe.

Returns:

The pipe containing query results. The return type is *pipe*.

13.1.64 $lib.pkg

A Storm Library for interacting with Storm Packages.

$lib.pkg.add(pkgdef, verify=(false))

Add a Storm Package to the Cortex.

Args:
pkgdef (dict): A Storm Package definition.

verify (boolean): Verify storm package signature.

Returns:
The return type is `null`.

$lib.pkg.del(name)

Delete a Storm Package from the Cortex.

Args:
name (str): The name of the package to delete.

Returns:
The return type is `null`.

$lib.pkg.deps(pkgdef)

Verify the dependencies for a Storm Package.

Args:
pkgdef (dict): A Storm Package definition.

Returns:
A dictionary listing dependencies and if they are met. The return type is *dict*.

$lib.pkg.get(name)

Get a Storm Package from the Cortex.

Args:
name (str): A Storm Package name.

Returns:
The Storm package definition. The return type is *dict*.

$lib.pkg.has(name)

Check if a Storm Package is available in the Cortex.

Args:
name (str): A Storm Package name to check for the existence of.

Returns:
True if the package exists in the Cortex, False if it does not. The return type is *boolean*.

$lib.pkg.list()

Get a list of Storm Packages loaded in the Cortex.

Returns:
A list of Storm Package definitions. The return type is *list*.

13.1.65 $lib.projects

A Storm Library for interacting with Projects in the Cortex.

$lib.projects.add(name, desc=)

Add a new project

Args:
name (str): The name of the Project to add

desc (str): A description of the overall project

Returns:
The newly created *proj:project* object The return type is *proj:project*.

$lib.projects.del(name)

Delete an existing project

Args:
name (str): The name of the Project to delete

Returns:
True if the project exists and gets deleted, otherwise False The return type is *boolean*.

$lib.projects.get(name)

Retrieve a project by name

Args:
name (str): The name of the Project to get

Returns:
The project object, if it exists, otherwise null The return type is *proj:project*.

13.1.66 $lib.ps

A Storm Library for interacting with running tasks on the Cortex.

$lib.ps.kill(prefix)

Stop a running task on the Cortex.

Args:
prefix (str): The prefix of the task to stop. Tasks will only be stopped if there is a single prefix match.

Returns:
True if the task was cancelled, False otherwise. The return type is *boolean*.

$lib.ps.list()

List tasks the current user can access.

Returns:
A list of task definitions. The return type is *list*.

13.1.67 $lib.queue

A Storm Library for interacting with persistent Queues in the Cortex.

$lib.queue.add(name)

Add a Queue to the Cortex with a given name.

Args:
name (str): The name of the queue to add.

Returns:
The return type is *queue*.

$lib.queue.del(name)

Delete a given named Queue.

Args:
name (str): The name of the queue to delete.

Returns:
The return type is `null`.

$lib.queue.gen(name)

Add or get a Storm Queue in a single operation.

Args:
name (str): The name of the Queue to add or get.

Returns:
The return type is *queue*.

$lib.queue.get(name)

Get an existing Storm Queue object.

Args:
name (str): The name of the Queue to get.

Returns:
A `queue` object. The return type is *queue*.

$lib.queue.list()

Get a list of the Queues in the Cortex.

Returns:
A list of queue definitions the current user is allowed to interact with. The return type is *list*.

13.1.68 $lib.random

A Storm library for generating random values.

$lib.random.generator(seed=(null))

Make a random generator with a given seed.

Args:
seed (str): The seed value used for the random generator.

Returns:
The random generator object. The return type is *random*.

$lib.random.int(maxval, minval=(0))

Generate a random integer.

Args:
maxval (int): The maximum random value.

minval (int): The minimum random value.

Returns:
A random integer in the range min-max inclusive. The return type is `int`.

13.1.69 $lib.regex

A Storm library for searching/matching with regular expressions.

$lib.regex.escape(text)

Escape arbitrary strings for use in a regular expression pattern.

Example:

Escape node values for use in a regex pattern:

```
for $match in $lib.regex.findall($lib.regex.escape($node.repr()), $mydocument)
↪{
    // do something with $match
}
```

Escape node values for use in regular expression filters:

```
it:dev:str~=$lib.regex.escape($node.repr())
```

Args:
text (str): The text to escape.

Returns:
Input string with special characters escaped. The return type is *str*.

$lib.regex.findall(pattern, text, flags=(0))

Search the given text for the patterns and return a list of matching strings.

Note:
If multiple matching groups are specified, the return value is a list of lists of strings.

Example:

Extract the matching strings from a piece of text:

```
for $x in $lib.regex.findall("G[0-9]{4}", "G0006 and G0001") {
    $dostuff($x)
}
```

Args:
pattern (str): The regular expression pattern.

text (str): The text to match.

flags (int): Regex flags to control the match behavior.

Returns:
A list of lists of strings for the matching groups in the pattern. The return type is *list*.

$lib.regex.flags.i

Regex flag to indicate that case insensitive matches are allowed.

Returns:
The type is `int`.

$lib.regex.flags.m

Regex flag to indicate that multiline matches are allowed.

Returns:
The type is `int`.

$lib.regex.matches(pattern, text, flags=(0))

Check if text matches a pattern.

Notes:
This API requires the pattern to match at the start of the string.

Example:
Check if the variable matches a expression:

```
if $lib.regex.matches("^[0-9]+.[0-9]+.[0-9]+$", $text) {
    $lib.print("It's semver! ...probably")
}
```

Args:
pattern (str): The regular expression pattern.

text (str): The text to match.

flags (int): Regex flags to control the match behavior.

Returns:
True if there is a match, False otherwise. The return type is *boolean*.

$lib.regex.replace(pattern, replace, text, flags=(0))

Replace any substrings that match the given regular expression with the specified replacement.

Example:
Replace a portion of a string with a new part based on a regex:

```
$norm = $lib.regex.replace("\sAND\s", " & ", "Ham and eggs!", $lib.regex.flags.i)
```

Args:
pattern (str): The regular expression pattern.

replace (str): The text to replace matching sub strings.

text (str): The input text to search/replace.

flags (int): Regex flags to control the match behavior.

Returns:
The new string with matches replaced. The return type is *str*.

$lib.regex.search(pattern, text, flags=(0))

Search the given text for the pattern and return the matching groups.

Note:
In order to get the matching groups, patterns must use parentheses to indicate the start and stop of the regex to return portions of. If groups are not used, a successful match will return a empty list and a unsuccessful match will return `(null)`.

Example:
Extract the matching groups from a piece of text:

```
$m = $lib.regex.search("^([0-9])+.([0-9])+.([0-9])+$", $text)
if $m {
    ($maj, $min, $pat) = $m
}
```

Args:
pattern (str): The regular expression pattern.

text (str): The text to match.

flags (int): Regex flags to control the match behavior.

Returns:
A list of strings for the matching groups in the pattern. The return type is *list*.

13.1.70 $lib.scrape

A Storm Library for providing helpers for scraping nodes from text.

$lib.scrape.context(text)

Attempt to scrape information from a blob of text, getting the context information about the values found.

Notes:
This does call the `scrape` Storm interface if that behavior is enabled on the Cortex.

Examples:
Scrape some text and make nodes out of it:

```
for ($form, $valu, $info) in $lib.scrape.context($text) {
    [ ( *$form ?= $valu ) ]
}
```

Args:
text (str): The text to scrape

Yields:
A dictionary of scraped values, rule types, and offsets scraped from the text. The return type is *dict*.

$lib.scrape.genMatches(text, pattern, fangs=(null), flags=(2))

genMatches is a generic helper function for constructing scrape interfaces using pure Storm.

It accepts the text, a regex pattern, and produce results that can easily be used to create

Notes:

The pattern must have a named regular expression match for the key `valu` using the named group syntax. For example `(somekey\s)(?P<valu>[a-z0-9]+)\s`.

Examples:

A scrape implementation with a regex that matches name keys in text:

```
$re="(Name\:\s)(?P<valu>[a-z0-9]+)\s"
$form="ps:name"

function scrape(text, form) {
        $ret = ()
        for ($valu, $info) in $lib.scrape.genMatches($text, $re) {
            $ret.append(($form, $valu, $info))
        }
        return ( $ret )
    }
```

Args:

text (str): The text to scrape

pattern (str): The regular expression pattern to match against.

fangs (list): A list of (src, dst) pairs to refang from text. The src must be equal or larger than the dst in length.

flags (int): Regex flags to use (defaults to IGNORECASE).

Yields:

The return type is *list*.

$lib.scrape.ndefs(text)

Attempt to scrape node form, value tuples from a blob of text.

Examples:

Scrape some text and attempt to make nodes out of it:

```
for ($form, $valu) in $lib.scrape($text) {
    [ ( *$form ?= $valu ) ]
}
```

Args:

text (str): The text to scrape

Yields:

A list of (form, value) tuples scraped from the text. The return type is *list*.

13.1.71 $lib.service

A Storm Library for interacting with Storm Services.

$lib.service.add(name, url)

Add a Storm Service to the Cortex.

Args:

name (str): Name of the Storm Service to add.

url (str): The Telepath URL to the Storm Service.

Returns:
The Storm Service definition. The return type is *dict*.

$lib.service.del(iden)

Remove a Storm Service from the Cortex.

Args:
iden (str): The iden of the service to remove.

Returns:
The return type is `null`.

$lib.service.get(name)

Get a Storm Service definition.

Args:
name (str): The local name, local iden, or remote name, of the service to get the definition for.

Returns:
A Storm Service definition. The return type is *dict*.

$lib.service.has(name)

Check if a Storm Service is available in the Cortex.

Args:
name (str): The local name, local iden, or remote name, of the service to check for the existence of.

Returns:
True if the service exists in the Cortex, False if it does not. The return type is *boolean*.

$lib.service.list()

List the Storm Service definitions for the Cortex.

Notes:
The definition dictionaries have an additional `ready` key added to them to indicate if the Cortex is currently connected to the Storm Service or not.

Returns:
A list of Storm Service definitions. The return type is *list*.

$lib.service.wait(name, timeout=(null))

Wait for a given service to be ready.

Notes:
If a timeout value is not specified, this will block a Storm query until the service is available.

Args:
name (str): The name, or iden, of the service to wait for.

timeout (int): Number of seconds to wait for the service.

Returns:
Returns true if the service is available, false on a timeout waiting for the service to be ready. The return type is *boolean*.

13.1.72 $lib.spooled

A Storm Library for interacting with Spooled Objects.

$lib.spooled.set(*vals)

Get a Spooled Storm Set object.

A Spooled Storm Set object is memory-safe to grow to extraordinarily large sizes, as it will fallback to file backed storage, with two restrictions. First is that all items in the set can be serialized to a file if the set grows too large, so all items added must be a serializable Storm primitive. Second is that when an item is added to the Set, because it could be immediately written disk, do not hold any references to it outside of the Set itself, as the two objects could differ.

Args:
*vals (any): Initial values to place in the set.

Returns:
The new set. The return type is *set*.

13.1.73 $lib.stats

A Storm Library for statistics related functionality.

$lib.stats.tally()

Get a Tally object.

Returns:
A new tally object. The return type is *stat:tally*.

13.1.74 $lib.stix

A Storm Library for interacting with Stix Version 2.1 CS02.

$lib.stix.lift(bundle)

Lift nodes from a STIX Bundle made by Synapse.

Notes:
This lifts nodes using the Node definitions embedded into the bundle when created by Synapse using custom extension properties.

Examples:
Lifting nodes from a STIX bundle:

```
yield $lib.stix($bundle)
```

Args:
bundle (dict): The STIX bundle to lift nodes from.

Yields:
Yields nodes The return type is *node*.

$lib.stix.validate(bundle)

Validate a STIX Bundle.

Notes:
This returns a dictionary containing the following values:

```
{
    'ok': <boolean> - False if bundle is invalid, True otherwise.
    'mesg': <str> - An error message if there was an error when validating the␣
↪bundle.
    'results': The results of validating the bundle.
}
```

Args:
bundle (dict): The stix bundle to validate.

Returns:
Results dictionary. The return type is *dict*.

13.1.75 $lib.stix.export

A Storm Library for exporting to STIX version 2.1 CS02.

$lib.stix.export.bundle(config=(null))

Return a new empty STIX bundle.

The config argument maps synapse forms to stix types and allows you to specify how to resolve STIX properties and relationships. The config expects to following format:

```
{
    "maxsize": 10000,

    "forms": {
        <formname>: {
            "default": <stixtype0>,
            "stix": {
                <stixtype0>: {
                    "props": {
                        <stix_prop_name>: <storm_with_return>,
                        ...
                    },
                    "rels": (
                        ( <relname>, <target_stixtype>, <storm> ),
                        ...
                    ),
                    "revs": (
                        ( <revname>, <source_stixtype>, <storm> ),
                        ...
                    )
                },
                <stixtype1>: ...
            },
        },
    },
},
```

For example, the default config includes the following entry to map ou:campaign nodes to stix campaigns:

```
{ "forms": {
    "ou:campaign": {
```

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```
        "default": "campaign",
        "stix": {
            "campaign": {
                "props": {
                    "name": "{+:name return(:name)} return($node.repr())",
                    "description": "+:desc return(:desc)",
                    "objective": "+:goal :goal -> ou:goal +:name return(:name)",
                    "created": "return($lib.stix.export.timestamp(.created))",
                    "modified": "return($lib.stix.export.timestamp(.created))",
                },
                "rels": (
                    ("attributed-to", "threat-actor", ":org -> ou:org"),
                    ("originates-from", "location", ":org -> ou:org :hq -> geo:place"),
                    ("targets", "identity", "-> risk:attack :target:org -> ou:org"),
                    ("targets", "identity", "-> risk:attack :target:person -> ps:person
↪"),
                ),
            },
        },
}},
```

You may also specify pivots on a per form+stixtype basis to automate pivoting to additional nodes to include in the bundle:

```
{"forms": {
    "inet:fqdn":
        ...
        "domain-name": {
            ...
            "pivots": [
                {"storm": "-> inet:dns:a -> inet:ipv4", "stixtype": "ipv4-addr"}
            ]
        {
    }
}
```

Note:
The default config is an evolving set of mappings. If you need to guarantee stable output please specify a config.

Args:
config (dict): The STIX bundle export config to use.

Returns:
A new `stix:bundle` instance. The return type is *stix:bundle*.

$lib.stix.export.config()

Construct a default STIX bundle export config.

Returns:
A default STIX bundle export config. The return type is *dict*.

$lib.stix.export.timestamp(tick)

Format an epoch milliseconds timestamp for use in STIX output.

Args:
tick (time): The epoch milliseconds timestamp.

Returns:
A STIX formatted timestamp string. The return type is *str*.

13.1.76 $lib.stix.import

A Storm Library for importing Stix Version 2.1 data.

$lib.stix.import.config()

Return an editable copy of the default STIX ingest config.

Returns:
A copy of the default STIX ingest configuration. The return type is *dict*.

$lib.stix.import.ingest(bundle, config=(null))

Import nodes from a STIX bundle.

Args:
bundle (dict): The STIX bundle to ingest.

config (dict): An optional STIX ingest configuration.

Yields:
Yields nodes The return type is *node*.

13.1.77 $lib.storm

A Storm library for evaluating dynamic storm expressions.

$lib.storm.eval(text, cast=(null))

Evaluate a Storm runtime value and optionally cast/coerce it.

Note:
If Storm logging is enabled, the expression being evaluated will be logged separately.

Args:
text (str): A storm expression string.

cast (str): A type to cast the result to.

Returns:
The value of the expression and optional cast. The return type is `any`.

$lib.storm.run(query, opts=(null))

Run a Storm query and yield the messages output by the Storm interpreter.

Note:
If Storm logging is enabled, the query being run will be logged separately.

Args:
query (str): A Storm query string.

opts (dict): Storm options dictionary.

Yields:
The output messages from the Storm runtime. The return type is *list*.

13.1.78 $lib.str

A Storm Library for interacting with strings.

$lib.str.concat(*args)

Concatenate a set of strings together.

Args:
*args (any): Items to join together.

Returns:
The joined string. The return type is *str*.

$lib.str.format(text, **kwargs)

Format a text string.

Args:
text (str): The base text string.

**kwargs (any): Keyword values which are substituted into the string.

Returns:
The new string. The return type is *str*.

$lib.str.join(sepr, items)

Join items into a string using a separator.

Args:
sepr (str): The separator used to join strings with.

items (list): A list of items to join together.

Returns:
The joined string. The return type is *str*.

13.1.79 $lib.tabular

A Storm Library for creating printable tables.

$lib.tabular.printer(conf)

Construct a new printer.

Examples:
Create a simple table using the default separators:

```
$conf = ({
    "columns": [
        {"name": "Year", "width": 4},
        {"name": "Author", "width": 20},
        {"name": "Title", "width": 12},
    ]
})
```

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```
$printer = $lib.tabular.printer($conf)

$lib.print($printer.header())

for ($year, $author, $title, $publisher) in $data {
    $lib.print($printer.row(($year, $author, $title))
}
```

Create a configuration with custom separators and column options:

```
$conf = ({
    "separators": {
        "row:outline": true,
        "column:outline": true,
        "header:row": "#",
        "data:row": "*",
        "column": "+",
    },
    "columns": [
        {"name": "Year", "width": 4, "justify": "right"},
        {"name": "Author", "width": 20, "justify": "center"},
        {"name": "Title", "width": 12, "overflow": "wrap"},
    ]
})

$printer = $lib.tabular.printer($conf)
```

Args:
conf (dict): The table configuration dictionary.

Returns:
The newly constructed tabular:printer. The return type is *tabular:printer*.

$lib.tabular.schema()

Get a copy of the table configuration schema.

Examples:
Print a human-readable version of the schema:

```
$schema = $lib.tabular.schema()
$lib.print($lib.yaml.save($schema))
```

Returns:
The table configuration schema. The return type is *dict*.

13.1.80 $lib.tags

Storm utility functions for tags.

$lib.tags.prefix(names, prefix, ispart=(false))

Normalize and prefix a list of syn:tag:part values so they can be applied.

Examples:

Add tag prefixes and then use them to tag nodes:

```
$tags = $lib.tags.prefix($result.tags, vtx.visi)
{ for $tag in $tags { [ +#$tag ] } }
```

Args:

names (list): A list of syn:tag:part values to normalize and prefix.

prefix (str): The string prefix to add to the syn:tag:part values.

ispart (boolean): Whether the names have already been normalized. Normalization will be skipped if set to true.

Returns:

A list of normalized and prefixed syn:tag values. The return type is *list*.

13.1.81 $lib.telepath

A Storm Library for making Telepath connections to remote services.

$lib.telepath.open(url)

Open and return a Telepath RPC proxy.

Args:

url (str): The Telepath URL to connect to.

Returns:

A object representing a Telepath Proxy. The return type is *telepath:proxy*.

13.1.82 $lib.time

A Storm Library for interacting with timestamps.

$lib.time.day(tick)

Returns the day part of a time value.

Args:

tick (time): A time value.

Returns:

The day part of the time expression. The return type is `int`.

$lib.time.dayofmonth(tick)

Returns the index (beginning with 0) of the day within the month.

Args:

tick (time): A time value.

Returns:

The index of the day within month. The return type is `int`.

$lib.time.dayofweek(tick)

Returns the index (beginning with monday as 0) of the day within the week.

Args:
tick (time): A time value.

Returns:
The index of the day within week. The return type is `int`.

$lib.time.dayofyear(tick)

Returns the index (beginning with 0) of the day within the year.

Args:
tick (time): A time value.

Returns:
The index of the day within year. The return type is `int`.

$lib.time.format(valu, format)

Format a Synapse timestamp into a string value using `datetime.strftime()`.

Examples:
Format a timestamp into a string:

```
storm> $now=$lib.time.now() $str=$lib.time.format($now, '%A %d, %B %Y') $lib.print(
↪$str)

Tuesday 14, July 2020
```

Args:
valu (int): A timestamp in epoch milliseconds.

format (str): The strftime format string.

Returns:
The formatted time string. The return type is *str*.

$lib.time.fromunix(secs)

Normalize a timestamp from a unix epoch time in seconds to milliseconds.

Examples:
Convert a timestamp from seconds to millis and format it:

```
storm> $seconds=1594684800 $millis=$lib.time.fromunix($seconds)
     $str=$lib.time.format($millis, '%A %d, %B %Y') $lib.print($str)

Tuesday 14, July 2020
```

Args:
secs (int): Unix epoch time in seconds.

Returns:
The normalized time in milliseconds. The return type is `int`.

$lib.time.hour(tick)

Returns the hour part of a time value.

Args:
tick (time): A time value.

Returns:
The hour part of the time expression. The return type is `int`.

$lib.time.minute(tick)

Returns the minute part of a time value.

Args:
tick (time): A time value.

Returns:
The minute part of the time expression. The return type is `int`.

$lib.time.month(tick)

Returns the month part of a time value.

Args:
tick (time): A time value.

Returns:
The month part of the time expression. The return type is `int`.

$lib.time.monthofyear(tick)

Returns the index (beginning with 0) of the month within the year.

Args:
tick (time): A time value.

Returns:
The index of the month within year. The return type is `int`.

$lib.time.now()

Get the current epoch time in milliseconds.

Returns:
Epoch time in milliseconds. The return type is `int`.

$lib.time.parse(valu, format, errok=(false))

Parse a timestamp string using `datetime.strptime()` into an epoch timestamp.

Examples:
Parse a string as for its month/day/year value into a timestamp:

```
storm> $s='06/01/2020' $ts=$lib.time.parse($s, '%m/%d/%Y') $lib.print($ts)

1590969600000
```

Args:
valu (str): The timestamp string to parse.

format (str): The format string to use for parsing.

errok (boolean): If set, parsing errors will return `(null)` instead of raising an exception.

Returns:
The epoch timestamp for the string. The return type is `int`.

$lib.time.second(tick)

Returns the second part of a time value.

Args:
tick (time): A time value.

Returns:
The second part of the time expression. The return type is `int`.

$lib.time.sleep(valu)

Pause the processing of data in the storm query.

Notes:
This has the effect of clearing the Snap's cache, so any node lifts performed after the `$lib.time.sleep(...)` executes will be lifted directly from storage.

Args:
valu (int): The number of seconds to pause for.

Returns:
The return type is `null`.

$lib.time.ticker(tick, count=(null))

Periodically pause the processing of data in the storm query.

Notes:
This has the effect of clearing the Snap's cache, so any node lifts performed after each tick will be lifted directly from storage.

Args:
tick (int): The amount of time to wait between each tick, in seconds.

count (int): The number of times to pause the query before exiting the loop. This defaults to None and will yield forever if not set.

Yields:
This yields the current tick count after each time it wakes up. The return type is `int`.

$lib.time.toUTC(tick, timezone)

Adjust an epoch milliseconds timestamp to UTC from the given timezone.

Args:
tick (time): A time value.

timezone (str): A timezone name. See python pytz docs for options.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

$lib.time.year(tick)

Returns the year part of a time value.

Args:
tick (time): A time value.

Returns:
The year part of the time expression. The return type is `int`.

13.1.83 $lib.trigger

A Storm Library for interacting with Triggers in the Cortex.

$lib.trigger.add(tdef)

Add a Trigger to the Cortex.

Args:
tdef (dict): A Trigger definition.

Returns:
The new trigger. The return type is *trigger*.

$lib.trigger.del(prefix)

Delete a Trigger from the Cortex.

Args:
prefix (str): A prefix to match in order to identify a trigger to delete. Only a single matching prefix will be deleted.

Returns:
The iden of the deleted trigger which matched the prefix. The return type is *str*.

$lib.trigger.disable(prefix)

Disable a Trigger in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a trigger to disable. Only a single matching prefix will be disabled.

Returns:
The iden of the trigger that was disabled. The return type is *str*.

$lib.trigger.enable(prefix)

Enable a Trigger in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a trigger to enable. Only a single matching prefix will be enabled.

Returns:
The iden of the trigger that was enabled. The return type is *str*.

$lib.trigger.get(iden)

Get a Trigger in the Cortex.

Args:
iden (str): The iden of the Trigger to get.

Returns:
The requested `trigger` object. The return type is *trigger*.

$lib.trigger.list(all=(false))

Get a list of Triggers in the current view or every view.

Args:
all (boolean): Get a list of all the readable Triggers in every readable View.

Returns:
A list of `trigger` objects the user is allowed to access. The return type is *list*.

$lib.trigger.mod(prefix, query)

Modify an existing Trigger in the Cortex.

Args:
prefix (str): A prefix to match in order to identify a trigger to modify. Only a single matching prefix will be modified.

query: The new Storm query to set as the trigger query. The input type may be one of the following: `str`, `storm:query`.

Returns:
The iden of the modified Trigger The return type is *str*.

13.1.84 $lib.user

A Storm Library for interacting with data about the current user.

$lib.user.allowed(permname, gateiden=(null), default=(false))

Check if the current user has a given permission.

Args:
permname (str): The permission string to check.

gateiden (str): The authgate iden.

default (boolean): The default value.

Returns:
True if the user has the requested permission, false otherwise. The return type is *boolean*.

$lib.user.iden

The user GUID for the current storm user.

Returns:
The type is *str*.

$lib.user.name()

Get the name of the current runtime user.

Returns:
The username. The return type is *str*.

$lib.user.profile

Get a dictionary representing the current user's profile information.

Returns:
The type is *auth:user:profile*.

$lib.user.vars

Get a dictionary representing the current user's persistent variables.

Returns:
The type is *auth:user:vars*.

13.1.85 $lib.utils

A Storm library for working with utility functions.

$lib.utils.todo(_todoname, *args, **kwargs)

Create a todo tuple of (name, args, kwargs).

Args:
_todoname (str): The todo name.

*args (any): Positional arguments for the todo.

**kwargs (any): Keyword arguments for the todo.

Returns:
A todo tuple of (name, args, kwargs). The return type is *list*.

13.1.86 $lib.vars

A Storm Library for interacting with runtime variables.

$lib.vars.del(name)

Unset a variable in the current Runtime.

Args:
name (str): The variable name to remove.

Returns:
The return type is `null`.

$lib.vars.get(name, defv=(null))

Get the value of a variable from the current Runtime.

Args:
name (str): Name of the variable to get.

defv (prim): The default value returned if the variable is not set in the runtime.

Returns:
The value of the variable. The return type is any.

$lib.vars.list()

Get a list of variables from the current Runtime.

Returns:
A list of variable names and their values for the current Runtime. The return type is *list*.

$lib.vars.set(name, valu)

Set the value of a variable in the current Runtime.

Args:
name (str): Name of the variable to set.

valu (prim): The value to set the variable too.

Returns:
The return type is null.

$lib.vars.type(valu)

Get the type of the argument value.

Args:
valu (any): Value to inspect.

Returns:
The type of the argument. The return type is *str*.

13.1.87 $lib.vault

A Storm Library for interacting with vaults.

$lib.vault.add(name, vtype, scope, owner, secrets, configs)

Create a new vault.

Args:
name (str): The name of the new vault.

vtype (str): The type of this vault.

scope (str): Scope for this vault. One of "user", "role", "global", or (null) for unscoped vaults.

owner (str): User/role iden for this vault if scope is "user" or "role". None for "global" scope vaults.

secrets (dict): The initial secret data to store in this vault.

configs (dict): The initial config data to store in this vault.

Returns:
Iden of the newly created vault. The return type is *str*.

$lib.vault.byname(name)

Get a vault by name.

Args:

name (str):
The name of the vault to retrieve. If user only has PERM_READ, the secrets data will not be returned. If the user has PERM_EDIT or higher, secrets data will be included in the vault.

Returns:
The requested vault. The return type is *dict*.

$lib.vault.bytype(vtype, scope=(null))

Get a vault for a specified vault type.

Args:
vtype (str): The vault type to retrieved.

scope (str): The scope for the specified type. If `(null)`, then getByType will search.

Returns:
Vault or `(null)` if the vault could not be retrieved. The return type is *vault*.

$lib.vault.get(iden)

Get a vault by iden.

Args:

iden (str):
The iden of the vault to retrieve. If user only has PERM_READ, the secrets data will not be returned. If the user has PERM_EDIT or higher, secrets data will be included in the vault.

Returns:
The requested vault. The return type is *dict*.

$lib.vault.list()

List vaults accessible to the current user.

Returns:
Yields vaults. The return type is *list*.

$lib.vault.print(vault)

Print the details of the specified vault.

Args:
vault (dict): The vault to print.

Returns:
The return type is `null`.

13.1.88 $lib.version

A Storm Library for interacting with version information.

$lib.version.commit()

The synapse commit hash for the local Cortex.

Returns:
The commit hash. The return type is *str*.

$lib.version.matches(vertup, reqstr)

Check if the given version triple meets the requirements string.

Examples:

Check if the synapse version is in a range:

```
$synver = $lib.version.synapse()
if $lib.version.matches($synver, ">=2.9.0") {
    $dostuff()
}
```

Args:

vertup (list): Triple of major, minor, and patch version integers.

reqstr (str): The version string to compare against.

Returns:

True if the version meets the requirements, False otherwise. The return type is *boolean*.

$lib.version.synapse()

The synapse version tuple for the local Cortex.

Returns:

The version triple. The return type is *list*.

13.1.89 $lib.view

A Storm Library for interacting with Views in the Cortex.

$lib.view.add(layers, name=(null), worldreadable=(false))

Add a View to the Cortex.

Args:

layers (list): A list of layer idens which make up the view.

name (str): The name of the view.

worldreadable (boolean): Grant read access to the *all* role.

Returns:

A `view` object representing the new View. The return type is *view*.

$lib.view.del(iden)

Delete a View from the Cortex.

Args:

iden (str): The iden of the View to delete.

Returns:

The return type is `null`.

$lib.view.get(iden=(null))

Get a View from the Cortex.

Args:

iden (str): The iden of the View to get. If not specified, returns the current View.

Returns:
The storm view object. The return type is *view*.

$lib.view.list(deporder=(false))

List the Views in the Cortex.

Args:
deporder (boolean): Return the lists in bottom-up dependency order.

Returns:
List of `view` objects. The return type is *list*.

13.1.90 $lib.xml

A Storm library for parsing XML.

$lib.xml.parse(valu)

Parse an XML string into an xml:element tree.

Args:
valu (str): The XML string to parse into an xml:element tree.

Returns:
An xml:element for the root node of the XML tree. The return type is *xml:element*.

13.1.91 $lib.yaml

A Storm Library for saving/loading YAML data.

$lib.yaml.load(valu)

Decode a YAML string/bytes into an object.

Args:
valu (str): The string to decode.

Returns:
The decoded primitive object. The return type is `prim`.

$lib.yaml.save(valu, sort_keys=(true))

Encode data as a YAML string.

Args:
valu (object): The object to encode.

sort_keys (boolean): Sort object keys.

Returns:
A YAML string. The return type is *str*.

13.2 Storm Types

Storm Objects are used as view objects for manipulating data in the Storm Runtime and in the Cortex itself.

13.2.1 aha:pool

Implements the Storm API for an AHA pool.

add(svcname)

Add a service to the AHA pool

Examples:

Add a service to a pool with its relative name:

```
$pool = $lib.aha.pool.get(pool00.cortex...)
$pool.add(00.cortex...)
```

Args:

svcname (str): The name of the AHA service to add. It is easiest to use the relative name of a service, ending with "...".

Returns:

The return type is `null`.

del(svcname)

Remove a service from the AHA pool.

Examples:

Remove a service from a pool with its relative name:

```
$pool = $lib.aha.pool.get(pool00.cortex...)
$pool.del(00.cortex...)
```

Args:

svcname (str): The name of the AHA service to remove. It is easiest to use the relative name of a service, ending with "...".

Returns:

The service removed from the pool or null if a service was not removed. The return type may be one of the following: `null`, *str*.

13.2.2 auth:gate

Implements the Storm API for an AuthGate.

iden

The iden of the AuthGate.

Returns:

The type is *str*.

roles

The role idens which are a member of the Authgate.

Returns:

The type is *list*.

type

The type of the AuthGate.

Returns:
The type is *str*.

users

The user idens which are a member of the Authgate.

Returns:
The type is *list*.

13.2.3 auth:role

Implements the Storm API for a Role.

addRule(rule, gateiden=(null), indx=(null))

Add a rule to the Role

Args:
rule (list): The rule tuple to added to the Role.

gateiden (str): The gate iden used for the rule.

indx (int): The position of the rule as a 0 based index.

Returns:
The return type is `null`.

delRule(rule, gateiden=(null))

Remove a rule from the Role.

Args:
rule (list): The rule tuple to removed from the Role.

gateiden (str): The gate iden used for the rule.

Returns:
The return type is `null`.

gates()

Return a list of auth gates that the role has rules for.

Returns:
A list of `auth:gates` that the role has rules for. The return type is *list*.

get(name)

Get a arbitrary property from the Role definition.

Args:
name (str): The name of the property to return.

Returns:
The requested value. The return type is `prim`.

getRules(gateiden=(null))

Get the rules for the role and optional auth gate.

Args:
gateiden (str): The gate iden used for the rules.

Returns:
A list of rules. The return type is *list*.

iden

The Role iden.

Returns:
The type is *str*.

name

A role's name. This can also be used to set the role name.

Example:
Change a role's name:

```
$role=$lib.auth.roles.byname(analyst) $role.name=superheroes
```

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

pack()

Get the packed version of the Role.

Returns:
The packed Role definition. The return type is *dict*.

popRule(indx, gateiden=(null))

Remove a rule by index from the Role.

Args:
indx (int): The index of the rule to remove.

gateiden (str): The gate iden used for the rule.

Returns:
The rule which was removed. The return type is *list*.

setRules(rules, gateiden=(null))

Replace the rules on the Role with new rules.

Args:
rules (list): A list of rules to set on the Role.

gateiden (str): The gate iden used for the rules.

Returns:
The return type is `null`.

13.2.4 auth:user

Implements the Storm API for a User.

addRule(rule, gateiden=(null), indx=(null))

Add a rule to the User.

Args:
rule (list): The rule tuple to add to the User.

gateiden (str): The gate iden used for the rule.

indx (int): The position of the rule as a 0 based index.

Returns:
The return type is `null`.

allowed(permname, gateiden=(null), default=(false))

Check if the user has a given permission.

Args:
permname (str): The permission string to check.

gateiden (str): The authgate iden.

default (boolean): The default value.

Returns:
True if the rule is allowed, False otherwise. The return type is *boolean*.

delApiKey(iden)

Delete an existing API key.

Args:
iden (str): The iden of the API key.

Returns:
True when the key was deleted. The return type is *boolean*.

delRule(rule, gateiden=(null))

Remove a rule from the User.

Args:
rule (list): The rule tuple to removed from the User.

gateiden (str): The gate iden used for the rule.

Returns:
The return type is `null`.

email

A user's email. This can also be used to set the user's email.

Example:
Change a user's email address:

```
$user=$lib.auth.users.byname(bob) $user.email="robert@bobcorp.net"
```

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

gates()

Return a list of auth gates that the user has rules for.

Returns:
A list of `auth:gates` that the user has rules for. The return type is *list*.

genApiKey(name, duration=(null))

Generate a new API key for the user.

Notes:
The secret API key returned by this function cannot be accessed again.

Args:
name (str): The name of the API key.

duration (integer): Duration of time for the API key to be valid, in milliseconds.

Returns:
A list, containing the secret API key and a dictionary containing metadata about the key. The return type is *list*.

get(name)

Get a arbitrary property from the User definition.

Args:
name (str): The name of the property to return.

Returns:
The requested value. The return type is `prim`.

getAllowedReason(permname, gateiden=(null), default=(false))

Return an allowed status and reason for the given perm.

Args:
permname (str): The permission string to check.

gateiden (str): The authgate iden.

default (boolean): The default value.

Returns:
An (allowed, reason) tuple. The return type is *list*.

getApiKey(iden)

Get information about a user's existing API key.

Args:
iden (str): The iden of the API key.

Returns:
A dictionary containing metadata about the key. The return type is *dict*.

getRules(gateiden=(null))

Get the rules for the user and optional auth gate.

Args:
gateiden (str): The gate iden used for the rules.

Returns:
A list of rules. The return type is *list*.

grant(iden, indx=(null))

Grant a Role to the User.

Args:
iden (str): The iden of the Role.

indx (int): The position of the Role as a 0 based index.

Returns:
The return type is `null`.

iden

The User iden.

Returns:
The type is *str*.

listApiKeys()

Get information about all the API keys the user has.

Returns:
A list of dictionaries containing metadata about each key. The return type is *list*.

modApiKey(iden, name, valu)

Modify metadata about an existing API key.

Args:
iden (str): The iden of the API key.

name (str): The name of the valu to update.

valu (any): The new value of the API key.

Returns:
An updated dictionary with metadata about the key. The return type is *dict*.

name

A user's name. This can also be used to set a user's name.

Example:
Change a user's name:

```
$user=$lib.auth.users.byname(bob) $user.name=robert
```

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

notify(mesgtype, mesgdata)

Warning

`$auth:user.notify` has been deprecated and will be removed in version v3.0.0.

Send an arbitrary user notification.

Args:

mesgtype (str): The notification type.

mesgdata (dict): The notification data.

Returns:

The return type is `null`.

pack()

Get the packed version of the User.

Returns:

The packed User definition. The return type is *dict*.

popRule(indx, gateiden=(null))

Remove a rule by index from the User.

Args:

indx (int): The index of the rule to remove.

gateiden (str): The gate iden used for the rule.

Returns:

The rule which was removed. The return type is *list*.

profile

A user profile dictionary. This can be used as an application level key-value store.

Example:

Set a value:

```
$user=$lib.auth.users.byname(bob) $user.profile.somekey="somevalue"
```

Get a value:

```
$user=$lib.auth.users.byname(bob) $value = $user.profile.somekey
```

Returns:

The return type is *auth:user:profile*.

revoke(iden)

Remove a Role from the User

Args:

iden (str): The iden of the Role.

Returns:

The return type is `null`.

roles()

Get the Roles for the User.

Returns:
A list of `auth:roles` which the user is a member of. The return type is *list*.

setAdmin(admin, gateiden=(null))

Set the Admin flag for the user.

Args:
admin (boolean): True to make the User an admin, false to remove their admin status.

gateiden (str): The gate iden used for the operation.

Returns:
The return type is `null`.

setArchived(archived)

Set the archived status for a user.

Notes:
Setting a user as "archived" will also lock the user. Removing a users "archived" status will not unlock the user.

Args:
archived (boolean): True to archive the user, false to unarchive them.

Returns:
The return type is `null`.

setEmail(email)

Set the email address of the User.

Args:
email (str): The email address to set for the User.

Returns:
The return type is `null`.

setLocked(locked)

Set the locked status for a user.

Args:
locked (boolean): True to lock the user, false to unlock them.

Returns:
The return type is `null`.

setPasswd(passwd)

Set the Users password.

Args:
passwd (str): The new password for the user. This is best passed into the runtime as a variable.

Returns:
The return type is `null`.

setRoles(idens)

Replace all the Roles of the User with a new list of roles.

Notes:
The roleiden for the "all" role must be present in the new list of roles. This replaces all existing roles that the user has with the new roles.

Args:
idens (list): The idens of the Roles to set on the User.

Returns:
The return type is `null`.

setRules(rules, gateiden=(null))

Replace the rules on the User with new rules.

Args:
rules (list): A list of rule tuples.

gateiden (str): The gate iden used for the rules.

Returns:
The return type is `null`.

tell(text)

> **Warning**
>
> `$auth:user.tell` has been deprecated and will be removed in version v3.0.0.

Send a tell notification to a user.

Args:
text (str): The text of the message to send.

Returns:
The return type is `null`.

vars

Get a dictionary representing the user's persistent variables.

Returns:
The return type is *auth:user:vars*.

13.2.5 auth:user:json

Implements per-user JSON storage.

del(path, prop=(null))

Delete a stored JSON object or object property for the user.

Args:
path (str|list): A path string or list of path parts.

prop (str|list): A property name or list of name parts.

Returns:
True if the del operation was successful. The return type is *boolean*.

get(path, prop=(null))

Return a stored JSON object or object property for the user.

Args:
path (str|list): A path string or list of path parts.

prop (str|list): A property name or list of name parts.

Returns:
The previously stored value or `(null)`. The return type is `prim`.

iter(path=(null))

Yield (<path>, <valu>) tuples for the users JSON objects.

Args:
path (str|list): A path string or list of path parts.

Yields:
(<path>, <item>) tuples. The return type is *list*.

set(path, valu, prop=(null))

Set a JSON object or object property for the user.

Args:
path (str|list): A path string or list of path elements.

valu (prim): The value to set as the JSON object or object property.

prop (str|list): A property name or list of name parts.

Returns:
True if the set operation was successful. The return type is *boolean*.

13.2.6 auth:user:profile

The Storm deref/setitem/iter convention on top of User profile information.

13.2.7 auth:user:vars

The Storm deref/setitem/iter convention on top of User vars information.

13.2.8 boolean

Implements the Storm API for a boolean instance.

13.2.9 bytes

Implements the Storm API for a Bytes object.

bunzip()

Decompress the bytes using bzip2.

Example:
Decompress bytes with bzip2:

```
$foo = $mybytez.bunzip()
```

Returns:
Decompressed bytes. The return type is *bytes*.

bzip()

Compress the bytes using bzip2 and return them.

Example:
Compress bytes with bzip:

```
$foo = $mybytez.bzip()
```

Returns:
The bzip2 compressed bytes. The return type is *bytes*.

decode(encoding=utf8, errors=surrogatepass)

Decode bytes to a string.

Args:
encoding (str): The encoding to use.

errors (str): The error handling scheme to use.

Returns:
The decoded string. The return type is *str*.

gunzip()

Decompress the bytes using gzip and return them.

Example:
Decompress bytes with bzip2:

```
$foo = $mybytez.gunzip()
```

Returns:
Decompressed bytes. The return type is *bytes*.

gzip()

Compress the bytes using gzip and return them.

Example:
Compress bytes with gzip:

```
$foo = $mybytez.gzip()
```

Returns:
The gzip compressed bytes. The return type is *bytes*.

json(encoding=(null), errors=surrogatepass)

Load JSON data from bytes.

Notes:
The bytes must be UTF8, UTF16 or UTF32 encoded.

Example:

Load bytes to a object:

```
$foo = $mybytez.json()
```

Args:

encoding (str): Specify an encoding to use.

errors (str): Specify an error handling scheme to use.

Returns:

The deserialized object. The return type is `prim`.

slice(start, end=(null))

Slice a subset of bytes from an existing bytes.

Examples:

Slice from index to 1 to 5:

```
$subbyts = $byts.slice(1,5)
```

Slice from index 3 to the end of the bytes:

```
$subbyts = $byts.slice(3)
```

Args:

start (int): The starting byte index.

end (int): The ending byte index. If not specified, slice to the end.

Returns:

The slice of bytes. The return type is *bytes*.

unpack(fmt, offset=(0))

Unpack structures from bytes using python struct.unpack syntax.

Examples:

Unpack 3 unsigned 16 bit integers in little endian format:

```
($x, $y, $z) = $byts.unpack("<HHH")
```

Args:

fmt (str): A python struck.pack format string.

offset (int): An offset to begin unpacking from.

Returns:

The unpacked primitive values. The return type is *list*.

13.2.10 cache:fixed

A StormLib API instance of a Storm Fixed Cache.

clear()

Clear all items from the cache.

Returns:
The return type is `null`.

get(key)

Get an item from the cache by key.

Args:
key (any): The key to lookup.

Returns:
The value from the cache, or the callback query if it does not exist The return type is `any`.

pop(key)

Pop an item from the cache.

Args:
key (any): The key to pop.

Returns:
The value from the cache, or `(null)` if it does not exist The return type is `any`.

put(key, value)

Put an item into the cache.

Args:
key (any): The key put in the cache.

value (any): The value to assign to the key.

Returns:
The return type is `null`.

query

Get the callback Storm query as string.

Returns:
The callback Storm query text. The return type is *str*.

13.2.11 cmdopts

A dictionary like object that holds a reference to a command options namespace. (This allows late-evaluation of command arguments rather than forcing capture)

13.2.12 cronjob

Implements the Storm api for a cronjob instance.

iden

The iden of the Cron Job.

Returns:
The type is *str*.

kill()

If the job is currently running, terminate the task.

Returns:
A boolean value which is true if the task was terminated. The return type is *boolean*.

pack()

Get the Cronjob definition.

Returns:
The definition. The return type is *dict*.

pprint()

Get a dictionary containing user friendly strings for printing the CronJob.

Returns:
A dictionary containing structured data about a cronjob for display purposes. The return type is *dict*.

set(name, valu)

Set an editable field in the cron job definition.

Example:
Change the name of a cron job:

```
$lib.cron.get($iden).set(name, "foo bar cron job")
```

Args:
name (str): The name of the field being set

valu (any): The value to set on the definition.

Returns:
The `cronjob` The return type is *cronjob*.

13.2.13 dict

Implements the Storm API for a Dictionary object.

13.2.14 hive:dict

A Storm Primitive representing a HiveDict.

get(name, default=(null))

Get the named value from the HiveDict.

Args:
name (str): The name of the value.

default (prim): The default value to return if the name is not set.

Returns:
The requested value. The return type is `prim`.

list()

List the keys and values in the HiveDict.

Returns:
A list of tuples containing key, value pairs. The return type is *list*.

pop(name, default=(null))

Remove a value out of the HiveDict.

Args:
name (str): The name of the value.

default (prim): The default value to return if the name is not set.

Returns:
The requested value. The return type is `prim`.

set(name, valu)

Set a value in the HiveDict.

Args:
name (str): The name of the value to set

valu (prim): The value to store in the HiveDict

Returns:
Old value of the dictionary if the value was previously set, or none. The return type may be one of the following: `null`, `prim`.

13.2.15 http:api

Extended HTTP API object.

This object represents an extended HTTP API that has been configured on the Cortex.

authenticated

Boolean value indicating if the Extended HTTP API requires an authenticated user or session.

Returns:
The return type is *boolean*. When this is used to set the value, it does not have a return type.

created

The time the Extended HTTP API was created.

Returns:
The type is `int`.

creator

The user that created the Extended HTTP API.

Returns:
The return type is *auth:user*.

desc

The description of the API instance.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

iden

The iden of the Extended HTTP API.

Returns:
The type is *str*.

methods

The dictionary containing the Storm code used to implement the HTTP methods.

Returns:
The return type is *http:api:methods*.

name

The name of the API instance.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

owner

The user that runs the endpoint query logic when runas=”owner”.

Returns:
The return type is *auth:user*. When this is used to set the value, it does not have a return type.

pack()

Get a packed copy of the HTTP API object.

Returns:
The return type is *dict*.

path

The path of the API instance.

This path may contain regular expression capture groups, which are used to populate request arguments.

Note:
The Cortex does not inspect paths in order to identify duplicates or overlapping paths. It is the responsibility of the Cortex administrator to configure their Extended HTTP API paths so that they are correct for their use cases.

Example:
Update an API path to contain a single wildcard argument:

```
$api.path = 'foo/bar/(.*)/baz'
```

Update an API path to contain a two wildcard arguments with restricted character sets:

```
$api.path = 'hehe/([a-z]*)/([0-9]{1-4})'
```

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

perms

The permissions an authenticated user must have in order to access the HTTP API.

Returns:
The return type is *http:api:perms*. When this is used to set the value, it does not have a return type.

pool

Boolean value indicating if the handler responses may be executed as part of a Storm pool.

Returns:
The return type is *boolean*. When this is used to set the value, it does not have a return type.

readonly

Boolean value indicating if the Storm methods are executed in a readonly Storm runtime.

Returns:
The return type is *boolean*. When this is used to set the value, it does not have a return type.

runas

String indicating whether the requests run as the owner or the authenticated user.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

updated

The time the Extended HTTP API was last modified.

Returns:
The return type is `int`.

vars

The Storm runtime variables specific for the API instance.

Returns:
The return type is *http:api:vars*. When this is used to set the value, it does not have a return type.

view

The View of the API instance. This is the view that Storm methods are executed in.

Returns:
The return type is *view*. When this is used to set the value, it does not have a return type.

13.2.16 http:api:methods

Accessor dictionary for getting and setting Extended HTTP API methods.

Notes:
The Storm code used to run these methods will have a $request object injected into them. This allows the method to send data back to the caller when it is run.

Examples:

Setting a simple GET method:

```
$api.methods.get = ${
    $data = ({"someKey": "someValue})
    $headers = ({"someHeader": "someOtherValue"})
    $request.reply(200, headers=$headers, body=$data)
}
```

Removing a PUT method:

```
$api.methods.put = $lib.undef
```

Crafting a custom text response:

```
$api.methods.get = ${
    // Create the body
    $data = 'some value'
    // Encode the response as bytes
    $data = $data.encode()
    // Set the headers
    $headers = ({"Content-Type": "text/plain", "Content-Length": $lib.len($data})
    $request.reply(200, headers=$headers, body=$data)
}
```

Streaming multiple chunks of data as JSON lines. This sends the code, headers and body separately:

```
$api.methods.get = ${
    $request.sendcode(200)
    $request.sendheaders(({"Content-Type": "text/plain; charset=utf8"}))
    $values = ((1), (2), (3))
    for $i in $values {
        $body=`{$lib.json.save(({"value": $i}))}

        $request.sendbody($body.encode())
    }
}
```

delete

The DELETE request Storm code.

Returns:

The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

get

The GET request Storm code.

Returns:

The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

head

The HEAD request Storm code

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

options

The OPTIONS request Storm code.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

patch

The PATCH request Storm code.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

post

The POST request Storm code.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

put

The PUT request Storm code.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

13.2.17 http:api:perms

Accessor list for getting and setting http:api permissions.

append(valu)

Append a permission to the list.

Args:
valu (any): The permission to append to the list.

Returns:
The return type is `null`.

extend(valu)

Extend a list using another iterable.

Args:
valu (list): A list or other iterable.

Returns:
The return type is `null`.

has(valu)

Check it a permission is in the list.

Args:
valu (any): The permission to check.

Returns:
True if the permission is in the list, false otherwise. The return type is *boolean*.

index(valu)

Return a single permission from the list by index.

Args:
valu (int): The list index value.

Returns:
The permission present in the list at the index position. The return type is `any`.

length()

> **Warning**
>
> `$http:api:perms.length` has been deprecated and will be removed in version v3.0.0.

Get the length of the list. This is deprecated; please use `.size()` instead.

Returns:
The size of the list. The return type is `int`.

pop()

Pop and return the last permission in the list.

Returns:
The last permission from the list. The return type is `any`.

reverse()

Reverse the order of the list in place

Returns:
The return type is `null`.

size()

Return the length of the list.

Returns:
The size of the list. The return type is `int`.

slice(start, end=(null))

Get a slice of the list.

Args:
start (int): The starting index.

end (int): The ending index. If not specified, slice to the end of the list.

Returns:
The slice of the list. The return type is *list*.

13.2.18 http:api:request

Extended HTTP API Request object.

api

The http:api object for the request.

Returns:
The return type is *http:api*.

args

A list of path arguments made as part of the HTTP API request. These are the results of any capture groups defined in the Extended HTTP API path regular expression.

Returns:
The type is *list*.

body

The raw request body.

Returns:
The type is *bytes*.

client

The remote IP of the requester.

Returns:
The type is *str*.

headers

The request headers.

Returns:
The return type is *http:api:request:headers*.

json

The request body as json.

Returns:
The return type is *dict*.

method

The request method

Returns:
The type is *str*.

params

Request parameters.

Returns:
The type is *dict*.

path

The path which was matched against the Extended HTTPAPI endpoint.

Returns:
The type is *str*.

reply(code, headers=(null), body=$lib.undef)

Convenience method to send the response code, headers and body together.

Notes:
This can only be called once.

If the response body is not bytes, this method will serialize the body as JSON and set the `Content-Type` and `Content-Length` response headers.

Args:
code (int): The response code.

headers (dict): The response headers.

body (any): The response body.

Returns:
The return type is `null`.

sendbody(body)

Send the HTTP response body.

Args:
body (bytes): The response body.

Returns:
The return type is `null`.

sendcode(code)

Send the HTTP response code.

Args:
code (int): The response code.

Returns:
The return type is `null`.

sendheaders(headers)

Send the HTTP response headers.

Args:
headers (dict): The response headers.

Returns:
The return type is `null`.

uri

The full request URI.

Returns:
The type is *str*.

user

The user iden who made the HTTP API request.

Returns:
The type is *str*.

13.2.19 http:api:request:headers

Immutable lowercase key access dictionary for HTTP request headers.

Example:
Request headers can be accessed in a case insensitive manner:

```
$valu = $request.headers.Cookie
// or the lower case value
$valu = $request.headers.cookie
```

13.2.20 http:api:vars

Accessor dictionary for getting and setting Extended HTTP API variables.

This can be used to set, unset or iterate over the runtime variables that are set for an Extended HTTP API endpoint. These variables are set in the Storm runtime for all of the HTTP methods configured to be executed by the endpoint.

Example:
Set a few variables on a given API:

```
$api.vars.foo = 'the foo string'
$api.vars.bar = (1234)
```

Remove a variable:

```
$api.vars.foo = $lib.undef
```

Iterate over the variables set for the endpoint:

```
for ($key, $valu) in $api.vars {
    $lib.print(`{$key) -> {$valu}`)
}
```

Overwrite all of the variables for a given API with a new dictionary:

```
$api.vars = ({"foo": "a new string", "bar": (137)})
```

13.2.21 inet:http:oauth:v1:client

A client for doing OAuth V1 Authentication from Storm.

sign(baseurl, method=GET, headers=(null), params=(null), body=(null))

Sign an OAuth request to a particular URL.

Args:

baseurl (str): The base url to sign and query.

method (dict): The HTTP Method to use as part of signing.

headers (dict): Optional headers used for signing. Can override the "Content-Type" header if the signature type is set to SIG_BODY

params (dict): Optional query parameters to pass to url construction and/or signing.

body (bytes): Optional HTTP body to pass to request signing.

Returns:

A 3-element tuple of ($url, $headers, $body). The OAuth signature elements will be embedded in the element specified when constructing the client. The return type is *list*.

13.2.22 inet:http:resp

Implements the Storm API for a HTTP response.

body

The raw HTTP response body as bytes.

Returns:

The type is *bytes*.

code

The HTTP status code. It is -1 if an exception occurred.

Returns:

The type is `int`.

err

Tuple of the error type and information if an exception occurred.

Returns:

The type is *list*.

headers

The HTTP Response headers.

Returns:

The type is *dict*.

history

A list of response objects representing the history of the response. This is populated when responses are redirected.

Returns:
A list of `inet:http:resp` objects. The return type is *list*.

json(encoding=(null), errors=surrogatepass)

Get the JSON deserialized response.

Args:
encoding (str): Specify an encoding to use.

errors (str): Specify an error handling scheme to use.

Returns:
The return type is `prim`.

msgpack()

Yield the msgpack deserialized objects.

Yields:
Unpacked values. The return type is `prim`.

reason

The reason phrase for the HTTP status code.

Returns:
The type is *str*.

request_headers

The HTTP Request headers.

Returns:
The type is *dict*.

url

The response URL. If the request was redirected, this would be the final URL in the redirection chain. If the status code is -1, then this is the request URL.

Returns:
The type is *str*.

13.2.23 inet:http:socket

Implements the Storm API for a Websocket.

rx(timeout=(null))

Receive a message from the web socket.

Args:
timeout (int): The timeout to wait for

Returns:
An ($ok, $valu) tuple. The return type is *list*.

tx(mesg)

Transmit a message over the web socket.

Args:
mesg (dict): A JSON compatible message.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

13.2.24 inet:imap:server

An IMAP server for retrieving email messages.

delete(uid_set)

Mark an RFC2060 UID message as deleted and expunge the mailbox.

The command uses the +FLAGS.SILENT command and applies the Deleted flag. The actual behavior of these commands are mailbox configuration dependent.

Examples:
Mark a single message as deleted and expunge:

```
($ok, $valu) = $server.delete("8182")
```

Mark ranges of messages as deleted and expunge:

```
($ok, $valu) = $server.delete("1:3,6:9")
```

Args:
uid_set (str): The UID message set to apply the flag to.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

fetch(uid)

Fetch a message by UID in RFC822 format.

The message is saved to the Axon, and a `file:bytes` node is returned.

Examples:
Fetch a message, save to the Axon, and yield `file:bytes` node:

```
yield $server.fetch("8182")
```

Args:
uid (str): The single message UID.

Returns:
The file:bytes node representing the message. The return type is *node*.

list(reference_name="", pattern=*)

List mailbox names.

By default this method uses a reference_name and pattern to return all mailboxes from the root.

Args:
reference_name (str): The mailbox reference name.

pattern (str): The pattern to filter by.

Returns:
An ($ok, $valu) tuple where $valu is a list of names if $ok=True. The return type is *list*.

login(user, passwd)

Login to the IMAP server.

Args:
user (str): The username to login with.

passwd (str): The password to login with.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

markSeen(uid_set)

Mark messages as seen by an RFC2060 UID message set.

The command uses the +FLAGS.SILENT command and applies the Seen flag.

Examples:
Mark a single messsage as seen:

```
($ok, $valu) = $server.markSeen("8182")
```

Mark ranges of messages as seen:

```
($ok, $valu) = $server.markSeen("1:3,6:9")
```

Args:
uid_set (str): The UID message set to apply the flag to.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

search(*args, charset=utf-8)

Search for messages using RFC2060 syntax.

Examples:
Retrieve all messages:

```
($ok, $uids) = $server.search("ALL")
```

Search by FROM and SINCE:

```
($ok, $uids) = $server.search("FROM", "visi@vertex.link", "SINCE", "01-Oct-2021")
```

Search by a subject substring:

```
($ok, $uids) = $search.search("HEADER", "Subject", "An email subject")
```

Args:
*args (str): A set of search criteria to use.

charset: The CHARSET used for the search. May be set to `(null)` to disable CHARSET. The input type may be one of the following: `str`, `null`.

Returns:
An ($ok, $valu) tuple, where $valu is a list of UIDs if $ok=True. The return type is *list*.

select(mailbox=INBOX)

Select a mailbox to use in subsequent commands.

Args:
mailbox (str): The mailbox name to select.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

13.2.25 inet:smtp:message

An SMTP message to compose and send.

headers

A dictionary of email header values.

Returns:
The type is *dict*.

html

The HTML body of the email message. This can also be used to set an HTML body in the message.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

recipients

An array of RCPT TO email addresses.

Returns:
The type is *list*.

send(host, port=(25), user=(null), passwd=(null), usetls=(false), starttls=(false), timeout=(60), ssl_verify=(true))

Transmit a message over the web socket.

Args:
host (str): The hostname or IP address of the SMTP server.

port (int): The port that the SMTP server is listening on.

user (str): The user name to use authenticating to the SMTP server.

passwd (str): The password to use authenticating to the SMTP server.

usetls (bool): Initiate a TLS connection to the SMTP server.

starttls (bool): Use the STARTTLS directive with the SMTP server.

timeout (int): The timeout (in seconds) to wait for message delivery.

ssl_verify (bool): Perform SSL/TLS verification.

Returns:
An ($ok, $valu) tuple. The return type is *list*.

sender

The inet:email to use in the MAIL FROM request. This can also be used to set the sender for the message.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

text

The text body of the email message. This can also be used to set the body of the message.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

13.2.26 json:schema

A JsonSchema validation object for use in validating data structures in Storm.

schema()

The schema belonging to this object.

Returns:
A copy of the schema used for this object. The return type is *dict*.

validate(item)

Validate a structure against the Json Schema

Args:
item (prim): A JSON structure to validate (dict, list, etc…)

Returns:
An ($ok, $valu) tuple. If $ok is True, then $valu should be used as the validated data structure. If $ok is False, $valu is a dictionary with a "mesg" key. The return type is *list*.

13.2.27 layer

Implements the Storm api for a layer instance.

addPull(url, offs=(0), queue_size=(10000), chunk_size=(1000))

Configure the layer to pull edits from a remote layer/feed.

Args:
url (str): The telepath URL to a layer/feed.

offs (int): The offset to begin from.

queue_size (int): The queue size of the puller.

chunk_size (int): The chunk size of the puller when consuming edits.

Returns:
Dictionary containing the pull definition. The return type is *dict*.

addPush(url, offs=(0), queue_size=(10000), chunk_size=(1000))

Configure the layer to push edits to a remote layer/feed.

Args:
url (str): A telepath URL of the target layer/feed.

offs (int): The local layer offset to begin pushing from

queue_size (int): The queue size of the pusher.

chunk_size (int): The chunk size of the pusher when pushing edits.

Returns:
Dictionary containing the push definition. The return type is *dict*.

delPull(iden)

Remove a pull config from the layer.

Args:
iden (str): The iden of the push config to remove.

Returns:
The return type is `null`.

delPush(iden)

Remove a push config from the layer.

Args:
iden (str): The iden of the push config to remove.

Returns:
The return type is `null`.

edited()

Return the last time the layer was edited or null if no edits are present.

Returns:
The last time the layer was edited. The return type is `time`.

edits(offs=(0), wait=(true), size=(null), reverse=(false))

Yield (offs, nodeedits) tuples from the given offset.

Notes:
Specifying reverse=(true) disables the wait behavior.

Args:
offs (int): Offset to start getting nodeedits from the layer at.

wait (boolean): If true, wait for new edits, otherwise exit the generator when there are no more edits.

size (int): The maximum number of nodeedits to yield.

reverse (boolean): Yield the edits in reverse order.

Yields:
Yields offset, nodeedit tuples from a given offset. The return type is *list*.

get(name, defv=(null))

Get a arbitrary value in the Layer definition.

Args:
name (str): Name of the value to get.

defv (prim): The default value returned if the name is not set in the Layer.

Returns:
The value requested or the default value. The return type is `prim`.

getEdges()

Yield (n1iden, verb, n2iden) tuples for any light edges in the layer.

Example:
Iterate the light edges in `$layer`:

```
for ($n1iden, $verb, $n2iden) in $layer.getEdges() {
    $lib.print(`{$n1iden} -({$verb})> {$n2iden}`)
}
```

Yields:
Yields (<n1iden>, <verb>, <n2iden>) tuples The return type is *list*.

getEdgesByN1(nodeid)

Yield (verb, n2iden) tuples for any light edges in the layer for the source node iden.

Example:
Iterate the N1 edges for `$node`:

```
for ($verb, $n2iden) in $layer.getEdgesByN1($node.iden()) {
    $lib.print(`-({$verb})> {$n2iden}`)
}
```

Args:
nodeid (str): The hex string of the node iden.

Yields:
Yields (<verb>, <n2iden>) tuples The return type is *list*.

getEdgesByN2(nodeid)

Yield (verb, n1iden) tuples for any light edges in the layer for the target node iden.

Example:
Iterate the N2 edges for `$node`:

```
for ($verb, $n1iden) in $layer.getEdgesByN2($node.iden()) {
    $lib.print(`-({$verb})> {$n1iden}`)
}
```

Args:
nodeid (str): The hex string of the node iden.

Yields:
Yields (<verb>, <n1iden>) tuples The return type is *list*.

getFormCounts()

Get the formcounts for the Layer.

Example:

Get the formcounts for the current Layer:

```
$counts = $lib.layer.get().getFormCounts()
```

Returns:

Dictionary containing form names and the count of the nodes in the Layer. The return type is *dict*.

getMirrorStatus()

Return a dictionary of the mirror synchronization status for the layer.

Returns:

An info dictionary describing mirror sync status. The return type is *dict*.

getNodeData(nodeid)

Yield (name, valu) tuples for any node data in the layer for the target node iden.

Example:

Iterate the node data for `$node`:

```
for ($name, $valu) in $layer.getNodeData($node.iden()) {
    $lib.print(`{$name} = {$valu}`)
}
```

Args:

nodeid (str): The hex string of the node iden.

Yields:

Yields (<name>, <valu>) tuples The return type is *list*.

getPropArrayCount(propname, valu=$lib.undef)

Get the number of individual value rows in the layer for the given array property name.

Args:

propname (str): The property name to look up.

valu (any): A specific value in the array property to look up.

Returns:

The count of rows. The return type is `int`.

getPropCount(propname, maxsize=(null), valu=$lib.undef)

Get the number of property rows in the layer for the given full form or property name.

Args:

propname (str): The property or form name to look up.

maxsize (int): The maximum number of rows to look up.

valu (any): A specific value of the property to look up.

Returns:

The count of rows. The return type is `int`.

getPropValues(propname)

Yield unique property values in the layer for the given form or property name.

Args:
propname (str): The property or form name to look up.

Yields:
Unique property values. The return type is `any`.

getStorNode(nodeid)

Retrieve the raw storage node for the specified node iden.

Args:
nodeid (str): The hex string of the node iden.

Returns:
The storage node dictionary. The return type is *dict*.

getStorNodes()

Get buid, sode tuples representing the data stored in the layer.

Notes:
The storage nodes represent **only** the data stored in the layer and may not represent whole nodes.

Yields:
Tuple of buid, sode values. The return type is *list*.

getStorNodesByForm(form)

Get buid, sode tuples representing the data stored in the layer for a given form.

Notes:
The storage nodes represent **only** the data stored in the layer and may not represent whole nodes. If the only data stored in the layer for a given buid is an N2 edge reference, a storage node will not be returned.

Args:
form (str): The name of the form to get storage nodes for.

Yields:
Tuple of buid, sode values. The return type is *list*.

getTagCount(tagname, formname=(null))

Return the number of tag rows in the layer for the given tag and optional form.

Examples:
Get the number of `inet:ipv4` nodes with the `$foo.bar` tag:

```
$count = $lib.layer.get().getTagCount(foo.bar, formname=inet:ipv4)
```

Args:
tagname (str): The name of the tag to look up.

formname (str): The form to constrain the look up by.

Returns:
The count of tag rows. The return type is `int`.

getTagPropCount(tag, propname, form=(null), valu=$lib.undef)

Get the number of rows in the layer for the given tag property.

Args:

tag (str): The tag to look up.

propname (str): The property name to look up.

form (str): The optional form to look up.

valu (any): A specific value of the property to look up.

Returns:

The count of rows. The return type is `int`.

iden

The iden of the Layer.

Returns:

The type is *str*.

liftByNodeData(name)

Lift and yield nodes with the given node data key set within the layer.

Example:

Yield all nodes with the data key zootsuit set in the top layer:

```
yield $lib.layer.get().liftByNodeData(zootsuit)
```

Args:

name (str): The node data name to lift by.

Yields:

Yields nodes. The return type is *node*.

liftByProp(propname, propvalu=(null), propcmpr==)

Lift and yield nodes with the property and optional value set within the layer.

Example:

Yield all nodes with the property `ou:org:name` set in the top layer:

```
yield $lib.layer.get().liftByProp(ou:org:name)
```

Yield all nodes with the property `ou:org:name=woot` in the top layer:

```
yield $lib.layer.get().liftByProp(ou:org:name, woot)
```

Yield all nodes with the property `ou:org:name^=woot` in the top layer:

```
yield $lib.layer.get().liftByProp(ou:org:name, woot, "^=")
```

Args:

propname (str): The full property name to lift by.

propvalu (obj): The value for the property.

propcmpr (str): The comparison operation to use on the value.

Yields:
Yields nodes. The return type is *node*.

liftByTag(tagname, formname=(null))

Lift and yield nodes with the tag set within the layer.

Example:
Yield all nodes with the tag #foo set in the layer:

```
yield $lib.layer.get().liftByTag(foo)
```

Yield all inet:fqdn with the tag #foo set in the layer:

```
yield $lib.layer.get().liftByTag(foo, inet:fqdn)
```

Args:
tagname (str): The tag name to lift by.

formname (str): The optional form to lift.

Yields:
Yields nodes. The return type is *node*.

name

The name of the Layer.

Returns:
The type is *str*.

pack()

Get the Layer definition.

Returns:
Dictionary containing the Layer definition. The return type is *dict*.

repr()

Get a string representation of the Layer.

Returns:
A string that can be printed, representing a Layer. The return type is *str*.

set(name, valu)

Set an arbitrary value in the Layer definition.

Args:
name (str): The name to set.

valu (any): The value to set.

Returns:
The return type is `null`.

verify(config=(null))

Verify consistency between the node storage and indexes in the given layer.

Example:

Get all messages about consistency issues in the default layer:

```
for $mesg in $lib.layer.get().verify() {
    $lib.print($mesg)
}
```

Notes:

The config format argument and message format yielded by this API is considered BETA and may be subject to change! The formats will be documented when the convention stabilizes.

Args:

config (dict): The scan config to use (default all enabled).

Yields:

Yields messages describing any index inconsistencies. The return type is *list*.

13.2.28 list

Implements the Storm API for a List instance.

append(valu)

Append a value to the list.

Args:

valu (any): The item to append to the list.

Returns:

The return type is `null`.

extend(valu)

Extend a list using another iterable.

Examples:

Populate a list by extending it with to other lists:

```
$list = ()

$foo = (f, o, o)
$bar = (b, a, r)

$list.extend($foo)
$list.extend($bar)

// $list is now (f, o, o, b, a, r)
```

Args:

valu (list): A list or other iterable.

Returns:

The return type is `null`.

has(valu)

Check if a value is in the list.

Args:
valu (any): The value to check.

Returns:
True if the item is in the list, false otherwise. The return type is *boolean*.

index(valu)

Return a single field from the list by index.

Args:
valu (int): The list index value.

Returns:
The item present in the list at the index position. The return type is `any`.

length()

> **Warning**
>
> `$list.length` has been deprecated and will be removed in version v3.0.0.

Get the length of the list. This is deprecated; please use `.size()` instead.

Returns:
The size of the list. The return type is `int`.

pop(index=(-1))

Pop and return the entry at the specified index in the list. If no index is specified, pop the last entry.

Args:
index (int): Index of entry to pop.

Returns:
The entry at the specified index in the list. The return type is `any`.

rem(item, all=(false))

Remove a specific item from anywhere in the list.

Args:
item (any): An item in the list.

all (boolean): Remove all instances of item from the list.

Returns:
Boolean indicating if the item was removed from the list. The return type is *boolean*.

reverse()

Reverse the order of the list in place

Returns:
The return type is `null`.

size()

Return the length of the list.

Returns:
The size of the list. The return type is `int`.

slice(start, end=(null))

Get a slice of the list.

Examples:
Slice from index to 1 to 5:

```
$x=(f, o, o, b, a, r)
$y=$x.slice(1,5)  // (o, o, b, a)
```

Slice from index 3 to the end of the list:

```
$y=$x.slice(3)  // (b, a, r)
```

Args:
start (int): The starting index.

end (int): The ending index. If not specified, slice to the end of the list.

Returns:
The slice of the list. The return type is *list*.

sort(reverse=(false))

Sort the list in place.

Args:
reverse (boolean): Sort the list in reverse order.

Returns:
The return type is `null`.

unique()

Get a copy of the list containing unique items.

Returns:
The return type is *list*.

13.2.29 model:form

Implements the Storm API for a Form.

name

The name of the Form

Returns:
The type is *str*.

prop(name)

Get a Property on the Form

Args:
name (str): The property to retrieve.

Returns:
The `model:property` instance if the property if present on the form or null. The return type may be one of the following: *model:property*, `null`.

type

Get the Type for the form.

Returns:
The return type is *model:type*.

13.2.30 model:property

Implements the Storm API for a Property.

form

Get the Form for the Property.

Returns:
The return type may be one of the following: *model:form*, `null`.

full

The full name of the Property.

Returns:
The type is *str*.

name

The short name of the Property.

Returns:
The type is *str*.

type

Get the Type for the Property.

Returns:
The return type is *model:type*.

13.2.31 model:tagprop

Implements the Storm API for a Tag Property.

name

The name of the Tag Property.

Returns:
The type is *str*.

type

Get the Type for the Tag Property.

Returns:
The return type is *model:type*.

13.2.32 model:type

A Storm types wrapper around a lib.types.Type

name

The name of the Type.

Returns:
The type is *str*.

norm(valu)

Get the norm and info for the Type.

Args:
valu (any): The value to norm.

Returns:
A tuple of the normed value and its information dictionary. The return type is *list*.

opts

The options for the Type.

Returns:
The type is *dict*.

repr(valu)

Get the repr of a value for the Type.

Args:
valu (any): The value to get the repr of.

Returns:
The string form of the value as represented by the type. The return type is *str*.

stortype

The storetype of the Type.

Returns:
The type is `int`.

13.2.33 node

Implements the Storm api for a node instance.

addEdge(verb, iden)

Add a light-weight edge.

Args:
verb (str): The edge verb to add.

iden (str): The node iden of the destination node.

Returns:
The return type is `null`.

delEdge(verb, iden)

Remove a light-weight edge.

Args:
verb (str): The edge verb to remove.

iden (str): The node iden of the destination node to remove.

Returns:
The return type is `null`.

difftags(tags, prefix=(null), apply=(false), norm=(false))

Get and optionally apply the difference between the current set of tags and another set.

Args:
tags (list): The set to compare against.

prefix (str): An optional prefix to match tags under.

apply (boolean): If true, apply the diff.

norm (boolean): Optionally norm the list of tags. If a prefix is provided, it will not be normed.

Returns:
The tags which have been added/deleted in the new set. The return type is *dict*.

edges(verb=(null), reverse=(false))

Yields the (verb, iden) tuples for this nodes edges.

Args:
verb (str): If provided, only return edges with this verb.

reverse (boolean): If true, yield edges with this node as the dest rather than source.

Yields:
A tuple of (verb, iden) values for this nodes edges. The return type is *list*.

form()

Get the form of the Node.

Returns:
The form of the Node. The return type is *str*.

getByLayer()

Return a dict you can use to lookup which props/tags came from which layers.

Returns:
property / tag lookup dictionary. The return type is *dict*.

getStorNodes()

Return a list of "storage nodes" which were fused from the layers to make this node.

Returns:
List of storage node objects. The return type is *list*.

globtags(glob)

Get a list of the tag components from a Node which match a tag glob expression.

Args:
glob (str): The glob expression to match.

Returns:
The components of tags which match the wildcard component of a glob expression. The return type is *list*.

iden()

Get the iden of the Node.

Returns:
The nodes iden. The return type is *str*.

isform(name)

Check if a Node is a given form.

Args:
name (str): The form to compare the Node against.

Returns:
True if the form matches, false otherwise. The return type is *boolean*.

ndef()

Get the form and primary property of the Node.

Returns:
A tuple of the form and primary property. The return type is *list*.

pack(dorepr=(false))

Return the serializable/packed version of the Node.

Args:
dorepr (boolean): Include repr information for human readable versions of properties.

Returns:
A tuple containing the ndef and property bag of the node. The return type is *list*.

repr(name=(null), defv=(null))

Get the repr for the primary property or secondary property of a Node.

Args:
name (str): The name of the secondary property to get the repr for.

defv (str): The default value to return if the secondary property does not exist

Returns:
The string representation of the requested value. The return type is *str*.

tags(glob=(null), leaf=(false))

Get a list of the tags on the Node.

Notes:
When providing a glob argument, the following rules are used. A single asterisk(*) will replace exactly one dot-delimited component of a tag. A double asterisk(**) will replace one or more of any character.

Args:
glob (str): A tag glob expression. If this is provided, only tags which match the expression are returned.

leaf (boolean): If true, only leaf tags are included in the returned tags.

Returns:
A list of tags on the node. If a glob match is provided, only matching tags are returned. The return type is *list*.

value()

Get the value of the primary property of the Node.

Returns:
The primary property. The return type is `prim`.

13.2.34 node:data

A Storm Primitive representing the NodeData stored for a Node.

cacheget(name, asof=now)

Retrieve data stored with cacheset() if it was stored more recently than the asof argument.

Args:
name (str): The name of the data to load.

asof (time): The max cache age.

Returns:
The cached value or null. The return type is `prim`.

cacheset(name, valu)

Set a node data value with an envelope that tracks time for cache use.

Args:
name (str): The name of the data to set.

valu (prim): The data to store.

Returns:
The return type is `null`.

get(name)

Get the Node data for a given name for the Node.

Args:
name (str): Name of the data to get.

Returns:
The stored node data. The return type is `prim`.

has(name)

Check if the Node data has the given key set on it

Args:
name (str): Name of the data to check for.

Returns:
True if the key is found, otherwise false. The return type is *boolean*.

list()

Get a list of the Node data on the Node as (name, value) tuples.

Returns:
List of (name, value) tuples stored on the node. The return type is *list*.

load(name)

Load the Node data onto the Node so that the Node data is packed and returned by the runtime.

Args:
name (str): The name of the data to load.

Returns:
The return type is `null`.

pop(name)

Pop (remove) a the Node data from the Node.

Args:
name (str): The name of the data to remove from the node.

Returns:
The data removed. The return type is `prim`.

set(name, valu)

Set the Node data for a given name on the Node.

Args:
name (str): The name of the data.

valu (prim): The data to store.

Returns:
The return type is `null`.

13.2.35 node:path

Implements the Storm API for the Path object.

idens()

The list of Node idens which this Path has been forked from during pivot operations.

Returns:
A list of node idens. The return type is *list*.

listvars()

List variables available in the path of a storm query.

Returns:
List of tuples containing the name and value of path variables. The return type is *list*.

meta

The PathMeta object for the Path.

Returns:
The type is *node:path:meta*.

vars

The PathVars object for the Path.

Returns:
The type is *node:path:vars*.

13.2.36 node:path:meta

Put the storm deref/setitem/iter convention on top of path meta information.

13.2.37 node:path:vars

Put the storm deref/setitem/iter convention on top of path variables.

13.2.38 node:props

A Storm Primitive representing the properties on a Node.

get(name)

Get a specific property value by name.

Args:
name (str): The name of the property to return.

Returns:
The requested value. The return type is `prim`.

list()

List the properties and their values from the `$node`.

Returns:
A list of (name, value) tuples. The return type is *list*.

set(prop, valu)

Set a specific property value by name.

Args:
prop (str): The name of the property to set.

valu (prim): The value to set the property to.

Returns:
The set value. The return type is `prim`.

13.2.39 number

Implements the Storm API for a Number instance.

Storm Numbers are high precision fixed point decimals corresponding to the the hugenum storage type.

scaleb(other)

Return the number multiplied by 10**other.

Example:
Multiply the value by 10**-18:

```
$baz.scaleb(-18)
```

Args:
other (int): The amount to adjust the exponent.

Returns:
The exponent adjusted number. The return type is *number*.

tofloat()

Return the number as a float.

Returns:
The number as a float. The return type is `float`.

toint(rounding=(null))

Return the number as an integer.

By default, decimal places will be truncated. Optionally, rounding rules can be specified by providing the name of a Python decimal rounding mode to the 'rounding' argument.

Example:
Round the value stored in $baz up instead of truncating:

```
$baz.toint(rounding=ROUND_UP)
```

Args:
rounding (str): An optional rounding mode to use.

Returns:
The number as an integer. The return type is `int`.

tostr()

Return the number as a string.

Returns:
The number as a string. The return type is *str*.

13.2.40 pipe

A Storm Pipe provides fast ephemeral queues.

put(item)

Add a single item to the Pipe.

Args:
item (any): An object to add to the Pipe.

Returns:
The return type is `null`.

puts(items)

Add a list of items to the Pipe.

Args:
items (list): A list of items to add.

Returns:
The return type is `null`.

size()

Retrieve the number of items in the Pipe.

Returns:
The number of items in the Pipe. The return type is `int`.

slice(size=(1000))

Return a list of up to size items from the Pipe.

Args:
size (int): The max number of items to return.

Returns:
A list of at least 1 item from the Pipe. The return type is *list*.

slices(size=(1000))

Yield lists of up to size items from the Pipe.

Notes:
The loop will exit when the Pipe is closed and empty.

Examples:
Operation on slices from a pipe one at a time:

```
for $slice in $pipe.slices(1000) {
    for $item in $slice { $dostuff($item) }
}
```

Operate on slices from a pipe in bulk:

```
for $slice in $pipe.slices(1000) {
    $dostuff_batch($slice)
}
```

Args:
size (int): The max number of items to yield per slice.

Yields:
Yields objects from the Pipe. The return type is `any`.

13.2.41 proj:comment

Implements the Storm API for a ProjectTicketComment

del()

Delete the comment.

Returns:
True if the ProjectTicketComment was deleted The return type is *boolean*.

text

The comment text. This can be used to set the text as well.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

13.2.42 proj:comments

Implements the Storm API for ProjectTicketComments objects, which are collections of comments associated with a ticket.

add(text)

Add a comment to the ticket.

Args:
text (str): The text for the new ProjectTicketComment.

Returns:
The newly created *proj:comment* object The return type is *proj:comment*.

get(guid)

Get a ticket comment by guid.

Args:
guid (str): The guid of the ProjectTicketComment to get.

Returns:
The *proj:comment* object The return type is *proj:comment*.

13.2.43 proj:epic

Implements the Storm API for a ProjectEpic

name

The name of the Epic. This can be used to set the name as well.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

13.2.44 proj:epics

Implements the Storm API for ProjectEpics objects, which are collections of ProjectEpic objects associated with a particular Project

add(name)

Add an epic.

Args:
name (str): The name for the new ProjectEpic.

Returns:
The newly created *proj:epic* object The return type is *proj:epic*.

del(name)

Delete an epic by name.

Args:
name (str): The name of the ProjectEpic to delete.

Returns:
True if the ProjectEpic can be found and deleted, otherwise False The return type is *boolean*.

get(name)

Get an epic by name.

Args:
name (str): The name (or iden) of the ProjectEpic to get.

Returns:
The *proj:epic* object The return type is *proj:epic*.

13.2.45 proj:project

Implements the Storm API for Project objects, which are used for managing a scrum style project in the Cortex

epics

A *proj:epics* object that contains the epics associated with the given project.

Returns:
The return type is *proj:epics*.

name

The name of the project. This can also be used to set the name of the project.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

sprints

A *proj:sprints* object that contains the sprints associated with the given project.

Returns:
The return type is *proj:sprints*.

tickets

A *proj:tickets* object that contains the tickets associated with the given project.

Returns:
The return type is *proj:tickets*.

13.2.46 proj:sprint

Implements the Storm API for a ProjectSprint

desc

A description of the sprint. This can also be used to set the description.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

name

The name of the sprint. This can also be used to set the name.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

status

The status of the sprint. This can also be used to set the status.

Returns:
The return type may be one of the following: `int`, `null`. When this is used to set the value, it does not have a return type.

tickets

Yields out the tickets associated with the given sprint (no call needed).

Returns:
The return type is `generator`.

13.2.47 proj:sprints

Implements the Storm API for ProjectSprints objects, which are collections of sprints associated with a single project

add(name, period=(null))

Add a sprint.

Args:
name (str): The name for the new ProjectSprint.

period (ival): The time interval the ProjectSprint runs for

Returns:
The newly created *proj:sprint* object The return type is *proj:sprint*.

del(name)

Delete a sprint by name.

Args:
name (str): The name of the Sprint to delete.

Returns:
True if the ProjectSprint can be found and deleted, otherwise False The return type is *boolean*.

get(name)

Get a sprint by name.

Args:
name (str): The name (or iden) of the ProjectSprint to get.

Returns:
The *proj:sprint* object The return type is *proj:sprint*.

13.2.48 proj:ticket

Implements the Storm API for a ProjectTicket.

assignee

The user the ticket is assigned to. This can be used to set the assignee of the ticket.

Returns:
The return type may be one of the following: `int`, `null`. When this is used to set the value, it does not have a return type.

comments

A `proj:comments` object that contains comments associated with the given ticket.

Returns:
The return type is *proj:comments*.

desc

A description of the ticket. This can be used to set the description.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

epic

The epic associated with the ticket. This can be used to set the epic.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

name

The name of the ticket. This can be used to set the name of the ticket.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

priority

An integer value from the enums [0, 10, 20, 30, 40, 50] of the priority of the ticket. This can be used to set the priority of the ticket.

Returns:
The return type may be one of the following: `int`, `null`. When this is used to set the value, it does not have a return type.

sprint

The sprint the ticket is in. This can be used to set the sprint this ticket is in.

Returns:
The return type may be one of the following: `int`, `null`. When this is used to set the value, it does not have a return type.

status

The status of the ticket. This can be used to set the status of the ticket.

Returns:
The return type may be one of the following: `int`, `null`. When this is used to set the value, it does not have a return type.

13.2.49 proj:tickets

Implements the Storm API for ProjectTickets objects, which are collections of tickets associated with a project

add(name, desc=)

Add a ticket.

Args:
name (str): The name for the new ProjectTicket.

desc (str): A description of the new ticket

Returns:
The newly created *proj:ticket* object The return type is *proj:ticket*.

del(name)

Delete a sprint by name.

Args:
name (str): The name of the ProjectTicket to delete.

Returns:
True if the ProjectTicket can be found and deleted, otherwise False The return type is *boolean*.

get(name)

Get a ticket by name.

Args:
name (str): The name (or iden) of the ProjectTicket to get.

Returns:
The *proj:ticket* object The return type is *proj:ticket*.

13.2.50 queue

A StormLib API instance of a named channel in the Cortex multiqueue.

cull(offs)

Remove items from the queue up to, and including, the offset.

Args:
offs (int): The offset which to cull records from the queue.

Returns:
The return type is `null`.

get(offs=(0), cull=(true), wait=(true))

Get a particular item from the Queue.

Args:
offs (int): The offset to retrieve an item from.

cull (boolean): Culls items up to, but not including, the specified offset.

wait (boolean): Wait for the offset to be available before returning the item.

Returns:
A tuple of the offset and the item from the queue. If wait is false and the offset is not present, null is returned. The return type is *list*.

gets(offs=(0), wait=(true), cull=(false), size=(null))

Get multiple items from the Queue as a iterator.

Args:
offs (int): The offset to retrieve an items from.

wait (boolean): Wait for the offset to be available before returning the item.

cull (boolean): Culls items up to, but not including, the specified offset.

size (int): The maximum number of items to yield

Yields:
Yields tuples of the offset and item. The return type is *list*.

name

The name of the Queue.

Returns:
The type is *str*.

pop(offs=(null), wait=(false))

Pop a item from the Queue at a specific offset.

Args:
offs (int): Offset to pop the item from. If not specified, the first item in the queue will be popped.

wait (boolean): Wait for an item to be available to pop.

Returns:
The offset and item popped from the queue. If there is no item at the offset or the queue is empty and wait is false, it returns null. The return type is *list*.

put(item)

Put an item into the queue.

Args:
item (prim): The item being put into the queue.

Returns:
The queue offset of the item. The return type is `int`.

puts(items)

Put multiple items into the Queue.

Args:
items (list): The items to put into the Queue.

Returns:
The queue offset of the first item. The return type is `int`.

size()

Get the number of items in the Queue.

Returns:
The number of items in the Queue. The return type is `int`.

13.2.51 random

A random number generator.

int(maxval, minval=(0))

Generate a random integer.

Args:
maxval (int): The maximum random value.

minval (int): The minimum random value.

Returns:
A random integer in the range min-max inclusive. The return type is `int`.

seed

The seed used for the generator. Setting this value resets the generator state.

Returns:
The return type may be one of the following: *str*, `null`. When this is used to set the value, it does not have a return type.

13.2.52 set

Implements the Storm API for a Set object.

add(*items)

Add a item to the set. Each argument is added to the set.

Args:
*items (any): The items to add to the set.

Returns:
The return type is `null`.

adds(*items)

Add the contents of a iterable items to the set.

Args:
*items (any): Iterables items to add to the set.

Returns:
The return type is `null`.

has(item)

Check if a item is a member of the set.

Args:
item (any): The item to check the set for membership.

Returns:
True if the item is in the set, false otherwise. The return type is *boolean*.

list()

Get a list of the current members of the set.

Returns:
A list containing the members of the set. The return type is *list*.

rem(*items)

Remove an item from the set.

Args:
*items (any): Items to be removed from the set.

Returns:
The return type is `null`.

rems(*items)

Remove the contents of a iterable object from the set.

Args:
*items (any): Iterables items to remove from the set.

Returns:
The return type is `null`.

size()

Get the size of the set.

Returns:
The size of the set. The return type is `int`.

13.2.53 spooled:set

A StormLib API instance of a Storm Set object that can fallback to lmdb.

add(*items)

Add a item to the set. Each argument is added to the set.

Args:
*items (any): The items to add to the set.

Returns:
The return type is `null`.

adds(*items)

Add the contents of a iterable items to the set.

Args:
*items (any): Iterables items to add to the set.

Returns:
The return type is `null`.

has(item)

Check if a item is a member of the set.

Args:
item (any): The item to check the set for membership.

Returns:
True if the item is in the set, false otherwise. The return type is *boolean*.

list()

Get a list of the current members of the set.

Returns:
A list containing the members of the set. The return type is *list*.

rem(*items)

Remove an item from the set.

Args:
*items (any): Items to be removed from the set.

Returns:
The return type is `null`.

rems(*items)

Remove the contents of a iterable object from the set.

Args:
*items (any): Iterables items to remove from the set.

Returns:
The return type is `null`.

size()

Get the size of the set.

Returns:
The size of the set. The return type is `int`.

13.2.54 stat:tally

A tally object.

An example of using it:

```
$tally = $lib.stats.tally()

$tally.inc(foo)

for $name, $total in $tally {
    $doStuff($name, $total)
}
```

get(name)

Get the value of a given counter.

Args:
name (str): The name of the counter to get.

Returns:
The value of the counter, or 0 if the counter does not exist. The return type is `int`.

inc(name, valu=(1))

Increment a given counter.

Args:
name (str): The name of the counter to increment.

valu (int): The value to increment the counter by.

Returns:
The return type is `null`.

sorted(byname=(false), reverse=(false))

Get a list of (counter, value) tuples in sorted order.

Args:
byname (bool): Sort by counter name instead of value.

reverse (bool): Sort in descending order instead of ascending order.

Returns:
List of (counter, value) tuples in sorted order. The return type is *list*.

13.2.55 stix:bundle

Implements the Storm API for creating and packing a STIX bundle for v2.1

add(node, stixtype=(null))

Make one or more STIX objects from a node, and add it to the bundle.

Examples:
Example Storm which would be called remotely via the `callStorm()` API:

```
init { $bundle = $lib.stix.bundle() }
#aka.feye.thr.apt1
$bundle.add($node)
fini { return($bundle) }
```

Args:
node (node): The node to make a STIX object from.

stixtype (str): The explicit name of the STIX type to map the node to. This will override the default mapping.

Returns:
The stable STIX id of the added object. The return type is *str*.

pack()

Return the bundle as a STIX JSON object.

Returns:
The return type is *dict*.

size()

Return the number of STIX objects currently in the bundle.

Returns:
The return type is `int`.

13.2.56 storm:query

A storm primitive representing an embedded query.

exec()

Execute the Query in a sub-runtime.

Notes:
The `.exec()` method can return a value if the Storm query contains a `return( ... )` statement in it.

Returns:
A value specified with a return statement, or none. The return type may be one of the following: `null`, `any`.

size(limit=(1000))

Execute the Query in a sub-runtime and return the number of nodes yielded.

Args:
limit (int): Limit the maximum number of nodes produced by the query.

Returns:
The number of nodes yielded by the query. The return type is `int`.

13.2.57 str

Implements the Storm API for a String object.

encode(encoding=utf8)

Encoding a string value to bytes.

Args:
encoding (str): Encoding to use. Defaults to utf8.

Returns:
The encoded string. The return type is *bytes*.

endswith(text)

Check if a string ends with text.

Args:
text (str): The text to check.

Returns:
True if the text ends with the string, false otherwise. The return type is *boolean*.

find(valu)

Find the offset of a given string within another.

Examples:
Find values in the string `asdf`:

```
$x = asdf
$x.find(d) // returns 2
$x.find(v) // returns null
```

Args:
valu (str): The substring to find.

Returns:
The first offset of substring or null. The return type is `int`.

format(**kwargs)

Format a text string from an existing string.

Examples:

Format a string with a fixed argument and a variable:

```
$template='Hello {name}, list is {list}!' $list=(1,2,3,4) $new=$template.
↪format(name='Reader', list=$list)
```

Args:

**kwargs (any): Keyword values which are substituted into the string.

Returns:

The new string. The return type is *str*.

join(items)

Join items into a string using the current string as a separator.

Examples:

Join together a list of strings with a dot separator:

```
storm> $sepr='.' $foo=$sepr.join(('rep', 'vtx', 'tag')) $lib.print($foo)

rep.vtx.tag
```

Join values inline together with a dot separator:

```
storm> $foo=('.').join(('rep', 'vtx', 'tag')) $lib.print($foo)

rep.vtx.tag
```

Args:

items (list): A list of items to join together.

Returns:

The joined string. The return type is *str*.

json()

Parse a JSON string and return the deserialized data.

Returns:

The JSON deserialized object. The return type is `prim`.

ljust(size, fillchar=)

Left justify the string.

Args:

size (int): The length of character to left justify.

fillchar (str): The character to use for padding.

Returns:

The left justified string. The return type is *str*.

lower()

Get a lowercased copy of the string.

Examples:

Printing a lowercased string:

```
$foo="Duck"
$lib.print($foo.lower())
```

Returns:

The lowercased string. The return type is *str*.

lstrip(chars=(null))

Remove leading characters from a string.

Examples:

Removing whitespace and specific characters:

```
$strippedFoo = $foo.lstrip()
$strippedBar = $bar.lstrip(w)
```

Args:

chars (str): A list of characters to remove. If not specified, whitespace is stripped.

Returns:

The stripped string. The return type is *str*.

replace(oldv, newv, maxv=(null))

Replace occurrences of a string with a new string, optionally restricting the number of replacements.

Example:

Replace instances of the string “bar” with the string “baz”:

```
$foo.replace('bar', 'baz')
```

Args:

oldv (str): The value to replace.

newv (str): The value to add into the string.

maxv (int): The maximum number of occurrences to replace.

Returns:

The new string with replaced instances. The return type is *str*.

reverse()

Get a reversed copy of the string.

Examples:

Printing a reversed string:

```
$foo="foobar"
$lib.print($foo.reverse())
```

Returns:

The reversed string. The return type is *str*.

rjust(size, fillchar=)

Right justify the string.

Args:
size (int): The length of character to right justify.

fillchar (str): The character to use for padding.

Returns:
The right justified string. The return type is *str*.

rsplit(text, maxsplit=(-1))

Split the string into multiple parts, from the right, based on a separator.

Example:
Split a string on the colon character:

```
($foo, $bar) = $baz.rsplit(":", maxsplit=1)
```

Args:
text (str): The text to split the string up with.

maxsplit (int): The max number of splits.

Returns:
A list of parts representing the split string. The return type is *list*.

rstrip(chars=(null))

Remove trailing characters from a string.

Examples:
Removing whitespace and specific characters:

```
$strippedFoo = $foo.rstrip()
$strippedBar = $bar.rstrip(asdf)
```

Args:
chars (str): A list of characters to remove. If not specified, whitespace is stripped.

Returns:
The stripped string. The return type is *str*.

size()

Return the length of the string.

Returns:
The size of the string. The return type is `int`.

slice(start, end=(null))

Get a substring slice of the string.

Examples:
Slice from index to 1 to 5:

```
$x="foobar"
$y=$x.slice(1,5)  // "ooba"
```

Slice from index 3 to the end of the string:

```
$y=$x.slice(3)  // "bar"
```

Args:
start (int): The starting character index.

end (int): The ending character index. If not specified, slice to the end of the string

Returns:
The slice substring. The return type is *str*.

split(text, maxsplit=(-1))

Split the string into multiple parts based on a separator.

Example:
Split a string on the colon character:

```
($foo, $bar) = $baz.split(":")
```

Args:
text (str): The text to split the string up with.

maxsplit (int): The max number of splits.

Returns:
A list of parts representing the split string. The return type is *list*.

startswith(text)

Check if a string starts with text.

Args:
text (str): The text to check.

Returns:
True if the text starts with the string, false otherwise. The return type is *boolean*.

strip(chars=(null))

Remove leading and trailing characters from a string.

Examples:
Removing whitespace and specific characters:

```
$strippedFoo = $foo.strip()
$strippedBar = $bar.strip(asdf)
```

Args:
chars (str): A list of characters to remove. If not specified, whitespace is stripped.

Returns:
The stripped string. The return type is *str*.

title()

Get a title cased copy of the string.

Examples:

Printing a title cased string:

```
$foo="Hello world."
$lib.print($foo.title())
```

Returns:

The title cased string. The return type is *str*.

upper()

Get a uppercased copy of the string.

Examples:

Printing a uppercased string:

```
$foo="Duck"
$lib.print($foo.upper())
```

Returns:

The uppercased string. The return type is *str*.

13.2.58 tabular:printer

A Storm object for printing tabular data using a defined configuration.

header()

Create a header row string.

Returns:

The header row string. The return type is *str*.

row(data)

Create a new row string from a data list.

Args:

data (list): The data to create the row from; length must match the number of configured columns.

Returns:

The row string. The return type is *str*.

13.2.59 telepath:proxy

Implements the Storm API for a Telepath proxy.

These can be created via `$lib.telepath.open()`. Storm Service objects are also Telepath proxy objects.

Methods called off of these objects are executed like regular Telepath RMI calls.

An example of calling a method which returns data:

```
$prox = $lib.telepath.open($url)
$result = $prox.doWork($data)
return ( $result )
```

An example of calling a method which is a generator:

```
$prox = $lib.telepath.open($url)
for $item in $prox.genrStuff($data) {
    $doStuff($item)
}
```

13.2.60 telepath:proxy:genrmethod

Implements the generator methods for the telepath:proxy.

An example of calling a method which is a generator:

```
$prox = $lib.telepath.open($url)
for $item in $prox.genrStuff($data) {
    $doStuff($item)
}
```

13.2.61 telepath:proxy:method

Implements the call methods for the telepath:proxy.

An example of calling a method which returns data:

```
$prox = $lib.telepath.open($url)
$result = $prox.doWork($data)
$doStuff($result)
```

13.2.62 text

A mutable text type for simple text construction.

add(text, **kwargs)

Add text to the Text object.

Args:

text (str): The text to add.

**kwargs (any): Keyword arguments used to format the text.

Returns:

The return type is `null`.

str()

Get the text content as a string.

Returns:

The current string of the text object. The return type is *str*.

13.2.63 trigger

Implements the Storm API for a Trigger.

iden

The Trigger iden.

Returns:
The type is *str*.

move(viewiden)

Modify the Trigger to run in a different View.

Args:
viewiden (str): The iden of the new View for the Trigger to run in.

Returns:
The return type is `null`.

pack()

Get the trigger definition.

Returns:
The definition. The return type is *dict*.

set(name, valu)

Set information in the Trigger.

Args:
name (str): Name of the key to set.

valu (prim): The data to set

Returns:
The return type is `null`.

13.2.64 user:profile:dict

A Storm Primitive that maps the HiveDict interface to a user profile dictionary.

get(name, default=(null))

Get a user profile value.

Args:
name (str): The name of the user profile value.

default (prim): The default value to return if not set.

Returns:
The requested value. The return type is `prim`.

list()

List the user profile vars and their values.

Returns:
A list of tuples containing var, value pairs. The return type is *list*.

pop(name, default=(null))

Remove a user profile value.

Args:
name (str): The name of the user profile value.

default (prim): The default value to return if not set.

Returns:
The requested value. The return type is `prim`.

set(name, valu)

Set a user profile value.

Args:
name (str): The name of the user profile value to set.

valu (prim): The value to store.

Returns:
Old value if it was previously set, or none. The return type may be one of the following: `null`, `prim`.

13.2.65 user:vars:dict

A Storm Primitive that maps the HiveDict interface to a user vars dictionary.

get(name, default=(null))

Get the value for a user var.

Args:
name (str): The name of the var.

default (prim): The default value to return if not set.

Returns:
The requested value. The return type is `prim`.

list()

List the vars and their values.

Returns:
A list of tuples containing var, value pairs. The return type is *list*.

pop(name, default=(null))

Remove a user var value.

Args:
name (str): The name of the var.

default (prim): The default value to return if not set.

Returns:
The requested value. The return type is `prim`.

set(name, valu)

Set a user var value.

Args:
name (str): The name of the var to set.

valu (prim): The value to store.

Returns:
Old value of the var if it was previously set, or none. The return type may be one of the following: `null`, `prim`.

13.2.66 vault

Implements the Storm API for a Vault.

Callers (instantiation) of this class must have already checked that the user has at least PERM_READ to the vault.

configs

The Vault configs data.

Returns:
The return type is *vault:data*. When this is used to set the value, it does not have a return type.

delete()

Delete the Vault.

Returns:
`(true)` if the vault was deleted, `(false)` otherwise. The return type is *boolean*.

iden

The Vault iden.

Returns:
The type is *str*.

name

The Vault name.

Returns:
The return type is *str*. When this is used to set the value, it does not have a return type.

owner

The Vault owner (user or role iden).

Returns:
The type is *str*.

permissions

The Vault permissions.

Returns:
The return type is *dict*.

scope

The Vault scope.

Returns:
The type is *str*.

secrets

The Vault secrets data.

Returns:
The return type is *vault:data*. When this is used to set the value, it does not have a return type.

setPerm(iden, level)

Set easy permissions on the Vault.

Args:
iden (str): The user or role to modify.

level (str): The easyperm level for the iden. `(null)` to remove an existing permission.

Returns:
`(true)` if the permission was set, `(false)` otherwise. The return type is *boolean*.

type

The Vault type.

Returns:
The type is *str*.

13.2.67 vault:data

Implements the Storm API for Vault data. This is used for both vault configs and vault secrets.

13.2.68 view

Implements the Storm api for a View instance.

addNode(form, valu, props=(null))

Transactionally add a single node and all it's properties. If any validation fails, no changes are made.

Args:
form (str): The form name.

valu (prim): The primary property value.

props (dict): An optional dictionary of props.

Returns:
The node if the view is the current view, otherwise null. The return type is *node*.

addNodeEdits(edits)

Add NodeEdits to the view.

Args:
edits (list): A list of nodeedits.

Returns:
The return type is `null`.

children()

Yield Views which are children of this View.

Yields:
Child Views. The return type is *view*.

delMergeRequest()

Remove the existing merge request.

Returns:
The deleted merge request. The return type is *dict*.

delMergeVote(useriden=(null))

Remove a previously created merge vote.

Notes:
The default use case removes a vote cast by the current user. Specifying the useriden parameter allows you to remove a vote cast by another user but requires global admin permissions.

Args:
useriden (str): Delete a merge vote by a different user.

Returns:
The vote record that was removed. The return type is *dict*.

detach()

Detach the view from its parent. WARNING: This cannot be reversed.

Returns:
The return type is `null`.

fork(name=(null))

Fork a View in the Cortex.

Args:
name (str): The name of the new view.

Returns:
The `view` object for the new View. The return type is *view*.

get(name, defv=(null))

Get a view configuration option.

Args:
name (str): Name of the value to get.

defv (prim): The default value returned if the name is not set in the View.

Returns:
The value requested or the default value. The return type is `prim`.

getEdgeVerbs()

Get the Edge verbs which exist in the View.

Yields:
Yields the edge verbs used by Layers which make up the View. The return type is *str*.

getEdges(verb=(null))

Get node information for Edges in the View.

Args:
verb (str): The name of the Edges verb to iterate over.

Yields:
Yields tuples containing the source iden, verb, and destination iden. The return type is *list*.

getFormCounts()

Get the formcounts for the View.

Example:
Get the formcounts for the current View:

```
$counts = $lib.view.get().getFormCounts()
```

Returns:
Dictionary containing form names and the count of the nodes in the View's Layers. The return type is *dict*.

getMergeRequest()

Return the existing merge request or null.

Returns:
The merge request. The return type is *dict*.

getMergeRequestSummary()

Return the merge request, votes, parent quorum definition, and current layer offset.

Returns:
The summary info. The return type is *dict*.

getMerges()

Yields previously successful merges into the view.

Yields:
Yields previously successful merges into the view. The return type is *dict*.

getMergingViews()

Get a list of idens of Views that have open merge requests to this View.

Idens:
The list of View idens that have an open merge request into this View. The return type is *list*.

getPropArrayCount(propname, valu=$lib.undef)

Get the number of individual array property values in the View for the given array property name.

Notes:

This is a fast approximate count calculated by summing the number of array property values in each layer of the view. Property values which are overwritten by different values in higher layers will still be included in the count.

Args:

propname (str): The property name to look up.

valu (any): The value in the array property to look up.

Returns:

The count of nodes. The return type is `int`.

getPropCount(propname, valu=$lib.undef)

Get the number of nodes in the View with a specific property and optional value.

Notes:

This is a fast approximate count calculated by summing the number of nodes with the property value in each layer of the view. Property values which are overwritten by different values in higher layers will still be included in the count.

Args:

propname (str): The property name to look up.

valu (any): The value of the property to look up.

Returns:

The count of nodes. The return type is `int`.

getPropValues(propname)

Yield unique property values in the view for the given form or property name.

Args:

propname (str): The property or form name to look up.

Yields:

Unique property values. The return type is `any`.

getTagPropCount(tag, propname, form=(null), valu=$lib.undef)

Get the number of nodes in the View with the given tag property and optional value.

Notes:

This is a fast approximate count calculated by summing the number of nodes with the tag property value in each layer of the view. Values which are overwritten by different values in higher layers will still be included in the count.

Args:

tag (str): The tag to look up.

propname (str): The property name to look up.

form (str): The optional form to look up.

valu (any): The value of the property to look up.

Returns:
The count of nodes. The return type is `int`.

iden

The iden of the View.

Returns:
The type is *str*.

insertParentFork(name=(null))

Insert a new View between a forked View and its parent.

Args:
name (str): The name of the new View.

Returns:
The `view` object for the new View. The return type is *view*.

layers

The `layer` objects associated with the `view`.

Returns:
The type is *list*.

merge(force=(false))

Merge a forked View back into its parent View.

Args:
force (boolean): Force the view to merge if possible.

Returns:
The return type is `null`.

pack()

Get the View definition.

Returns:
Dictionary containing the View definition. The return type is *dict*.

parent

The parent View. Will be `(null)` if the view is not a fork.

Returns:
The type is *str*.

repr()

Get a string representation of the View.

Returns:
A list of lines that can be printed, representing a View. The return type is *list*.

set(name, valu)

Set a view configuration option.

Current runtime updatable view options include:

name (str)
A terse name for the View.

desc (str)
A description of the View.

parent (str)
The parent View iden.

nomerge (bool)
Deprecated - use protected. Updates to this option will be redirected to the protected option (below) until this option is removed.

protected (bool)
Setting to `(true)` will prevent the layer from being merged or deleted.

layers (list(str))
Set the list of layer idens for a non-forked view. Layers are specified in precedence order with the first layer in the list being the write layer.

quorum (dict)
A dictionary of the quorum settings which require users to vote on merges. {

"count": <int>, "roles": [<roleid>, ...]

} Once quorum is enabled for a view, any forks must use the setMergeRequest() API to request that the child view is merged. The $view.addMergeVote() API is used for users to add their votes if they have been granted one of the roles listed. Once the number of approvals are met and there are no vetoes, a background process will kick off which merges the nodes and ultimately deletes the view and top layer.

To maintain consistency with the view.fork() semantics, setting the "parent" option on a view has a few limitations:

- The view must not already have a parent
- The view must not have more than 1 layer

Args:
name (str): The name of the value to set.

valu (prim): The value to set.

Returns:
The return type is `null`.

setMergeComment(comment)

Set the main comment/description of a merge request.

Args:
comment (str): The text comment to set for the merge request

Returns:
The updated merge request. The return type is *dict*.

setMergeRequest(comment=(null))

Setup a merge request for the view in the current state.

Args:
comment (str): A text comment to include in the merge request.

Returns:
The newly created merge request. The return type is *dict*.

setMergeVote(approved=(true), comment=(null))

Register a vote for or against the current merge request.

Args:
approved (boolean): Set to (true) to approve the merge or (false) to veto it.

comment (str): A comment attached to the vote.

Returns:
The vote record that was created. The return type is *dict*.

setMergeVoteComment(comment)

Set the comment associated with your vote on a merge request.

Args:
comment (str): The text comment to set for the merge vote

Returns:
The fully updated vote record. The return type is *dict*.

swapLayer()

Swaps the top layer for a fresh one and deletes the old layer.

Returns:
The return type is `null`.

triggers

The `trigger` objects associated with the `view`.

Returns:
The type is *list*.

wipeLayer()

Delete all nodes and nodedata from the write layer. Triggers will be run.

Returns:
The return type is `null`.

13.2.69 xml:element

A Storm object for dealing with elements in an XML tree.

attrs

The element attributes list.

Returns:
The type is *dict*.

find(name, nested=(true))

Find all nested elements with the specified tag name.

Args:
name (str): The name of the XML tag.

nested (bool): Set to `(false)` to only find direct children.

Returns:
A generator which yields xml:elements. The return type is `generator`.

get(name)

Get a single child element by XML tag name.

Args:
name (str): The name of the child XML element tag.

Returns:
The child XML element or `(null)`. The return type is *xml:element*.

name

The element tag name.

Returns:
The type is *str*.

text

The element text body.

Returns:
The type is *str*.

CHAPTER

FOURTEEN

SYNAPSE POWER-UPS

Power-Ups are part of The Vertex Project's commercial offering, Synapse Enterprise. Synapse Enterprise is an on-premises solution that includes Optic (the Synapse UI) and all of the Power-Ups. The license includes unlimited users and does not limit the amount of data or number of instances you deploy. We take a white-glove approach to each deployment where we're with you every step of the way from planning deployment sizes to helping to train your analysts.

Feel free to contact us or request a demo instance.

Power-Ups provide specific add-on capabilities to Synapse via Storm Packages and Services. For example, Power-Ups may provide connectivity to external databases, third-party data sources, or enable functionality such as the ability to manage YARA rules, scans, and matches.

For an introduction to Power-Ups from our analysts and seeing them in use, see the following video introducing them:

The Vertex Project is constantly releasing new Power-Ups and expanding features of existing Power-Ups. If you join the `#synapse-releases` channel in Synapse Slack, you can get realtime notices of these updates!

14.1 Rapid Power-Ups

Rapid Power-Ups are delivered to a Cortex as Storm packages directly, without requiring any additional containers to be deployed. This allows users to rapidly expand the power of their Synapse deployments without needing to engage with additional operations teams in their environments. For an introduction to Rapid Power-Ups and some information about publicly available Power-Ups, see the following blog post.

See the Rapid Power-Ups List for a complete list of all available Rapid Power-Ups.

14.1.1 Getting Started with Rapid Power-Ups

Vertex maintains a package repository which allows for loading public and private packages.

If you are a *Synapse User Interface* user, you can navigate to the **Power-Ups Tool** to register your Cortex and configure packages.

Alternatively, one can use the *storm* tool to get started with Rapid Power-Ups in their Cortex.

See our blog article for a step-by step guide to registering your Cortex to install the free `synapse-misp`, `synapse-mitre-attack`, and `synapse-tor` Power-Ups.

14.2 Advanced Power-Ups

Advanced Power-Ups are enhancements to a Cortex which require the deployment of additional containers in order to run their services.

Documentation for specific Advanced Power-Ups can be found here:

- Synapse Backup
- Synapse Fileparser
- Synapse Maxmind
- Synapse GCS
- Synapse Metrics
- Synapse Nettools
- Synapse NSRL
- Synapse Playwright
- Synapse S3
- Synapse Search
- Synapse Sidepocket
- Synapse Swarm
- Synapse Yara
- Synapse Axon Azure

CHAPTER

FIFTEEN

SYNAPSE USER INTERFACE

Optic (the Synapse UI) is part of The Vertex Project's commercial offering, Synapse Enterprise. Synapse Enterprise is an on-premises solution that includes Optic and all of the Power-Ups. The license includes unlimited users and does not limit the amount of data or number of instances you deploy. We take a white-glove approach to each deployment where we're with you every step of the way from planning deployment sizes to helping to train your analysts.

Feel free to contact us or request a demo instance.

For additional information see the Optic Documentation.

CHAPTER

SIXTEEN

SYNAPSE SUPPORT

Information for Vertex support.

16.1 Slack

Best effort chat based support is available through the Synapse Slack. You can find Vertex Project analysts, engineers, and other users who can help with questions you may have.

16.2 Service Desk

Commercial customers have access to the Vertex Support Service Desk. This is the ideal place for customers to submit issues, modeling questions, and feature requests.

CHAPTER

SEVENTEEN

SYNAPSE CHANGELOG

17.1 v2.215.0 - 2025-07-03

17.1.1 Model Changes

- Added `it:os:windows:service` to model Microsoft Windows Service configuration details. (#4380)
- See *v2.215.0 Model Updates* for more detailed model changes.

17.1.2 Bugfixes

- Fixed an issue where certain JsonStor edit operations could have delays before being committed to the slab. (#4383)
- Fixed an issue where removing a tag property from a tag could also remove other tag properties on that same tag. (#4384)
- Fixed an issue in the error handling when deleting a Cortex queue. (#4385)

17.2 v2.214.0 - 2025-07-02

17.2.1 Automatic Migrations

- Removed AuthGates for Queues which no longer exist in the Cortex. (#4370)
- See *Data Migration* for more information about automatic migrations.

17.2.2 Model Changes

- Added `inet:service:instance:app` to capture the app containing the instance. (#4365)
- Added `:app` to the `inet:service:object` interface to capture the app containing the object. (#4365)
- See *v2.214.0 Model Updates* for more detailed model changes.

17.2.3 Features and Enhancements

- Added CLI tools `synapse.tools.cortex.layer.dump` and `synapse.tools.cortex.layer.load` for exporting node edits from one layer

and importing them to a layer on a different Cortex.
(#4325)

- Added CLI tool `synapse.tools.pkgs.gendocs` for converting Storm package documentation from RST to Markdown. (#4331)

- Added CLI tools `synapse.tools.axon.dump` and `synapse.tools.axon.load` for exporting blobs from one Axon and importing them to another Axon. (#4333)
- Updated Cortex Storm pool behavior to prefer all remote pool members before the local leader. (#4336)
- Added CLI tool `synapse.tools.shutdown` to facilitate graceful shutdown of services by allowing them to complete current tasks. (#4336)
- Remove runtsafety requirement for `init`, `fini`, and `empty` blocks in Storm. (#4340)
- Added CLI tool `synapse.tools.demote` to allow automatic demotion of service leaders. (#4341)
- Improved console logging by dropping warning messages for optional properties which fail to normalize in a GUID based dictionary object. (#4360)
- Updated dictionary GUID syntax to allow nested use when adding or lifting nodes. (#4362)
- Added more utility APIs for working with the Drive class. (#4366)

17.2.4 Bugfixes

- Fixed incorrect output in the graph command when multiple global pivots were specified. (#4343)
- Improved error handling when connecting to local cells by raising `LinkErr` if the socket is not listening and `NoSuchPath` if the socket is missing. (#4345)
- Fixed SpooledSet Storm objects not cleaning up their slabs on runtime fini. (#4346)
- Lowered logging levels for telepath socket early close events. (#4353)
- Fixed Drive's incompatibility with the EasyPerms API. (#4366)
- Fixed an issue where deleting a Queue did not remove the Queue's AuthGate on mirrors. (#4370)

17.2.5 Notes

- Updated AHA provisioning to remove Certificate Signing Request files after they have been used. (#4368)
- Added `mesg` values to Telepath `NoSuchMeth` exceptions. (#4369)

17.3 v2.213.0 - 2025-06-10

17.3.1 Features and Enhancements

- Updated Storm `hex` type to allow setting/lifting with integers. (#4283)
- Updated the Docker image to support the latest Python 3.11.13 release. (#4284)
- Improved performance of boolean evaluation of container types such as lists and dictionaries in Storm. (#4322)
- Updated the scrape logic for `inet:url` to recognize URLs surrounded by smart quotes (`U+2018`, `U+2019`, `U+201C`, `U+201D`). (#4328)

17.3.2 Bugfixes

- Fixed bug in `synapse.lib.telepath.openurl` where a share name specified via the `name` keyword argument could be ignored if a share name was also specified in the URL. (#4323)

17.4 v2.212.0 - 2025-05-29

17.4.1 Model Changes

- Added forms for JA4/JA4S TLS fingerprints, samples, and handshakes. (#4319)
- See *v2.212.0 Model Updates* for more detailed model changes.

17.4.2 Features and Enhancements

- Embedded node values returned from Storm now include the node's form under the key `$form`, and the iden under the key `$iden`. (#4306)

17.4.3 Bugfixes

- Fixed a bug with `$lib.json.schema()` which would prevent passing a list to specify the valid types for an object property. (#4314)

17.5 v2.211.0 - 2025-05-23

17.5.1 Model Changes

- Removed the readonly attribute from the `ou:conference:event:conference` property. (#4301)
- See *v2.211.0 Model Updates* for more detailed model changes.

17.5.2 Features and Enhancements

- Updated `synapse.tools.genpkg` to include the Synapse version info used to build the Power-Up in the package definitions. (#4290)

17.5.3 Bugfixes

- Fixed an issue where applying a tag in a fork to a node which already had that tag with a value in a parent view would additionally store that tag value in the fork's write layer. (#4303)
- Fixed bug with embeds including types that extend from `ndef`. (#4307)

17.5.4 Improved documentation

- Fixed the documentation for `$node.data.list()` to specify that it returns (name, value) tuples, not just names. (#4297)

17.6 v2.210.0 - 2025-05-12

17.6.1 Model Changes

- Added `entity:relationship` to model relationships between entities. Special thanks to Cisco Talos for collaborating on this addition. (#4285)
- Added `inet:service:message:hashtags` to capture hashtags mentioned in a message. (#4268)
- Added the following properties to `ps:contact`: `:banner`, `:passwd`, `:website`, `:websites`. (#4269)
- Added `inet:service:channel:topic` to capture the topic of the channel. (#4271)

- Added `inet:service:message:mentions` to capture contactable entities mentioned within the message. (#4273)
- See *v2.210.0 Model Updates* for more detailed model changes.

17.6.2 Features and Enhancements

- Updated JSON library backend from `orjson` to `vtx-yyjson` which has large integer support. (#4251)

17.6.3 Bugfixes

- Fixed an issue where an AHA promotion would result in services following fixed mirror values, instead of dynamic mirror values. (#4246)

17.6.4 Improved documentation

- Updated documentation to clarify `view.del` only deletes the view and does not remove any layers. (#4261)

17.6.5 Deprecations

- Deprecated `$lib.notification`, `user.notify()`, and `user.tell()` Storm APIs. (#4267)

17.7 v2.209.0 - 2025-04-23

17.7.1 Features and Enhancements

- Added support for removing layer mirror and upstream configurations to the `layer.set` Storm command. (#4238)
- Updated view merge behavior to be less greedy with the IO loop, particularly in cases involving nodes with a large number of edges. (#4250)

17.8 v2.208.0 - 2025-04-17

17.8.1 Features and Enhancements

- Updated Cortex to run Storm package `onload()` handlers every time it starts up or upon promotion to being a leader. (#4237)
- Updated the allowed versions of the `pycryptodome`, `fastjsonschema`, `idna`, `pygments`, and `pytz` libraries. (#4230) (#4240)

17.8.2 Bugfixes

- Fixed a bug where `$lib.storm.run()` calls would cause a task to be improperly promoted. (#4186)
- Fixed an issue with `$lib.time.toUTC()` conversions by anchoring epoch to UTC instead of local timezone. (#4230)
- Fixed an issue with backtick format strings where certain combinations of escape characters preceding an expression could cause the substitution to fail. (#4234)

17.9 v2.207.0 - 2025-04-10

17.9.1 Features and Enhancements

- Added a `join()` method on the Storm `str` object. (#4227)

17.9.2 Bugfixes

- Fixed an issue with Storm `inet:http:resp` objects containing header values which could fail to save as JSON. (#4224)
- Fixed an issue where Axon `wget()` and `wput()` APIs could return header values which could fail to save as JSON. (#4235)

17.10 v2.206.0 - 2025-04-04

17.10.1 Model Changes

- Added `tel:mob:tadig` and `tel:mob:carrier:tadig` to track GSM carrier TADIG codes. (#4216)
- Added `it:network:dns:resolvers` to track DNS resolvers for a network. (#4216)
- Added a `has` light edge between `meta:ruleset` and the following forms: `inet:service:rule`, `it:app:snort:rule`, `it:app:yara:rule`. (#4218)
- See *v2.206.0 Model Updates* for more detailed model changes.

17.10.2 Features and Enhancements

- Updated the `aha.svc.mirror` command to print the individual service version alongside the Synapse version. (#4215)

17.10.3 Bugfixes

- Updated Synapse HTTP APIs to set a non-200 HTTP status code when errors are returned. (#4169)
- Fixed a bug in storage iteration which could cause an item to be yielded twice if a very narrow race window was encountered. (#4200)
- Added missing permission declarations for light edges and queues. (#4214)

17.10.4 Deprecations

- Deprecated the `modules` Cortex configuration option. (#4188)
- Deprecated support for multiple AHA network names being hosted by one AHA deployment. Synapse 3.0 AHA deployments will be simplified to hosting only one network. (#4221)

17.11 v2.205.0 - 2025-03-28

17.11.1 Model Changes

- Added a `uses` light edge between `it:prod:soft` and `risk:vuln` forms. (#4198)
- Added a `targets` light edge between `risk:compromise` and `ou:industry` forms. (#4198)
- See *v2.205.0 Model Updates* for more detailed model changes.

17.12 v2.204.1 - 2025-03-25

17.12.1 Bugfixes

- Fixed a regression in the Storm `parallel` command where variables containing certain heavy Storm object types were not passed into the parallel runtimes. (#4197)

17.13 v2.204.0 - 2025-03-21

17.13.1 Model Changes

- See *v2.204.0 Model Updates* for more detailed model changes.

17.13.2 Bugfixes

- Fixed an issue where locked users could still access HTTP endpoints with an existing session cookie. User lock status now invalidates existing sessions across all authenticated endpoints. (#4180)
- Fixed an issue in Storm where the `(` and `$` control characters were allowed in unquoted strings. (#4187)
- Fixed a regression where the Storm `not` operator was incorrectly whitespace sensitive. (#4187)
- Fixed an issue with URL sanitizing where incorrect data was being removed from the URL string. (#4190)
- Fixed an issue with the Storm `parallel` command where variables initialized within a parallel runtime were not properly isolated to that specific runtime. (#4194)

17.14 v2.203.0 - 2025-03-14

17.14.1 Model Changes

- Deprecated the `meta:seen` form. (#4170)
- Added `meta:feed` to track ingest progress from multi-feed sources. (#4172)
- See *v2.203.0 Model Updates* for more detailed model changes.

17.14.2 Features and Enhancements

- Added support to the OAuth2 providers to use `client_assertion` values to authenticate to OAuth2 endpoints. These can be used instead of providing a `client_secret` value if the OAuth2 provider supports `client_assertion` authentication. This update includes support for obtaining the assertion values via user defined Storm callbacks; as well as obtaining the assertions from Azure Managed Identity Workloads. (#4125)
- Updated the JSON library used by Synapse to `orjson` which is more strict to the JSON standards and shown to be more performant than the builtin Python `json` library. (#4129)
- Added a default name when inserting a parent fork to a view. The default name is now `inserted fork of {oldparent.name}` or `inserted fork of {oldparent.iden}` if the view doesn't have a name. (#4175)
- Updated URL pattern matching to validate schemes against IANA standards for the `scrape` command. (#4177)

17.14.3 Bugfixes

- Fixed an issue with some exceptions missing a `mesg` value. Thank you `colingrady` for the contribution. (#4179)
- Fixed an issue with the Storm `stats:tally` object not validating its API arguments. (#4181)

17.14.4 Notes

- Updated the `indent` keyword argument of `$lib.json.save()` to be a boolean instead of an integer. This API will now indent by two spaces if requested instead of an arbitrary number of spaces. (#4129)

17.14.5 Improved documentation

- Updated Storm library and type documentation to use `(true)`, `(false)` and `(null)` instead of `$lib.true`, `$lib.false`, and `$lib.null`. (#4173)
- Updated Kubernetes example documentation by renaming `aha` to ``aha00` to support future instances, simplifed the use of automatic DNS matching via `SYN_AHA_DNS_NAME`, and allow for independent Certificate Authority naming via `SYN_AHA_AHA_NETWORK`. (#4178)

17.15 v2.202.0 - 2025-03-04

17.15.1 Features and Enhancements

- Updated Storm query pool behavior to fallback to other mirrors first before running queries locally. (#4166)
- Updated Telepath proxy behavior to dynamically adjust the size of the link pool. (#4166)

17.15.2 Bugfixes

- Added word boundary checks in Storm for `null` and `not` to prevent matching these terms when they appear within other words. (#4162)
- Fixed an issue where Storm query pool timeouts would cancel other queries to that pool member. (#4166)
- Fixed an issue where streaming backups with `remove=True` could fail to remove the local backup. (#4166)

17.16 v2.201.0 - 2025-02-28

17.16.1 Model Changes

- See *v2.201.0 Model Updates* for more detailed model changes.

17.16.2 Features and Enhancements

- Updated cron job execution to emit container warnings when the cron job uses `$lib.warn()`. (#4152)
- Updated `synapse.tools.autodoc` to include the list of interfaces implemented by a type. (#4158)

17.16.3 Bugfixes

- Fixed an issue where the `risk:mitigation:type:taxonomy` form did not inherit the `meta:taxonomy` interface. (#4156)
- Fixed an issue where interface properties which were overridden by a form specific property were not liftable by the interface property. (#4161)
- Fixed a bug where the `lasterrs` in cron jobs could be a tuple, which caused issues appending new errors. (#4163)
- Fixed an issue where the Storm `batch` command failed to accept `storm:query` objects as query arguments. (#4164)

17.17 v2.200.0 - 2025-02-21

17.17.1 Features and Enhancements

- Updated the `lmdb` library constraints to `>=1.2.1,<1.7.0`. (#4145)
- Added Endpoints section with path and description to Storm command help output when defined. (#4149)

17.17.2 Bugfixes

- Fixed an issue where the guid dictionary syntax could raise an exception when attempting to filter by alternate property values. (#4147)
- Fixed bug where data model interface template values were modified by inheritors. (#4148)

17.17.3 Deprecations

- Removed `hiveauth.py` and related APIs which depended on it. (#4140)

17.18 v2.199.0 - 2025-02-18

17.18.1 Features and Enhancements

- Updated property set behavior to avoid warning when deprecated properties are set as subs. (#4143)
- Increased performance of the Storm `merge` command and `View.merge()` method. (#4144)

17.18.2 Bugfixes

- Fixed an issue with Snap construction in the Storm `merge` command. (#4144)

17.19 v2.198.0 - 2025-02-14

17.19.1 Automatic Migrations

- Added a migration to lock any service users which are marked as archived but are not locked. (#4100)
- See *Data Migration* for more information about automatic migrations.

17.19.2 Model Changes

- See *v2.198.0 Model Updates* for more detailed model changes.

17.19.3 Features and Enhancements

- Added brief I/O yields for various LMDB operations to help improve responsiveness when handling certain transactions. (#3937)
- Added edit syntax for adding/removing node edges using a variable value rather than a subquery. (#4117)
- Added new endpoints section in the package definition schema, allowing the configuration of multiple endpoints and details. (#4127)
- Added `++=`, `--=`, `?++=`, and `?--=` edit operators to Storm for adding or removing multiple values from an array property in a single operation. (#4130)
- Updated Storm lift behavior to allow lifting guid forms and properties using the property dictionary syntax. (#4132)

17.19.4 Bugfixes

- Fixed bug where archived users could be unlocked. (#4100)
- Fixed an issue in `$lib.regex` where Python regex exceptions were leaking into the Storm runtime. (#4118)
- Fixed bug with `syn:user` and `syn:role` nodes when queried name does not exist and the value is not a valid `guid`. (#4119)
- Fixed an issue where certain `BadSyntax` exceptions had incomplete error highlighting information. (#4120)
- Fixed an issue where leading/trailing whitespace and comments were not included in the string representation of embedded Storm query objects. (#4121)
- Fixed a bug where `syn:user` and `syn:role` types could take a `*` and return a new `guid`. (#4122)
- Fixed an issue where the Axon failed to yield when calling the `history()` or `get()` APIs. (#4131)

17.19.5 Deprecations

- Deprecated `synapse/lib/hiveauth.py` and added deprecation messages to related APIs. This file and related APIs will be removed in `v2.199.0`. (#4100) (#4141)

17.20 v2.197.0 - 2025-02-05

17.20.1 Model Changes

- Added `doc:resume` and `doc:requirement` to the data model. (#4104)
- See *v2.197.0 Model Updates* for more detailed model changes.

17.20.2 Features and Enhancements

- Increased the performance of executing Storm commands which have type annotations. (#4111)
- Move Storm Package JSON schema to `synapse.lib.schemas`. (#4112)
- Added `index.count.prop` command to make it easier to count properties stored in the view and layers. (#4113)

17.21 v2.196.0 - 2025-01-31

17.21.1 Automatic Migrations

- Generated `entity:name` nodes for existing `transport:sea:vessel:name` properties. (#4096)
- See *Data Migration* for more information about automatic migrations.

17.21.2 Model Changes

- See *v2.196.0 Model Updates* for more detailed model changes.

17.21.3 Features and Enhancements

- Added new AHA APIs that may be used to dispatch functions on service clusters. (#3795)
- Added new `getTasks()` API which can include gathering tasks from peers via AHA. (#3795)
- Added a new `aha.svc.mirror` Storm command to query the status of the mirror clusters managed by the AHA server. (#4019)

- Added a new command-line tool `synapse.tools.aha.mirror` for querying the status of service mirror clusters managed by the AHA server. (#4019)
- Added `$lib.axon.read()` and `$lib.axon.unpack()` Storm APIs. (#4097)
- Added `liftByNodeData()` API to the Storm `layer` type to allow lifting by node data in a given layer. (#4099)

17.21.4 Bugfixes

- Fixed issue where sub-properties were being assigned when the sub-property was deprecated and locked. (#4098)
- Fixed an issue where `JsonStor.delPathObjProp()` could raise a KeyError. (#4101)

17.22 v2.195.1 - 2025-01-28

17.22.1 Bugfixes

- Fixed an issue with unbound text values being included in some `StormRuntimeError` exceptions raised when interacting with Storm APIs. (#4092)
- Fixed an issue where pending Nexus edits to an object which was in the process of being deleted could potentially still be distributed to mirrors. (#4094)

17.23 v2.195.0 - 2025-01-24

17.23.1 Automatic Migrations

- Renormalized the `:model` property on `transport:air:craft` and `transport:sea:vessel` to normalize whitespace. (#4090)
- See *Data Migration* for more information about automatic migrations.

17.23.2 Model Changes

- Added `names` property to the `ou:id:type` form and `alts` definition to the `ou:id:type:name` property. (#4081)
- See *v2.195.0 Model Updates* for more detailed model changes.

17.23.3 Features and Enhancements

- Added `$lib.cell.iden` to retrieve the iden of the Cortex which the Storm query is executing on. Unlike `$lib.cell.getCellInfo().cell.iden`, this value is available to non-admin users. (#4082)
- Added `--find` option to `auth.perms.list` to easily filter permission results. (#4083) (#4087)

17.23.4 Bugfixes

- Fixed an issue where the deprecated types `edge` and `timeedge` were not annotated as such by the `getModelDict()` API. (#4079)
- Fixed an issue where certain User and Role properties could be modified via Storm and adversely affect the in-memory representation of those objects. (#4084)
- Fixed an issue where exceptionally large telepath messages may cause OpenSSL malloc failures. (#4088)
- Added limits for scraping file paths. The number of components in a path must not exceed `1,024`. Linux and Windows paths must not exceed `4,096` and `32,767` characters, respectively. (#4089)

17.23.5 Deprecations

- The `forms` key in Storm package command definitions has been deprecated. The `cmdinputs` key may still be used to specify node forms that commands are intended to accept as input. (#4076)
- Deprecated `$lib.infosec.cvss.calculate()` and `$lib.infosec.cvss.calculateFromProps()`. (#4079)

17.24 v2.194.0 - 2025-01-16

17.24.1 Model Changes

- Added `alts` definitions to the following forms: `geo:place`, `it:prod:soft`, `it:prod:softver`, `ou:campaign`, `ou:conference`, `ou:goal`, `ou:industry`, `pol:country`, `ps:contact`, `ps:person`, `risk:threat`, `risk:tool:software`, and `risk:vuln`. (#4064)
- See *v2.194.0 Model Updates* for more detailed model changes.

17.24.2 Features and Enhancements

- Added syntax for conditional node property edit operators in Storm. (#4046)
- Updated the `pkg.load` Storm command to include an `X-Synapse-Version` HTTP header in requests. (#4074)

17.24.3 Bugfixes

- Fixed an issue with the Storm loop and generator keywords, `continue`, `break`, and `stop`. Using these keywords outside of a loop or generator function will now raise a `StormRuntimeError` exception. Using these keywords to tear down the Storm runtime will now emit an `err` message with the type `StormRuntimeError` and a message indicating the invalid use of the keywords. The use of these keywords or `$lib.exit()` in `$lib.cache.fixed` callbacks will now raise a `StormRuntimeError`. (#4025) (#4073)
- Fixed a Cortex cron scheduler loop error during a mirror promotion. (#4058)
- Fixed bug in password complexity rules where setting a password to (null) or None would fail. (#4059)
- Fixed an issue in Storm where attempting to iterate a non-iterable object would raise a Python exception rather than a `StormRuntimeError`. (#4066)
- Fixed an issue in Storm functions where using the return keyword in a subquery used as a value could incorrectly change the function type. (#4066)
- Fixed an issue where invalid dictionary constructor values would result in unhandled Python `AttributeError` exceptions leaking into the Storm runtime. (#4068)
- Fixed an issue where the dictionary based guid constructor could raise unclear Python `IndexError` exceptions. It now raises `BadTypeValu` exceptions detailing the problem. (#4068)

17.24.4 Deprecations

- The Storm function `$lib.list()` has been deprecated, in favor of using the `()` or `([])` style syntax for directly declaring a list in Storm. (#4071)
- Deprecated `$lib.text()`. Please use a list to append strings to, and then use `$lib.str.join()` to join them on demand. (#4072)

17.25 v2.193.0 - 2025-01-06

17.25.1 Model Changes

- Updated the `infotech`, `inet`, and `risk` models. (#4047)
- See *v2.193.0 Model Updates* for more detailed model changes.

17.25.2 Features and Enhancements

- Updated the Storm `parallel` command behavior to avoid creating empty pipelines when there are fewer inbound nodes than the number of pipelines specified by the `--size` argument. (#4041)
- Refactored backup streaming logic and error handling. (#4042)
- Added `indent` kwarg to `$lib.json.save()` to indent serialized json with a number of spaces. (#4052)

17.25.3 Bugfixes

- Relaxed `inet:web:hashtag` regex. (#4033)
- Fixed an issue where certain exceptions raised while calling a function in Storm were not providing appropriate details about the origin of the exception. (#4038)
- Added a patch for Python `http.cookies` module to address CVE-2024-7592 exposure. (#4045)
- Fixed SIGINT handling in the `synapse.tools.storm` CLI tool. (#4048)

17.26 v2.192.0 - 2024-12-13

17.26.1 Features and Enhancements

- Added the user-agent string to the structured log information captured by the HTTP API handlers. (#4026)
- Added support for passing `$lib.true` to Storm HTTP APIs that accept a proxy argument to indicate that the configured proxy should be used if set. (#4030)
- Added support for passing `True` as a proxy argument to the `wget`, `wput`, and `postfiles` Axon APIs to indicate that the configured proxy should be used if set. (#4030)
- Added `synapse.tools.apikey` tool for managing user API keys via telepath. (#4032)

17.26.2 Bugfixes

- Fixed an issue where mirrors of Synapse services may fail to indicate that they have entered into realtime change windows. (#4028)
- Fixed a bug that skipped global and form pivots when validating graph projection Storm queries. (#4031)
- Fixed an issue where line number information was not added to exceptions raised while dereferencing a Storm variable. (#4035)

17.26.3 Deprecations

- Deprecated passing `None` as a proxy argument to the `wget`, `wput`, and `postfiles` Axon APIs. (#4030)
- Deprecated passing `$lib.null` to Storm HTTP APIs that accept a proxy argument. (#4030)

17.27 v2.191.0 - 2024-12-06

17.27.1 Model Changes

- Added `econ:pay:instrument` interface and type to create an abstraction for payment instruments. (#3995)
- Added `inet:service:tenant`, `inet:service:subscriber`, and `inet:service:subscription` to model service tenants, subscribers, and subscriptions. (#3995)
- See *v2.191.0 Model Updates* for more detailed model changes.

17.27.2 Features and Enhancements

- Updated the allowed versions of the `msgpack` and `pycryptodome` libraries. Updated the pinned version of the `lark` library to `1.2.2`. (#4011)
- Added `$lib.model.migration.s.inetServiceMessageClientAddress()` migration helper to migrate deprecated `inet:service:message:client:address` properties. (#4022)

17.27.3 Bugfixes

- Fixed a bug which causes an error when the contents change while lifting runtime nodes such as syn:cron et. al. (#4018)

17.27.4 Deprecations

- Deprecated `inet:web:acct` secondary properties. (#4001)
- Deprecated `inet:service:message:client:address`. (#4022)

17.28 v2.190.0 - 2024-11-29

17.28.1 Features and Enhancements

- Updated Storm pool query logging to not log the query being executed and added additional context in the structured log data. (#4008)
- Updated Storm list `.pop()` method to accept an optional index to pop from instead of always popping the last entry. (#4013)
- Restricted the upper version of the `pyopenssl` dependency to `<24.3.0`. (#4015)

17.28.2 Bugfixes

- Fix an issue in Storm HTTP request libraries where HTTP request parameter dictionaries with a list of values for a key name were stringified rather than sent as multiple values for the same key. (#3990)

17.29 v2.189.0 - 2024-11-21

17.29.1 Model Changes

- Added `:technique` to the `risk:vulnerable` form to represent a node being susceptible to a technique. (#4006)
- See *v2.189.0 Model Updates* for more detailed model changes.

17.29.2 Features and Enhancements

- Updated the `pkg.list` command to use a tabular printer and added a `--verbose` option to view build time. (#4007)

17.30 v2.188.1 - 2024-11-13

17.30.1 Bugfixes

- Fix an issue in the type schema enforcement of a Cell's Drive where a list of types for a field would cause schema checking to always fail after a Cell reboot. (#4002)

17.31 v2.188.0 - 2024-11-08

17.31.1 Model Changes

- Added `meta:aggregate` to represent aggregate counts. (#3968)
- Added `risk:outage` to represent outage events. (#3968)
- Added `:reporter` and `:reporter:name` to the `ou:industry` form to allow reporter specific industries. (#3968)
- Added `file:attachment` to unify file attachment types. (#3969)
- Added `ou:candidate` to track job applications and candidates. (#3969)
- Added `:src:txfiles` and `:dst:txfiles` to `inet:flow` to capture transferred files. (#3969)
- Added `inet:service:emote` to track account emotes. (#3988)
- Added `inet:service:relationship` to track service object relationships. (#3988)
- Add a `uses` light edge between `ou:technique` and `risk:vuln` forms. (#3994)
- See *v2.188.0 Model Updates* for more detailed model changes.

17.31.2 Features and Enhancements

- Add support for *ndef* types in embed property definitions. (#3979)
- Add `children()` method on Storm `view` objects. (#3984)
- Update the `cron.list` command to use a tabular printer for table generation. (#3986)
- Add `$lib.model.ext.addType()` and `$lib.model.ext.delType()` Storm APIs for managing extended model types. (#3989)
- Allow optionally specifying typeopts to the `Cortex.getPropNorm` and `Cortex.getTypeNorm` APIs. (#3992)
- Update async scrape APIs to use the forked process pool rather than spawned processes. (#3993)

17.31.3 Bugfixes

- Fixed an issue where creating a cron job with a stable iden could overlap with existing authgates. (#3981)
- Fixed an issue where Nexus events from updated mirrors pushed to a leader on an older version which did not yet support those events were not handled correctly. (#3985)
- Fix an issue where extended model types could be deleted while still in use by other extended model types. (#3989)

- Fix an issue where the Storm `background` and `parallel` commands could incorrectly throw NoSuchVar exceptions when validating query arguments. (#3991)

17.32 v2.187.1 - 2025-04-14

17.32.1 Bugfixes

- Fixed a bug in storage iteration which could cause an item to be yielded twice if a very narrow race window was encountered. (#4207) (#4226)

17.33 v2.187.0 - 2024-11-01

17.33.1 Automatic Migrations

- WARNING - It is strongly advised to perform a backup before upgrading to or above this version. The `it:sec:cpe` migration described below WILL remove invalid `it:sec:cpe` and some associated nodes from the Cortex.

  Migrate invalid `it:sec:cpe` nodes if possible. Migration of these nodes will only be successful if one of the CPE 2.3 (primary property) or the CPE 2.2 (`:v2_2`) strings are valid CPEs. If both CPE strings are invalid, the node will be removed from the Cortex and stored in a Cortex queue (`model_0_2_31:nodes`).

  The structure of items in this queue is opaque. The intent is for Power-Ups to be able to process the queue in an attempt to fix the invalid nodes on a per Power-Up basis (the idea being that Power-Up data vendors probably make the same mistake consistently).

  During migration or removal of invalid `it:sec:cpe` nodes, referencing nodes with readonly properties will be removed and also stored in the queue. We are unable to automatically migrate these nodes due to the dynamic nature of their construction. (#3918)

- See *Data Migration* for more information about automatic migrations.

17.33.2 Model Changes

- Update the parsing of CPE 2.2 and CPE 2.3 strings to be strict according to the CPE specification (NISTIR 7695). (#3918)
- See *v2.187.0 Model Updates* for more detailed model changes.

17.33.3 Features and Enhancements

- Update storm `queue.put()` and `queue.puts()` methods to return the offset of the queued item. (#3918)
- Add CPE migration helper functions. The following functions were added to assist with invalid nodes that were queued as part of the CPE model migration: `$lib.model.migration.s.model_0_2_31.listNodes()`, `$lib.model.migration.s.model_0_2_31.printNode()`, and `$lib.model.migration.s.model_0_2_31.repairNode()` (#3918)
- Added a `getNodeData()` API to the Storm Layer object for yielding node data by node iden. (#3918)

17.34 v2.186.0 - 2024-10-29

17.34.1 Model Changes

- Added `risk:tool:software:id` to model an ID for a tool. (#3970)
- See *v2.186.0 Model Updates* for more detailed model changes.

17.34.2 Features and Enhancements

- Update tag type normalization to verify the tag is valid for any configured tag model specifications in the Cortex. Tags which fail validation will now raise a `BadTypeValu` exception rather than a `BadTag` exception. (#3973)
- Implemented `synapse.tools.snapshot` CLI tool which can be used to pause edits and sync dirty buffers to disk to safely generate a volume snaphot. (#3977)

17.34.3 Bugfixes

- Fixed several CLI commands usage output formatting. (#3977)

17.35 v2.185.0 - 2024-10-25

17.35.1 Model Changes

- Added `proj:task` interface to ensure consistent properties on task-like forms. (#3962)
- Added `doc:document` interface to ensure consistent properties on document forms. (#3962)
- Added `ou:enacted` to track an organization enacting policies and standards. (#3962)
- Added `doc:policy` and `doc:standard` forms to model policies and standards. (#3962)
- See *v2.185.0 Model Updates* for more detailed model changes.

17.35.2 Features and Enhancements

- Added support for `syn:user` and `syn:role` types to be converted to/from names. (#3959)
- Added `$lib.repr()` to convert a system mode value to a display mode string. (#3959)
- Added support for templates in interface doc strings. (#3962)
- Added `storm.lib.stix.export.maxsize` permission to allow STIX export configurations to set maxsize > 10,000. (#3963)
- Added syntax for lifting nodes by embedded property values. (#3964)
- Add the `mirror` URL to the output of the `getCellInfo()` APIs to indicate which service is being followed for change events. This URL has password information sanitized from it. (#3966)
- Improve text alignment with multiline command argument help descriptions. (#3967)
- Update Storm grammar to allow embed queries in JSON expressions. (#3972)

17.35.3 Bugfixes

- Fixed issue where interfaces took precedence over properties declared on a form. (#3962)
- Fixed incorrect coercion behavior in `$lib.dict.pop()` and docs for `$lib.dict.has()`. (#3965)
- Update `synapse.tools.promote` to prevent a graceful promotion of a service where a detectable leadership schism would occur. (#3966)
- Fixed an issue where list variables could be passed into the `background` command or Storm Dmons in such a way that they could not be modified. (#3971) (#3976)

17.36 v2.184.0 - 2024-10-18

17.36.1 Model Changes

- Added `ou:requirement:type` taxonomy property to track requirement types. (#3954)
- Added `it:app:snort:hit:dropped` property to track when hits result in the traffic being dropped. (#3954)
- Added `ou:vitals:budget` property to track budget allocations. (#3954)
- Added `risk:mitigation:type` as a `taxonomy` to track mitigation types. (#3957)
- Added `ou:asset` form and associated properties to model organizational asset tracking. (#3957)
- See *v2.184.0 Model Updates* for more detailed model changes.

17.36.2 Features and Enhancements

- Add `$lib.graph.revoke()` API for revoking user/role permissions on a graph projection. (#3950)
- Mark all functions in a deprecated Storm library as deprecated. (#3952)

17.36.3 Bugfixes

- Fix a Storm bug where a runtsafe list unpacking operation which was executed per-node would be executed one additional time after all nodes had finished moving through the pipeline. (#3949)
- Fix an issue where the default permission level specified when adding a graph projection was overwritten. (#3950)
- Fixed an issue where extended model forms which implemented interfaces could not be removed due to inherited props. (#3958)

17.36.4 Deprecations

- Deprecate `$lib.inet.whois.guid`. (#3951)

17.37 v2.183.0 - 2024-10-09

17.37.1 Model Changes

- Fix an issue where the `:path:base`, `:path:dir`, and `:path:ext` secondary properties were marked readonly on the `it:fs:file`, `it:exec:file:add`, `it:exec:file:del`, `it:exec:file:read`, and `it:exec:file:write` forms. (#3942)
- See *v2.183.0 Model Updates* for more detailed model changes.

17.37.2 Features and Enhancements

- Expose Stormlib deprecation status from the Python API. (#3929)
- Add `$lib.random.generator()` to get a random number generator in Storm. (#3945)

17.37.3 Bugfixes

- Tag add operations with the try syntax (`+?#`) now catch BadTag exceptions raised by tags which are not valid for a defined tag model. (#3941)
- Added `task.get` and `task.del` permissions declarations so they get included in the output of the `auth.perms.list` command. (#3944)

17.37.4 Improved documentation

- Clarify parts of the Storm automation guide. (#3938)
- Clarify Storm type specific documentation for `guid` types. (#3939)

17.38 v2.182.0 - 2024-09-27

17.38.1 Features and Enhancements

- Update the allowed version of the `packaging` and `xxhash` libraries. (#3931)
- Allow a user to specify a role iden when creating a role with the `$lib.auth.role.add()` Storm API. (#3932)

17.38.2 Bugfixes

- Fix an issue in the `merge` command where errors in establishing the node in the parent view could result in an exception. These errors are now surfaced as warnings in the runtime, and the node will be skipped. (#3925)
- Fix an issue where the Cell would log that the free space write hold was removed irrespective of the write hold reason. (#3934)

17.39 v2.181.0 - 2024-09-25

17.39.1 Automatic Migrations

- Update `inet:ipv4` and `inet:ipv6` sub properties for values affected by IANA Special Purpose Registry updates. (#3902)
- A small migration to populate `ou:industry:type:taxonomy` nodes from existing `ou:industry:type` values. (#3912)
- See *Data Migration* for more information about automatic migrations.

17.39.2 Model Changes

- The `inet:rfc2822:addr` type now rejects malformed inputs which could cause incorrect email addresses to be recorded. (#3902)
- The `inet:ipv4:type` and `inet:ipv6:type` secondary properties now reflect updated behaviors from the IANA Special Purposes registries. (#3902)
- Added `math:algorithm` form to model algorithms and link to generated output. (#3906)
- Added `:mitigated=<bool>` and `:mitigations=[<risk:mitigation>]` properties to the `risk:vulnerable` form to track mitigations used to address vulnerable nodes. (#3910) (#3911)
- Added `ou:org:motto` and `ou:campaign:slogan` properties and the `lang:phrase` form. (#3915)
- See *v2.181.0 Model Updates* for more detailed model changes.

17.39.3 Features and Enhancements

- Storm lists now have a `remove` method that can be used to remove a single item from the list without having to iterate through the list. (#3815)
- Added `opts` field to `model:type` Storm type. This field contains the property type options as defined in the data model. (#3815)

- Updated Storm coverage tracker to support `pragma: no cover` for ignoring single lines of code and `pragma: no cover start/pragma: no cover stop` for ignoring multi-line blocks of Storm code. (#3815)
- Make the `Slab.putmulti()` API an async function. (#3896)
- Expose the response URL on the Storm `http:resp` object. (#3898)
- Expose the HTTP request headers on the Storm `http:resp` object. (#3899)
- Add request history on the Storm `inet:http:resp` object. (#3900)
- Add a `getPropValues()` API to Storm View and Layer objects for yielding distinct values of a property. (#3903)
- Update Storm language to add support for matching multiple switch case values to a single Storm query. (#3904)
- Provide additional handling for Storm pool members who are online but unresponsive to new Telepath calls. (#3914)
- Add the ability to provide an iden when creating a new HTTP Extended API. (#3920)
- Added initial dictionary validator and deconfliction for guid based node constructor logic to Storm. (#3917)

17.39.4 Bugfixes

- Fix an issue where user defined Storm functions could be greedy with the IO loop. (#3894)
- Fixed bug where nodedata may not be properly removed when it's in a view/layer above the actual node. (#3923)

17.39.5 Improved documentation

- Added documentation about `tls:ca:dir` configuration option for specifying custom TLS CA certificates. (#3895)
- Added an example of using `scrape` on the primary property to the command usage statement. (#3907)

17.39.6 Deprecations

- Remove deprecated `synapse.lib.jupyter` module. (#3897)

17.40 v2.180.1 - 2024-09-04

17.40.1 Features and Enhancements

- Update the `cryptography` library to require its latest version. (#3890)

17.40.2 Improved documentation

- Fixed a typo in the `trigger.enable` docs which mistakenly referred to the `trigger-enable` command. (#3889)

17.41 v2.180.0 - 2024-08-30

17.41.1 Automatic Migrations

- A small migration to normalize `it:dev:repo:commit:id` to remove leading and trailing whitespace. (#3884)
- See *Data Migration* for more information about automatic migrations.

17.41.2 Model Changes

- Added `pol:candidate:id` to track election authority issued candidate IDs. (#3878)
- Updated `it:dev:repo` elements to inherit `inet:service:object`. (#3879)
- Add `inet:service:account` properties to forms with `inet:web:acct` properties. (#3880)
- See *v2.180.0 Model Updates* for more detailed model changes.

17.41.3 Features and Enhancements

- Include detailed link traversal information from the Storm runtime when the `link` option is set. (#3862)
- Add support for disabling readahead on layer slabs by setting the `SYNDEV_CORTEX_LAYER_READAHEAD` environment variable. (#3877)

17.41.4 Improved documentation

- Add Devops task for using `onboot:optimize` to optimize LMDB databases in services. (#3876)
- Clarify documentation on taxonomy types. (#3883)

17.42 v2.179.0 - 2024-08-23

17.42.1 Model Changes

- Update `pe:langid` to include all language IDs and tags from MS-LCID. (#3851)
- Add additional fields to `it:sec:stix:indicator`. (#3858)
- Add `geo:telem:node` property to more directly track where a node has been. (#3864)
- Add DNS reply code enumeration values to `inet:dns:request:reply:code`. (#3868)
- See *v2.179.0 Model Updates* for more detailed model changes.

17.42.2 Features and Enhancements

- Add support for a `ca_cert` key to `$ssl_opts` on Storm APIs. This can be used to provide a CA chain for a specific HTTP API call. (#3849)
- Optimize pivot behavior in Storm to avoid unnecessarily re-normalizing values. (#3853)
- Added `force` option to extended property delete APIs to automatically remove data. (#3863)

17.42.3 Bugfixes

- Fix a bug where trigger name and doc updates set via `syn:trigger` nodes did not persist. (#3848)
- Fix an issue that prevented removing permissions from vaults. (#3865)
- Fix an issue that prevented the old name reference from being removed when a vault is renamed. (#3865)
- When generating the AHA provisioning URL, the AHA service now binds to 0.0.0.0 instead of the `dns:name` configuration value. (#3866)
- Catch additional Python exceptions which could be raised by malformed input to `$lib.stix.import.ingest()` and raise `BadArg` instead. (#3867)
- Catch Python `TypeError` exceptions in `$lib.math.number()` and raise `BadCast` exceptions. (#3871)

17.42.4 Deprecations

- Deprecate the `$tag` variable in triggers in favor of `$auto.opts.tag` (#3854)

17.43 v2.178.0 - 2024-08-09

17.43.1 Features and Enhancements

- Setting the `aha:network` value on the AHA service, as demonstrated in the deployment guide, is now mandatory. (#3783)
- Added `synapse.tools.aha.clone` command to make it easy to bootstrap AHA mirrors. (#3783)
- Added support for dynamically registered AHA mirrors. (#3783)
- Updated service base class to retrieve updated AHA servers on startup. (#3783)
- Update `$lib.inet.imap` and `$lib.inet.smtp` APIs to use certificates present in the Cortex `tls:ca:dir` directory. Add `ssl_verify` options to the `$lib.inet.imap.connect()` and `inet:smtp:message.send()` APIs to disable TLS verification. (#3842)
- Update the `aioimaplib` library constraints to `>=1.1.0,<1.2.0`. (#3842)
- Log the path of the LMDB file that was backed up in `synapse.tools.backup.backup_lmdb`. (#3843)

17.43.2 Bugfixes

- Remove a potential race condition in onfini handler registration. (#3840)
- Cause service startup to fail with a clear error message when attempting to bootstrap a service with a `mirror` configuration and the `aha:provision` configuration option is missing, or the service storage has been manipulated into a invalid state. (#3844)

17.43.3 Improved documentation

- Update deployment guide to include optional steps to deploy AHA mirrors. (#3783)
- Update deployment guide to clarify `aha:network` selection vs `dns:name` selection. (#3783)
- Move data model update information for the `v2.133.0` release and above from the changelog and into their own section of the User Guide. (#3839)
- Update Synapse tool examples to use `aha://` URLs. (#3839)

17.43.4 Deprecations

- Deprecate the `Cell.conf.reqConfValu()` API. This has been replaced with `Cell.conf.req()`. (#3783)

17.44 v2.177.0 - 2024-08-01

17.44.1 Automatic Migrations

- Migrate Axon metrics from hive to hotcounts. Migrate Cryotank names storage from hive to SafeKeyVal storage. Migrate Cortex configuration data from hive to SafeKeyVal storage. Migrate Cell info and auth configuration from hive to SafeKeyVal storage. (#3698) (#3825)
- See *Data Migration* for more information about automatic migrations.

17.44.2 Model Changes

- Add model elements to represent the DriveSerialNumber and MachineID properties of an LNK file. (#3817)
- Add `biz:deal:id` property to track deal identifiers. (#3832)
- Add `inet:service:message:type` property to capture message types. (#3832)
- Added `meta:rule:type` taxonomy. (#3834)
- See *v2.177.0 Model Updates* for more detailed model changes.

17.44.3 Features and Enhancements

- Add a new Cell configuration option, `auth:password:policy`. This can be used to configure password policy options for authentication. (#3698)
- Add `$lib.gen.cryptoX509CertBySha256()` helper function to create `crypto:x509:cert` nodes from a SHA256. (#3801)
- Add `$lib.gen.fileBytesBySha256()` helper function to create `file:bytes` nodes from a SHA256. (#3801)
- Add `$lib.model.migration.s.inetSslCertToTlsServercert()` migration helper to migrate `inet:ssl:cert` nodes to `inet:tls:servercert` nodes. (#3801)
- Add `$lib.gen.inetTlsServerCertByServerAndSha256()` helper function to create `inet:tls:servercert` nodes from a server (or URI) and SHA256. (#3801)
- Added Storm library for creating printable tables: `$lib.tabular`. (#3818)
- Add `$lib.model.ext.addEdge()` and `$lib.model.ext.delEdge()` APIs for managing extended model edge definitions. (#3824)
- Added `--wipe` option to the `merge` command which replaces the top layer of the view once the merge is complete. Using `--wipe` makes incremental merges more performant. (#3828)
- Updated `view.merge` command to use `$view.swapLayer()` for improved performance. (#3828)
- Added `$view.swapLayer()` API to allow users to start fresh with an existing view. (#3828)
- Update the `aiohttp` library constraints to `>=3.10.0,<4.0`. Update the `aiohttp-socks` library constraints to `>=0.10.0,<0.11.0`. (#3830)
- Tightened up `aha.svc.list` Storm command output when using `--nexus`. (#3835)

17.44.4 Bugfixes

- Prevent the root user for a Synapse service from being locked, archived, or having its admin status removed. (#3698)
- Catch Python `TypeError` exceptions that could be raised by `$lib.base64.decode()` and now raise `StormRuntimeError` detailing the problem. (#3827)
- Fix `Bad file descriptor` errors that could happen during link teardown. (#3831)

17.45 v2.176.0 - 2024-07-18

17.45.1 Model Changes

- Updates to the `inet` model. (#3811) (#3814)
- See *v2.176.0 Model Updates* for more detailed model changes.

17.45.2 Features and Enhancements

- Add `storm.exec` command for executing arbitrary text as Storm. (#3807) (#3812)
- Ensure the `synapse.storm` structured log messages contain the view iden. (#3812)
- Added `$lib.storm.run()` to programmatically invoke Storm. (#3813)
- Remove the per-node pivot errors from the Cortex log output. (#3819)

17.46 v2.175.0 - 2024-07-15

17.46.1 Automatic Migrations

- Migrate existing ndef secondary properties to use the new ndef property indexing. (#3794) (#3809)
- See *Data Migration* for more information about automatic migrations.

17.46.2 Features and Enhancements

- Update Cell with `_getCellHttpOpts()` method to allow for overriding default HTTP options. (#3770)
- Add additional indexing for ndef based secondary properties. (#3794) (#3809)
- Implement `--prs-from-git` in `synapse.tools.changelog`. (#3800)
- Update the `getCellInfo()` API to include HTTPS listener addresses and ports. (#3802)
- Improve permissions checking performance in the Storm `merge` command. (#3804)
- Support multiple tags in the diff command, which also allows for more efficient deduplication (e.g. `diff --tag foo bar` versus `diff --tag foo | diff --tag bar | uniq`). (#3806)
- Add information about the remote link when logging common server side Telepath errors. (#3808)

17.46.3 Bugfixes

- Fix an AttributeError in `synapse.tools.changelog`. (#3798)
- Fix for large array props causing system lag. (#3799)

17.46.4 Improved documentation

- Remaining docs have been converted from Jupyter notebook format to RST. (#3803)

17.46.5 Deprecations

- Deprecate the use of the `synapse.lib.jupyter` library. This will be removed on 2024-08-26. (#3803)

17.47 v2.174.0 - 2024-07-09

17.47.1 Automatic Migrations

- Renormalize `ou:position:title`, `ou:conference:name`, and `ou:conference:names` secondary properties. (#3701)
- Populate new `econ:currency` nodes from existing secondary properties. (#3790)
- Add a Cortex storage migration to set the correct View iden value on all Trigger definitions. (#3760)
- See *Data Migration* for more information about automatic migrations.

17.47.2 Model Changes

- Add a new model, `entity`, for modeling elements related to entity resolution. (#3781)
- Updates to the `crypto`, `econ`, `files`, `ou`, and `pol` models. (#3790) (#3781)
- See *v2.174.0 Model Updates* for more detailed model changes.

17.47.3 Features and Enhancements

- Add additional context to structured log information when a long LMDB commit is detected. (#3747)
- Add support to `synapse.lib.msgpack` functions for handling integers requiring more than 64 bits to store them. (#3767) (#3780)
- Add support for Storm variables in array filters. (#3775)
- Add a `kill()` API to the Storm `cron` objects. (#3787) (#3796)
- Add log messages when a cron job is enabled or disabled. (#3793)

17.47.4 Bugfixes

- Trigger definitions now always have the View iden that they belong to set upon View creation. The Storm `$lib.trigger.set()` API now uses the trigger view instead of the current view when checking permissions. (#3760)
- Add missing item information when an error occurs while replaying a nexus change entry upon startup (#3778)
- Fix the startup order for the Cortex embedded JSONStor to avoid an issue with the nexus replay on startup. (#3779)
- Wrap the Nexus mirror loop setup code in a try/except block to handle unexpected errors. (#3781)
- Only fire the beholder `pkg:add` events when the contents of a Storm package change. (#3785)

17.48 v2.173.1 - 2024-06-25

This release also includes the changes from v2.173.0, which was not released due to an issue with CI pipelines.

17.48.1 Model Changes

- Updates to the `ou`, `plan`, and `ps` models. (#3772) (#3773)
- See *v2.173.1 Model Updates* for more detailed model changes.

17.48.2 Bugfixes

- Fix a bug in the `view.merge` optimizations from `v2.172.0` where deny rules were not properly accounted for when checking for fast paths on the `node` permission hierarchy. (#3771)

17.49 v2.173.0 - 2024-06-25

This release was replaced with `v2.173.1`.

17.50 v2.172.0 - 2024-06-24

17.50.1 Model Changes

- Updates to the `biz`, `econ`, `inet`, `meta`, `ou` `risk`, and `transit` models. (#3561) (#3756)

- See *v2.172.0 Model Updates* for more detailed model changes.

17.50.2 Features and Enhancements

- Update the permission checking for View merging (`view.merge`) to optimize the permission checking based on user permissions and layer index data. (#3736) (#3750) (#3758)
- Add a hotfix that can be used to migrate `risk:hasvuln` nodes to `risk:vulnerable` nodes. (#3745)
- Add a Storm API, `$lib.env.get()`, to get environment variables from the Cortex process which start with the prefix `SYN_STORM_ENV_`. (#3761)
- Add a `edited()` API to the `layer` object in Storm. This API can be used to get the last time a given layer was edited. Add a `reverse` argument to the `layer.edits()` API to return the node edits in reverse order. (#3763)
- Add a `setArchived()` API to the `auth:user` object in Storm. (#3759)
- The `synapse.tool.storm` tool now returns a non-zero status code when it is invoked to execute a single command and the command encounters an error. (#3765)
- Add a `nodup` option to the `slab.scanKeys()` API. Use this to increase the efficiency of the the Storm `model.edge.list` command. (#3762)
- Add a `synapse.common.trimText()` API for trimming strings in a consistent fashion. Use that API to trim long text strings that may be included in exception messages. (#3753)
- When a Storm subquery assignment yields more than a single node, add the trimmed subquery text to the `BadTypeValu` exception that is raised. (#3753)

17.50.3 Bugfixes

- Fix a typo in the Storm `gen.it.av.scan.result` command help output. (#3766)
- Fix a typo in the Rapid Power-Up development documentation. (#3766)

17.50.4 Improved Documentation

- Add documentation for `$lib.auth.easyperm.level` constants and the `$lib.dict.has()` function. (#3706)

17.51 v2.171.0 - 2024-06-07

17.51.1 Features and Enhancements

- Update `synapse.test.utils.SynTest` helpers to disable sysctl checks for test services by default. (#3741)

17.51.2 Bugfixes

- Fix a key positioning error in the LMDBSlab when scanning backwards by prefix. (#3739)
- Fix a bug in the `str` type normalization routine for handling floating point values. The floating point values are now also run through the string norming logic. (#3742)
- Add missing beholder messages for view layer modifications. (#3743)

17.51.3 Improved Documentation

- Update Devops documentation to add additional information about low downtime service updates, Rapid Power-Up updates, and release cadence information. Update references from `docker-compose` to use `docker compose`. (#3722)

17.52 v2.170.0 - 2024-06-04

17.52.1 Automatic Migrations

- Populate an additional index of buids by form in Layers. (#3729)
- See *Data Migration* for more information about automatic migrations.

17.52.2 Model Changes

- Updates to the `infotech` and `file` models. (#3702) (#3725) (#3732)
- See *v2.170.0 Model Updates* for more detailed model changes.

17.52.3 Features and Enhancements

- Added `$lib.model.migration.s.riskHasVulnToVulnerable` migration helper to create `risk:vulnerable` nodes from `risk:hasvuln` nodes. (#3734)
- Added `$lib.model.migration.s.itSecCpe_2_170_0()` migration helper to update `it:sec:cpe` nodes created before this release. Details about the migration helper can be found in the help (`help -v $lib.model.migration.s.itSecCpe_2_170_0`) (#3515)
- Update Storm lift optimization for tag filters to also allow hinting based on runtsafe variable values. (#3733)
- Log an info message with the current Cell and Synapse version on startup. (#3723)
- Add per-Cell version checks to prevent accidental downgrades of services. (#3728)
- Add a check to Cells that will warn when performance related sysctl values are not configured correctly on the host. This warning can be disabled with the `health:sysctl:checks` configuration option. (#3712)
- Add `forms` and `interfaces` type options to the `ndef` type, which require the value to be one of the specified forms, or inherit one of the specified interfaces. (#3724)
- Add support for pivoting from an `ndef` secondary prop to specific form. (#3715)
- Add support for pivoting to or from `ndef` array properties. (#3720)
- Add an index of buids by form to Layers. A `getStorNodesByForm()` API has been added to Storm Layer objects to retrieve storage nodes using this index. (#3729)
- Storm Dmon APIs called on a Cortex mirror now call up to the leader to retrieve their result. (#3735)
- Add a `insertParentFork()` API on Storm View objects to insert a new View between an existing fork and its parent View. (#3731)
- Quorum merge requests are now allowed on Views which have forks. (#3738)

17.52.4 Bugfixes

- Fix a formatting issue in an error message that could be raised during JSON decoding in a Storm `http:api:request` object. (#3730)
- Fix an issue where `inet:url` norming did not handle IPv6 addresses in the host portion of the URL correctly. (#3727)
- Fix an issue where executing the `view.exec` command from within a privileged Storm runtime still checked user permissions for the specified view. (#3726)
- Update logic for parsing CPE 2.2 and CPE 2.3 strings to be more compliant with the specification. This resulted in better conversions from CPE 2.2 to CPE 2.3 and CPE 2.3 to CPE 2.2. (#3515)

17.53 v2.169.0 - 2024-05-10

17.53.1 Features and Enhancements

- Add a data migration helper library, `$lib.model.migration`. This contains functions to help with migrating data via Storm. (#3714)
- Add Extended HTTP API iden values to structured Storm query logs. (#3710)
- Add `node.data.set` and `node.data.pop` to the list of declared Cortex permissions. (#3716)

17.53.2 Bugfixes

- Restore cron iden values in structured Storm query logs. (#3710)
- The Storm APIs `$lib.min()` and `$lib.max()` now handle a single input. The Storm APIs `$lib.min()` and `$lib.max()` now raise a `StormRuntimeError` when there is no input provided to them. Previously these conditions caused a Python exception in the Storm runtime. (#3711)
- The `onboot:optimize` configuration now skips optimizing any LMDB files found in the Cell local backup storage. (#3713)

17.53.3 Deprecations

- Removed the Telepath APIs `CoreApi.enableMigrationMode` and `CoreApi.disableMigrationMode`. Remove support for the Cell `hiveboot.yaml` file. These had a removal date of 2025-05-05. (#3717)

17.54 v2.168.0 - 2024-05-03

17.54.1 Model Changes

- Add a new model, `plan`, for modeling elements of plannings systems. (#3697)
- See *v2.168.0 Model Updates* for more detailed model changes.

17.54.2 Features and Enhancements

- Cortex data model migrations will now be checked and executed when the service is promoted to being a leader. This allows for Cortex updates which use mirrors to have minimal downtime. Cortex model migrations which are executed using Storm will always run directly on the Cortex leader. (#3694) (#3695)
- The Storm `aha:pool.del()` method now returns the full name of the service that was removed. (#3704)

17.54.3 Bugfixes

- The Storm command `aha.pool.svc.del` now prints out the name of the service that was removed from the pool or notes that there were no services removed. (#3704)
- When setting a service "down" with AHA, conditionally clear the `ready` flag as well. Previously this flag was not cleared, and offline services could still report as `ready`. (#3705)
- Add missing sleep statements to callers of `Layer.syncNodeEdits2()`. (#3700)

17.54.4 Improved Documentation

- Update Storm command reference documentation to add additional examples for the `uniq` command. Update Storm command reference documentation to add `gen.geo.place` and `gen.it.av.scan.result` commands. (#3699)

- Update type specific documentation. Add additional information about `loc` and `syn:tag` behavior with prefixes and wlidcards. Add a section on the `duration` and `taxonomy` types. (#3703)
- Add documentation for `$lib.auth.easyperm.level` constants and the `$lib.dict.has()` function. (#3706)

17.55 v2.167.0 - 2024-04-19

17.55.1 Automatic Migrations

- Set the `protected` flag on all Views in the Cortex, using the existing value of the `nomerge` flag. (#3681)
- See *Data Migration* for more information about automatic migrations.

17.55.2 Model Changes

- Updates to the `base` and `file` models. (#3674) (#3688)
- See *v2.167.0 Model Updates* for more detailed model changes.

17.55.3 Features and Enhancements

- Add `aha.svc.list` and `aha.svc.stat` commands to enumerate the AHA services. Add `$lib.aha` Storm APIs to delete, get, and list the AHA services. (#3685) (#3692) (#3693)
- Add a `protected` option that can be set on Views to prevent merging and deletion. This replaces the `nomerge` option. (#3679)
- Add Beholder events for creating, deleting, and updating Macros. (#3681)
- Update the `StormPkgTest.getTestCore()` API to add a `prepkghook` callback option. This can be used to execute code prior to loading Storm packages. The `getTestCore()` API now waits for `onload` handlers to complete for each package it loads. (#3687)
- Ensure that the `Cell.ahaclient` is fully owned and managed by the `Cell`. It will no longer use a global client that may exist. (#3677)
- Update the `stix2-validator` library constraints to `>=3.2.0,<4.0.0`. Update the allowed range of the `idna` library to `>=3.6,<3.8`. (#3672) (#3684)

17.55.4 Bugfixes

- Asyncio Tasks created by signal handlers on the Base object are now held onto, to ensure that they cannot be garbage collected before or during their task execution. (#3686)
- Update the `Axon.postfiles` and `Axon.wput` APIs to check for the existence of files before attempting to send them over an HTTP connection. (#3682)
- Fix an issue where pruning a non-existent tag mistakenly pruned related tags. (#3673)
- Ensure that macro names are at least 1 character in length. (#3679)
- Fix a bug where `$lib.telepath.open()` could leak Python exceptions into the Storm runtime. (#3685)

17.55.5 Improved Documentation

- Add documentation for `$lib.aha`, `$lib.aha.pool`, and the `aha:pool` type. (#3685)

17.55.6 Deprecations

- Deprecate the use of `hiveboot.yaml` to configure a Cell hive. This will be removed on 2024-05-05. (#3678)
- The `nomerge` option on views has been deprecated. It is automatically redirected to the `protected` option. This redirection will be removed in `v3.0.0`. (#3681)
- The Telepath APIs for interacting with a Cell Hive, `listHiveKey`, `getHiveKeys`, `getHiveKey`, `setHiveKey`, `popHiveKey`, and `saveHiveTree` have been deprecated. The tools `synapse.tools.hive.load` and `synapse.tools.hive.save` have been deprecated. These will be removed in `v3.0.0`. (#3683)
- The `Telepath.Pipeline` class has been marked as deprecated and will be removed in `v3.0.0`. (#3691)

17.56 v2.166.0 - 2024-04-05

17.56.1 Model Changes

- Updates to the `inet`, `ou`, `person` and `risk` models. (#3649) (#3653) (#3657)
- See *v2.166.0 Model Updates* for more detailed model changes.

17.56.2 Features and Enhancements

- When setting a tag on a node, the tag value is now redirected based on parent tags having `:isnow` properties set. (#3650)
- Add a `$lib.spooled.set()` Storm API. This can be used to get a `spooled:set` object. This set will offload the storage of its members to a temporary location on disk when it grows above a certain size. (#3632)
- Add a `$lib.cache.fixed()` Storm API. This can be used to get a `cache:fixed` object. This cache will execute user provided callbacks written in Storm upon a cache miss. (#3661)
- Add a `pool` option to Cron jobs. This can be set to True to enable a Cron job storm query to be executed on a Storm pool member. (#3652)
- Add a `pool` option to Extended HTTP API handlers. This can be set to True to enable an HTTP request handler to be executed on a Storm pool member. (#3663) (#3667)
- Add a new Storm API, `$lib.cortex.httpapi.getByPath()`, that can be used to get an `http:api` object by its path. The `path` value is evaluated in the same order that the HTTP endpoint resolves the handlers. (#3663)
- Add `--list` and `--gate` options to `synapse.tools.modrole` and `synapse.tools.moduser`. (#3632)
- Add a `view.getMergingViews()` Storm API. This returns a list of view idens that have open merge requests on a view. (#3666)
- The Storm API `show:storage` option now includes storage information for any embedded properties. (#3656)
- Update the `LinkShutDown` exception that a Telepath client may raise to indicate that the connection has been disconnected. (#3640)
- Add repr functions for printing the `aha:pool` and `http:api` objects in Storm. (#3663) (#3665)
- The Telepath `Pool` object has been replaced with a new object, `ClientV2`. This is now the only object returned by the `synapse.telepath.open()` API. This is an AHA pool aware Client which can be used to connect to an AHA pool. (#3662)
- Remove the unused Provenance subsystem from the Cortex. (#3655)
- Constrain the `stix2-validator` library to `3.0.0,<3.2.0` due to an API change. This constraint is expected be changed in the next release. (#3669)

17.56.3 Bugfixes

- Fix a bug where a Cortex `promote()` call could hang when tearing down any running Cron jobs. Cron jobs cancelled during a promotion event will be logged but their cancelled status will not be recorded in the Nexus. (#3658)
- Fix a bug where the Storm pool configuration could cause a Cortex to fail to start up. The Storm pool is now configured upon startup but its use is blocked until the Storm pool is ready to service requests. (#3662)
- Ensure that the URL argument provided to `cortex.storm.pool.set` can be parsed as a Telepath URL. Previously any string input was accepted. (#3665)

17.56.4 Improved Documentation

- Update the list of Cortex permissions in the Admin Guide to include `service.add`, `service.del`, `service.get`, and `service.list`. (#3647)
- Update the docstring for the Storm `cortex.storm.pool.del` command to note the effects of removing a pool and the interruption of running queries. (#3665)
- Update the documentation for the Storm `http:api` object to include the `methods` attribute. (#3663)

17.56.5 Deprecations

- The Telepath `task:init` message format has been marked as deprecated and will be removed in `v3.0.0`. This should not affect any users using Synapse `v2.x.x` in their client code. (#3640)
- The authgate with the name `cortex` is not used for permission checking and will be removed in `v3.0.0`. At startup, the Cortex will now check for any use of this authgate and log warning messages. Attempts to set permissions with this gateiden via Storm will produce `warn` messages. (#3648)

17.57 v2.165.0 - 2024-03-25

17.57.1 Automatic Migrations

- Re-normalize `risk:mitigation:name`, `it:mitre:attack:technique:name`, and `it:mitre:attack:mitigation:name` secondary properties. (#3585)
- Re-normalize `velocity` properties which are float values. (#3616)
- See *Data Migration* for more information about automatic migrations.

17.57.2 Model Changes

- Add a new model, `sci`, for modeling elements of the scientific method. Updates to the `econ`, `file`, `infotech`, `inet`, `ou`, `ps`, and `risk` models. (#3559) (#3585) (#3595) (#3604) (#3606) (#3622) (#3635)
- See *v2.165.0 Model Updates* for more detailed model changes.

17.57.3 Features and Enhancements

- Change the compression mode used when streaming Cell backups to speed up the backup process. (#3608)
- When a Cell is mirroring, gracefully go into read-only mode if the leader is a greater version than the mirror. (#3581) (#3631)
- Add `null` as a constant that can be used in Storm expression syntax. (#3600)

- Add `cortex.storm.pool.get`, `cortex.storm.pool.set`, and `cortex.storm.pool.del` commands to manage the Storm query pool which may be used by the Cortex. This replaces the experimental support added in `v2.160.0` for Storm query pool configuration. The experimental Cortex configurations options `storm:pool`, `storm:pool:timeout:sync`, and `storm:pool:timeout:connection` have been removed. (#3602)
- Add `$lib.regex.escape()` API for escaping strings which may be used as regular expression patterns. (#3605)
- Add `View.setMergeComment()` and `View.setMergeVoteComment()` Storm APIs for setting comments on merge requests and merge votes. (#3597)
- Add handlers to the `float`, `int`, and `str` types to handle norming Storm `Number` objects. (#3601)
- Add a new Storm command, `gen.geo.place`, to generate a `geo:place` node by name. (#3620)
- Add an optional reporter name argument to the Storm command `gen.risk.vuln`. (#3628)
- Add a `norm` option to the `$node.difftags()` command. (#3612)
- Add logging around the leader promotion and handoff actions. (#3615)
- Add Telepath APIs to AHA for clearing unused provisioning information. (#3607)

17.57.4 Bugfixes

- Fix a bug where Cortex Cron jobs could start prior to data migrations having completed running. (#3610)
- Fix an issue where `node.prop.set` and `node.prop.del` permissions were not being properly checked. (#3627)
- Fix a bug in the Storm `merge` command where the destination layer was not being properly checked for property set and deletion permissions. (#3627)
- Fix a bug in the Storm `copyto` command where the destination layer was not being properly checked for property set permissions. (#3641)
- Fix an error when granting a role admin permissions on a vault. (#3603)
- Prevent the `synapse.tools.easycert` tool from making certificates with names greater than 64 characters in length. Prevent AHA provisioning from creating provisioning requests which would exceed that length. (#3609)
- Fix an issue with the `velocity` base type returning a float instead of an integer when handling a string value without a unit. (#3616)
- Fix an issue that could occur when pivoting from a secondary property to a form when using variables for the source and target values. (#3618)
- Fix a syntax parsing issue when using the try-set-plus or try-set-minus operator to update an array property on a node using a variable for the property name. (#3630)
- Fix an issue with AHA service pools where their Telepath Clients were not configured for use as `aha://` clients. (#3643)
- Fix an issue with AHA service pools where a fini'd Proxy was not properly cleaned up. (#3645)

17.57.5 Improved Documentation

- Update Storm pivot documentation to add additional examples. (#3599)
- Update the Cortex deployment guide to include a step to configure a Storm query pool. (#3602)

17.57.6 Deprecations

- The tool `synapse.tools.cellauth` has been marked as deprecated and will be removed in `v3.0.0`. (#3587)
- The tool `synapse.tools.cmdr` has been marked as deprecated and will be removed in `v3.0.0`. (#3589)
- The Storm `$lib.model.edge` APIs have been marked as deprecated and will be removed in `v3.0.0`. (#3623)
- The `CoreAPI.enableMigrationMode()` and `CoreAPI.disableMigrationMode()` Telepath methods have been marked as deprecated and will be removed after 2024-05-05. (#3610)
- The Cortex configuration options `cron:enable` and `trigger:enable` have been marked as deprecated and will be removed in `v3.0.0`. These configuration options no longer control cron or trigger behavior. (#3610)
- The Storm Package `synapse_minversion` key has been deprecated and will be removed in `v3.0.0`. Package authors should use the `synapse_version` key to specify a version range for Synapse they support. An example is the string `>=2.165.0,<3.0.0`. (#3593)

17.58 v2.164.0 - 2024-03-01

17.58.1 Features and Enhancements

- Update the Beholder messages `view:merge:init`, `view:merge:prog`, and `view:merge:fini` to add `merge` and `vote` information. (#3580)
- When optimizing Storm lift operations, skip lifts that would be fully filtered out. (#3582)
- Add `tmpdir` information to the `getSystemInfo()` APIs. This is the directory that the service would use for creating any temporary files. (#3583)
- Update the `synapse.tools.modrole` tool to add a `--del` option to delete a role. (#3586)
- Add the `reporter` `ou:org` to `ou:campaign` nodes generated with `gen.ou.campaign` (#3594)
- The `synapse.lib.certdir.CertDir` class has been updated to use the `cryptography` APIs instead of the `PyOpenSSL` APIs where possible. The `CertDir` APIs no longer return `PyOpenSSL` objects, and now return `cryptography` related objects. (#3568)
- Update the `cryptography` and `PyOpenSSL` libraries to require their latest versions. (#3568)

17.58.2 Bugfixes

- Model interfaces now populate properties for the sub-interfaces. (#3582)
- Use `tostr` on property and form names when computing lifts and pivots to avoid a Python `AttributeError` exception. Invalid types will now raise a `StormRuntimeException`. (#3584)

17.58.3 Deprecations

- The tool `synapse.tools.cellauth` has been marked as deprecated and will be removed in `v3.0.0`. (#3587)
- The tool `synapse.tools.cmdr` has been marked as deprecated and will be removed in `v3.0.0`. (#3589)

17.59 v2.163.0 - 2024-02-21

17.59.1 Features and Enhancements

- Add Storm API methods to `$lib.axon` which share the functionality of `$lib.bytes` APIs. These include `$lib.axon.has`, `$lib.axon.hashset`, `$lib.axon.put`, `$lib.axon.size`, and `$lib.axon.upload`. (#3570) (#3576)

- Add support for user provided certificates for doing mTLS in Storm HTTP requests. (#3566)
- Enable constructing a guid in Storm from a single value with `$lib.guid(valu=$item)`. (#3575)

17.60 v2.162.0 - 2024-02-15

17.60.1 Model Changes

- Updates to the `inet`, `infotech`, `ou`, `proj`, and `risk` models. (#3549) (#3551) (#3564)
- See *v2.162.0 Model Updates* for more detailed model changes.

17.60.2 Features and Enhancements

- Add Storm API methods for inspecting and manipulating dictionary objects in Storm. These are `$lib.dict.has()`, `$lib.dict.keys()`, `$lib.dict.pop()`, `$lib.dict.update()`, and `$lib.dict.values()`. (#3548)
- Add a `json()` method to the `str` type in Storm to deserialize a string as JSON data. (#3555)
- Add an `_ahainfo` attribute to the `Telepath.Proxy`, containing AHA service name information if that is provided to the Dmon. (#3552)
- Add permissions checks to `$lib.bytes` APIs using `axon.has` for APIs that check for information about the Axon or metrics; and `axon.upload` for APIs which put bytes in the Axon. These are checked with `default=True` for backward compatibility. (#3563)
- The rstorm `storm-svc` and `storm-pkg` directives now wait for any `onload` handlers to complete. (#3567)
- Update the Synapse Python package trove classifiers to list the platforms we support using Synapse with. (#3557)

17.60.3 Bugfixes

- Fix a bug in the `Cell.updateHttpSessInfo()` API when the Cell does not have the session in memory. (#3556)
- Fix a bug where a user was allowed to vote for their own View merge request. (#3565)
- Include Storm variables from the current and parent scopes when resolving STIX properties and relationships. (#3571)

17.60.4 Improved Documentation

- Update the Storm automation documentation. Added additional information about permissions used to manage automations. Added examples for `edge:add` and `edge:del` triggers. Added examples for managing Macro permissions. (#3547)
- Update the Storm filtering and lifting documentation to add information about using interfaces and wildcard values with those operations. (#3560)
- Update the Synapse introduction to note that Synapse is not intended to replace big-data or data-lake solutions. (#3553)

17.60.5 Deprecations

- The Storm function `$lib.dict()` has been deprecated, in favor of using the `({"key": "value"})` style syntax for directly declaring a dictionary in Storm. (#3548)
- Writeback layer mirrors and upstream layer mirrors have been marked as deprecated configuration options. (#3562)

17.61 v2.161.0 - 2024-02-06

17.61.1 Features and Enhancements

- Add a Storm command `gen.it.av.scan.result` to help generate `it:av:scan:result` nodes. (#3516)
- Add item specific error message when users do not have sufficient permissions on an object which is using easyperms. (#3532)
- Ensure that Nexus events which are written to the log are always applied and cannot be cancelled while the Nexus handler is running. (#3518)
- Add `getMergeRequest()` and `getMergeRequestSummary()` Storm APIs to the `View` object, in order to get information about View merges via Storm. (#3541)
- Add AHA information to the output of the `Cell.getCellInfo()` API. This includes the service name, leader, and network. (#3519)
- Logs related to AHA service registration and setting services as offline are now logged at the `INFO` level. (#3534)
- When creating Cron jobs and Triggers, record their creation time. (#3521) (#3538)
- Add a `Cell.updateHttpSessInfo()` API to set multiple keys at once on a HTTP session. (#3544)
- Update the allowed versions of the `cbor2` and `` pycryptodome`` libraries. (#3540)

17.61.2 Bugfixes

- The Storm API for creating websockets, `$lib.inet.http.connect()`, did not properly handle the `ssl_verify` argument, causing SSL verification of Websocket requests to default to being disabled. This argument is now handled correctly, with SSL verification being enabled by default. (#3527)
- Fix a bug in embedded Storm queries where they failed to grab their variables properly. (#3531)
- Fix a bad variable reference in the Storm `graph` implementation. (#3531)
- Fix a bug where modifying nodes in a Storm Dmon did not properly update the in-flight node. (#3520)

17.61.3 Improved Documentation

- Update the Cortex admin guide with additional information about removing extended forms and properties. (#3510)
- Update the Data Model documentation to include additional information about extended forms and properties. (#3523)
- Update the Data Model documentation to include information about property interfaces. (#3523)

17.62 v2.160.0 - 2024-01-24

17.62.1 Automatic Migrations

- Update `inet:ipv6` nodes to set their `:type` and `:scope` properties. (#3498)
- Update existing layer push and layer pull configurations to set the default chunk size and queue size values on them. (#3480)
- See *Data Migration* for more information about automatic migrations.

17.62.2 Model Changes

- Updates to the `infotech`, `ou`, and `risk` models. (#3501) (#3504) (#3498)
- See *v2.160.0 Model Updates* for more detailed model changes.

17.62.3 Features and Enhancements

- Add tab completion of commands, forms, properties, tags, and `$lib.` functions the Storm CLI tool. (#3493) (#3507)
- Add `node.set.<form>.<prop>` and `node.del.<form>.<prop>` permissions conventions to the Cortex for property sets and deletes. (#3505)
- Add experimental support for Storm query offloading to the Cortex. This can be used to offload Storm queries to an AHA service pool. This can be configured with the `storm:pool` option on the Cortex. (#3452) (#3513)
- Add a `--deledges` option to the `delnode` command. This deletes the N2 edges for a node before deleting the node. (#3503)
- When creating layer push or pull configurations, the chunk size and queue size can now be set. (#3480)
- Add a `cell.hasHttpSess()` API to check if a given Cell has a known HTTP session. (#3485)
- Fire a `core:pkg:onload:complete` event when a Storm package `onload` handler is completed. This can be used when writing unit tests for Rapid Power-ups. (#3497)

17.62.4 Bugfixes

- Remove dataname index entries when removing all nodedata from a node. (#3499)
- Fix an issue with `tagprops` not being correctly returned in `$node.getByLayer()`. (#3500)
- Fix an issue with the `edges.del` command when using the `--n2` option. This now behaves correctly when the N1 node does not exist. (#3506)
- Fix an issue with duplicate properties being tracked in the property type map of the data model. This could have resulted in multiple nodes being lifted with interface properties. (#3512)

17.62.5 Improved Documentation

- Update Storm filter documentation. Additional information about tag globbing and interval filtering has been included. (#3489)

17.63 v2.159.0 - 2024-01-16

17.63.1 Automatic Migrations

- Update any extended model elements which used the `taxonomy` interface to now use the `meta:taxonomy` interface. (#3334)
- See *Data Migration* for more information about automatic migrations.

17.63.2 Features and Enhancements

- Add support for lifting, pivoting, and filtering using wildcards, lists, variables, and interfaces as form and property names. (#3334)
- Migrate the name of the `taxonomy` interface to `meta:taxonomy`. (#3334)
- Update the pinned version of the `lark` library to `1.1.9` for compatibility with Python 3.11.7. (#3488)

17.63.3 Bugfixes

- Prevent re-adding extended model elements in Nexus handlers. (#3486)
- Add missing permissions checks on the `$lib.axon.urlfile()` API. This now requires the `node.add.file:bytes` and `node.add.inet:urlfile` permissions. (#3490)
- Fix the permission checking for Vaults to check the Storm runtime `asroot` status. (#3492)
- Fix an issue with `$lib.stix.import.ingest()` not converting `bundle` to a dictionary. (#3495)

17.63.4 Improved Documentation

- Add documentation for the `reverse` keyword. (#3487)
- Clarify the use of the "try" operator (`+?`) in edit operations. (#3482) (#3487)
- Update Storm lift documentation to add additional examples and clarify existing documentation. (#3487)
- Update Storm data modification documentation to add additional examples and clarify existing documentation. (#3482)

17.64 v2.158.0 - 2024-01-03

17.64.1 Features and Enhancements

- Update the allowed versions of the``fastjsonschema``, `idna`, `pygments`, and `aiosmtplib` libraries. (#3478)

17.64.2 Bugfixes

- Fix a bug where the `role:add` and `user:add` Nexus handlers could raise an exception when being called by a service mirror. (#3483)

17.64.3 Improved Documentation

- Update the Storm command reference guide. (#3481)
- Update the Synapse glossary. (#3481)

17.65 v2.157.0 - 2023-12-21

17.65.1 Features and Enhancements

- Added vaults feature for storing and sharing secret values (such as API keys) and associated configuration settings. Vaults can be shared with and used by another user without them being able to see the enclosed secret values. (#3319) (#3461)
- Added Storm commands to interact with vaults: `vaults.*`. (#3319)
- Added Storm library to interact with vaults: `$lib.vaults.*`. (#3319)
- Add merge request voting and history tracking for full View merges. (#3466) (#3473) (#3475)
- Add service pooling support to AHA. This allows for dynamic service topologies and distributed Telepath API calls. (#3353) (#3477)
- Add user managed API keys that can be used to access HTTP API endpoints. (#3470)
- Added an `--optsfile` option to the Storm CLI tool. This can be used to specify opts to the CLI tool via YAML. See *Storm Opts* for details about available options. (#3468)

- Cron status changes are now persisted through the Nexus. (#3460)
- Add a `show:storage` option to the Storm runtime opts to include the storage node data in the `node` message. (#3471)

17.65.2 Bugfixes

- Log a warning message when calling the Python `User.pack(packroles=True)` method when a user role is missing from the Auth subsystem. A missing role previously caused an `AttributeError` exception. (#3469)
- Ensure the Nexus `view:detach` event is idempotent. (#3474)
- Fix an issue where Storm subqueries containing non-runtsafe values could potentially not execute. (#3443)

17.66 v2.156.0 - 2023-12-08

17.66.1 Model Changes

- Updates to the `infotech`, `ou`, and `risk` models. (#3436) (#3438) (#3446) (#3447)
- See *v2.156.0 Model Updates* for more detailed model changes.

17.66.2 Features and Enhancements

- Add an `empty` keyword to Storm to conditionally execute queries when there are no nodes in the pipeline. (#3434)
- Add Storm APIs for getting property counts for a given `layer` or `view.`. These APIs are `getPropCount()`, `getPropArrayCount()`, `getTagPropCount()`. (#3435)
- Add a new permission, `view.fork`, which can be used to control access for forking a view. This permission defaults to being allowed. (#3437)
- Add Storm operators to allow pivoting and joining across light edges. The following examples show pivoting across `refs` edges and joining the destination nodes with the inbound nodes: `-(refs)+>` and `<+(refs)-`. (#3441)
- Add Storm operators to do pivot out and join (`--+>`) and pivot in and join (`<+--`) operations across light edges. (#3441) (#3442)
- Storm subqueries used to assign a value now always run. (#3445)
- Non-runtsafe `try...catch` blocks in Storm now run when there are no inbound nodes. (#3445)
- The Storm API `$lib.storm.eval()` now logs its `text` argument to the `synapse.storm` logger. (#3448)
- Add a `--by-name` argument to the Storm `stats.countby` command. This can be used to sort the results by name instead of count. (#3450)
- Add a new Storm API `$lib.gis.bbox()` to allow computing geospatial bounding boxes. (#3455)

17.66.3 Bugfixes

- Prevent recursion errors in `inet:fqdn` onset handlers. (#3433)
- When dereferencing a list or dictionary object off of a Node in Storm, the returned value is now a copy of the value. This avoids the situation where modifying the deferenced value appeared to alter the node but did not actually result in any edits to the underlying data. (#3439)
- Add a missing sub-query example to Storm `for` loop documentation. (#3451)
- Fix an issue where attempting to norm an IPv4 with an invalid netmask would raise a Python error. (#3459)

17.66.4 Deprecations

- Deprecated Cortex and splice related APIs which were marked for removal after 2023-10-01 have been removed. The list of these APIs can be found at *API Deprecation Notice - 2023-10-01*. These additional splice related changes have also been made:

  The HTTP API `/api/v1/storm` now sets the default `editformat` opt value to `nodeedits`. Previously this API produced splice changes by default.

  The `synapse.tools.cmdr` `storm` command no longer displays splices.

  The `synapse.tools.cmdr` `log` command no longer records splices.

  The `synapse.tools.csvtool` tool no longer records or displays splices.

  The `synapse.tools.feed` tool no longer supports splices or nodeedits as input and the splice documentation example has been removed.

  (#3449)

- The deprecated function `synapse.common.aclosing()` has been removed. (#3449)
- Provisioning a Synapse service with AHA now always updates the local CA certificate and generates new host and user certificates for the service. Previously these would not be regenerated if the CA or service names did not change. (#3457)

17.67 v2.155.0 - 2023-11-17

17.67.1 Model Changes

- Updates to the `infotech`, `proj`, and `risk` models. (#3422)
- See *v2.155.0 Model Updates* for more detailed model changes.

17.67.2 Features and Enhancements

- Add a `detach()` method to the Storm `view` object. This will detach a forked View from its parent. (#3423)
- Change the method used to generate the `took` value in the Storm `fini` message to use a monotonic clock. (#3425)
- Performing an invalid "pivot in" operation with a form target (`<- some:form`) now raises a `StormRuntimeError` instead of silently doing nothing. (#3426)
- Allow relative properties on the right hand side of a filter operation when using Storm expression syntax. (#3424)
- Add an `/api/v1/logout` method on the Cell to allow HTTPS users to logout of their sessions. (#3430)
- Allow taxonomy prefix lift and filter operations to work with taxon parts. (#3429)
- Update the allowed versions of the `cbor2`, `pycryptodome`, `pygments`, `vcrpy`, and `xxhash` libraries. Update the pinned version of the `lark` library. (#3418)

17.67.3 Bugfixes

- Fix a performance regression in graph projection for computing large graphs in Storm. (#3375)
- Fix a conflict between Storm `$lib.inet.http` functions and `vcrpy` where `json` and `data` args shouldn't be passed together. (#3428)

17.67.4 Improved Documentation

- Fix an error in the Cortex mirror deployment guide. The example `docker-compose.yaml` was missing the environment variables for `SYN_CORTEX_AXON` and `SYN_CORTEX_JSONSTOR`. (#3430)

17.68 v2.154.1 - 2023-11-15

This release is for updating the version of the `cryptography` package in Synapse containers to `41.0.5`.

17.69 v2.154.0 - 2023-11-15

17.69.1 Automatic Migrations

- Update the `inet:ipv4:type` value for RFC6598 addresses to `shared`. (#3410)
- See *Data Migration* for more information about automatic migrations.

17.69.2 Model Changes

- Update to the `inet` and `ou` models.

  (#3406) (#3407) (#3410) (#3416)

- See *v2.154.0 Model Updates* for more detailed model changes.

17.69.3 Features and Enhancements

- Add `edge:add` and `edge:del` as trigger conditions. These trigger when light edges are added or removed from a node. (#3389)
- Storm lift and filter operations using regular expressions (~=) are now case insensitive by default. (#3403)
- Add a `unique()` method to the Storm `list` object. This returns a new list with only unique elements in it. (#3415)
- Add support for `synapse.tools.autodoc` to generate documentation for API definitions declared in Storm packages. (#3382)
- A review of Storm library functions was performed and all `readonly` safe functions have been marked for execution in a `readonly` Storm runtime. (#3402)
- Allow setting the layers on a root View with forks. (#3413)

17.69.4 Bugfixes

- Per-node Storm variables are now passed into subquery assignment expressions. (#3405)
- Fix an issue with Storm Dmon hive storage being opened too late in the Cortex startup sequence. (#3411)
- Remove a check when deleting tags from a node which prevented tag deletion from a node when the root tag was deleted in a parent view. (#3408)

17.70 v2.153.0 - 2023-10-27

17.70.1 Model Changes

- Update to the `inet` and `ou` models. (#3393) (#3396)
- See *v2.153.0 Model Updates* for more detailed model changes.

17.70.2 Features and Enhancements

- Add a new Storm API, `$lib.cortex.httpapi`, for creating and managing Extended HTTP API endpoints. These Cortex HTTP API endpoints allow a user to create custom responses via Storm. Documentation for this feature can be found at *Extended HTTP API*. (#3366)
- Add a new Storm API, `$lib.iters.zip()`, to iterate over sequences of items together. (#3392) (#3398)
- Add a Storm command `stats.countby` to tally occurrences of values and display a barchart representing the values. (#3385)
- Update the Storm command `auth.user.mod` to allow setting a user as admin on a specific auth gate. (#3391)
- The `proxy` argument to `$lib.inet.http.*`, `$lib.axon.wget()`, `$lib.axon.urlfile()`, and `$lib.axon.wput()` APIs is now gated behind the permission `storm.lib.inet.http.proxy`. Previously this required admin permission to utilize. (#3397)
- Add an `errors` parameter to `$lib.axon.readlines()`, `$lib.axon.csvrows()`, and `$lib.axon.jsonlines()`. This parameter defaults to `ignore` to ignore any decoding errors that are encountered when decoding text. (#3395)
- Lower the maximum allowed version of the `pyopenssl` library. (#3399)

17.70.3 Bugfixes

- Fix a bug in the `Cortex.syncLayersEvents()` and `Cortex.syncIndexEvents()` APIs which caused layers to stop sending their node edits under certain conditions. (#3394)
- Storm now raises a `BadSyntaxError` when attempting to filter by wildcard tags or tagprops when a value is specified for the filter. (#3373)

17.71 v2.152.0 - 2023-10-17

17.71.1 Model Changes

- Update to the `biz`, `crypto`, `geo`, `it`, `mat`, `media`, and `risk` models. (#3341) (#3377) (#3376) (#3381)
- See *v2.152.0 Model Updates* for more detailed model changes.

17.71.2 Features and Enhancements

- Update the Storm string repr for `$lib.null` and `$lib.undef` values to `$lib.null` and `$lib.undef`. Previously these printed `None` and an opaque Python object repr. (#3361)
- The `synapse.tools.aha.list` CLI tool now checks if it is connected to an Aha server prior to enumerating Aha services. (#3371)

17.71.3 Bugfixes

- Update the `file:path` support for scrape related APIs to address an issue when matching against Linux style paths. (#3378)
- Update the `hex` type to `zeropad` strings prior to checking their validity. (#3387)
- Update the `yaml.CSafeLoader` check to not require the class to be available. (#3386)

17.71.4 Improved Documentation

- Update the documentation for the Storm `view.exec` command to explain the separation of events and nodes between the parent and sub-runtimes. (#3379)

17.72 v2.151.0 - 2023-10-06

17.72.1 Model Changes

- Update to the `it` model. (#3361)
- See *v2.151.0 Model Updates* for more detailed model changes.

17.72.2 Features and Enhancements

- Add a new Storm library `$lib.infosec.mitre.attack.flow`. This can be used to normalize and create `it:mitre:attack:flow` nodes from MITRE ATT&CK Flow Diagrams. (#3361) (#3372)
- Update the Storm `note.add` command to set the `meta:note:created` property on the note. (#3569)
- Add the Axon HTTP APIs to the Cortex. These API endpoints use the Axon that the Cortex is configured to use. (#3550)
- Allow user defined functions in Storm to execute in a `readonly` Storm runtime. (#3552)
- Clarify the Nexus `IsReadOnly` exception to include the common cause for the error, which is normally insufficent space on disk. (#3359)
- Add a `SYN_LOG_DATEFORMAT` environment variable to allow specifying custom timestamp formats for Synapse services. (#3362)
- Add a `status` attribute to structured log events for user and role related log events. This attribute indicates if the event was a `CREATE`, `DELETE`, or `MODIFY` operation. (#3363)
- Update `Cell.getLogExtra()` to prefer using the `user` key from the task scope before using the `sess` key from the task scope. Cortex APIs which execute Storm queries now set the `user` scope to the user the query is running as. This increases the accuracy of log events caused by Storm queries when the `user` is specified in the `opts`. (#3356)
- Update Storm setitem AST operator to check the readonly flag on functions when operating in a `readonly` Storm runtime. (#3364)
- Update the minimum required version of the `fastjsonschema` library. (#3358)
- Update tests and remove the use of deprecated functions for improved Python 3.12 compatibility. (#3355) (#3567)

17.72.3 Bugfixes

- Fixed a bug when parenting a View to another View where the bottom view has more than one layer in it omitted non-write layers. The set of layers is now properly computed. (#3354)

17.72.4 Improved Documentation

- Update the list of Cortex permissions in the Admin Guide. (#3331)
- The Form documentation has been updated to project the secondary properties and associated light edges as tables. (#3348)

17.73 v2.150.0 - 2023-09-22

17.73.1 Model Changes

- Updates to the `inet` model. (#3347)
- See *v2.150.0 Model Updates* for more detailed model changes.

17.73.2 Features and Enhancements

- Allow Storm trigger APIs to reference triggers from other views. (#3342)
- Update the `synapse.lib.scrape` and associated APIs to capture additional data: (#3223) (#3347)

  `it:sec:cpe`
  : CPE 2.3 strings are now identified.

  `inet:url`
  : UNC based paths are now identified.

- Update the `synapse.lib.scrape` and associated APIs to use subprocesses when scraping large volumes of text. (#3344)
- Add additional logging for HTTP API endpoints when a request has invalid login information. (#3345)
- The CryoTank service has had permissions added to it. (#3328)

17.73.3 Bugfixes

- Stormtypes `stor` functions were not previously checked during `readonly` runtime execution. These are now validated and `stor` functions which would result in changing data in the Cortex will now raise an exception when used with a `readonly` Storm runtime. (#3349)

17.73.4 Improved Documentation

- Update the list of Cortex permissions in the Admin Guide. (#3331)
- The Form documentation has been updated to project the secondary properties and associated light edges as tables. (#3348)

17.74 v2.149.0 - 2023-09-14

17.74.1 Model Changes

- Updates to the `it`, `meta`, and `ou` models. (#3338)
- See *v2.149.0 Model Updates* for more detailed model changes.

17.74.2 Features and Enhancements

- Add best-effort support to scrape APIs to identify Windows and Linux file paths. (#3343)
- Update the Storm `view.add` command to add a `--worldreadable` flag to create a view which is readable by the `all` role. The `$lib.view.add()` Storm API now also accepts an optional `worldreadable` argument as well. (#3333)
- Update the Storm `note.add` command to add a `--yield` flag which yields the newly created note. (#3337)
- Add Storm commands `gen.ou.id.number` and `gen.ou.id.type` to help generate `ou:id:number` and `ou:id:type` nodes. (#3339)

- Support dynamically setting a Layer to `readonly` using the Storm `$layer.set()` API. (#3332)
- Update the Storm command `help` to display information about Storm types, Storm Libraries and functions. (#3335)

17.74.3 Bugfixes

- Ensure that the Cell `tmp` directory is on the same volume as the Cell storage directory prior to attempting to run the onboot optimization process. If the volumes are different this now issues a warning message and skips the optimization process. (#3336)
- Protect the Cortex Cron scheduling loop from errors that could happen when starting an agenda item. (#3340)

17.75 v2.148.0 - 2023-09-05

17.75.1 Features and Enhancements

- Add a `$lib.jsonstor.cachedel()` API to allow for the removal of data created by `$lib.jsonstor.cacheget()`. (#3322)

17.75.2 Bugfixes

- Ensure the base Cell `fini()`'s the Aha client that it creates. This fixes a unit test performance issue. (#3324)

17.75.3 Deprecations

- Mark the following Cryotank related API arguments and functions as deprecated. These APIs are related to server-side offset tracking for callers. Code which relies on these should be updated to do local offset tracking. These APIs and arguments will be removed in v2.150.0. (#3326)
  - `CryoApi.puts(seqn=...)` argument.
  - `CryoApi.rows(seqn=...)` argument.
  - `CryoApi.slice(iden=...)` argument.
  - `CryoApi.offset()` function.
  - `CryoTank.getOffset()` function.
  - `CryoTank.setOffset()` function.
  - `CryoTank.puts(seqn=...)` argument.
  - `CryoTank.rows(seqn=...)` argument.
  - `CryoTank.slice(iden=...)` argument.
  - `TankAPI.offset()` function.
  - `TankApi.puts(seqn=...)` argument.
  - `TankAPI.slice(iden=...)` argument.

17.76 v2.147.0 - 2023-08-31

17.76.1 Features and Enhancements

- Add `wait` and `timeout` arguments to Cryotank `slice()` APIs. (#3320)

- Add a `charset` parameter to the Storm `inet:imap:server.search()` API. This can be used to specify the `CHARSET` value when crafting a search query. (#3318)

17.76.2 Bugfixes

- Vendor the `asyncio.timeouts.Timeout` class from Python 3.11.3 to ensure correct task cancellation behavior is available for `synapse.common.wait_for()`. (#3321)

17.77 v2.146.0 - 2023-08-29

17.77.1 Features and Enhancements

- Update Storm `graph` projection to only include edges between nodes in the result set and include a *"reverse": true* in the edge info when embedding an edge on its target node once it is yielded. (#3305)
- Map the Nexus LMDB slab with `map_async=True` by default. (#3314)
- Mark the Storm `macro.exec` as a `readonly` safe command. Mark the Storm APIs `$lib.macro.list()` and `$lib.macro.get()` as `readonly` safe. Mark the `str` APIs as `readonly` safe. (#3316)

17.77.2 Bugfixes

- Fix an issue where Layer data migrations failed when a layer was marked as `readonly`. (#3313)
- Fix an issue where utility functions for packed nodes in `synapse.lib.node` did not handle nodes from HTTP API endpoints. (#3315)

17.78 v2.145.0 - 2023-08-25

17.78.1 Automatic Migrations

- Update indexing for light edges to index the N1 and N2 node identifiers together. (#3302)
- See *Data Migration* for more information about automatic migrations.

17.78.2 Model Changes

- Update to the `inet`, `it`, and `meta` models. (#3285) (#3298) (#3301) (#3310)
- See *v2.145.0 Model Updates* for more detailed model changes.

17.78.3 Features and Enhancements

- Add a new Storm keyword, `reverse( ... )`, which can be used to run a lift operation in reverse order. (#3266)
- Update indexing for light edges to index the N1 and N2 node identifiers together. (#3302)
- Update the Storm `once` command behavior and documentation to be more intuitive when setting its timestamp and allowing nodes through it. (#3282)
- Add a `synapse_version` key to the Storm Package schema. This can be used to provide a string version identifier with a minimum and maximum version, such as `>=2.145.0,<3.0.0`. (#3304)
- Update the Storm runtime to respect permissions declared with a `default` value of `true`. This allows Storm packages to define permissions which are defaulted to `true`. (#3287)
- Add a `SIGHUP` handler to the base Cell which can be used to reload HTTPS certificate files from disk. The `synapse.tools.reload` tool can also be used to trigger this behavior. (#3293)

- The optional `max:users` feature no longer counts `locked` or `archived` users when adding users. (#3295)
- Update the YAML functions to use the `yaml.CSafeLoader` and `yaml.CSafeDumper`. (#3289)

17.78.4 Bugfixes

- Replace `asyncio.wait_for()` use with a copy of the Python 3.12 implementation to avoid a race condition when cancelling tasks. (#3299) (#3307)
- Fix an issue with the Storm trigger `set()` method not properly checking the values that it allows to be set. (#3290)
- Fix an off-by-one bug in the `SlabSeqn.aiter()` method. (#3300)
- Fix a performance issue with the IPv6 regular expression used in the scrape APIs. (#3311)

17.78.5 Improved Documentation

- Revise the Storm User Guide to consolidate the background information and data modeling sections. Add a user focused section on Views and Layers. (#3303)
- Add `int` type specific information to the Storm documentation. (#3288)
- The Storm `movetag` command now moves the `doc:url` property from the old `syn:tag` node to the new `syn:tag` node. (#3294)
- Storm Library and Type documentation no longer renders function signatures with Python style defaults. (#3296)

17.78.6 Deprecations

- Many deprecated Cortex and splice related APIs have been marked for removal after 2023-10-01. The full list of APIs which will be removed can be found at *API Deprecation Notice - 2023-10-01*. (#3292)
- The use of `synapse.common.aclosing()` has been replaced with `contextlib.aclosing()`. The vendored `aclosing()` implementation will be removed in `v2.250.0`. (#3206)

17.79 v2.144.0 - 2023-08-09

17.79.1 Model Changes

- Updates to the `inet:dns` and `it` model. (#3257) (#3276)
- See *v2.144.0 Model Updates* for more detailed model changes.

17.79.2 Features and Enhancements

- The iden of the Cron job is now added to the Storm query log made with the `synapse.storm` logger when using structured logging. (#3235)
- Add a `keepalive` option to the Storm query `opts`. This may be used with long-running Storm queries when behind a network proxy or load balancer which may terminate idle connections. (#3272)
- Update the allowed versions of the `cryptography` library. (#3281)

17.79.3 Bugfixes

- Fix an issue where Storm Dmons could start prior to data model migrations. (#3279)
- Adjust the storage convention for `once` state data to fix an edge case and clarify documentation. (#3282)
- Fix an issue with missing keys in storage nodes during migrations. (#3284)

17.80 v2.143.0 - 2023-07-28

17.80.1 Model Changes

- Update to the `crypto` model. (#3256)
- See *v2.143.0 Model Updates* for more detailed model changes.

17.80.2 Features and Enhancements

- Add `$lib.model.ext.getExtModel()` and `$lib.model.ext.addExtModel()` Storm APIs to get all the extended model definitions in a Cortex and to add extended model definitions to a Cortex in bulk. (#3252)
- Add `inet:ipv6` to the list of types identified with scrape APIs. The `inet:server` form identified by scrape APIs now also identifies IPv6 server addresses. (#3259)
- Add a check to the Cortex startup to identify and log the presence of deprecated model elements and direct users to check and lock them at *model.deprecated.check*. (#3253) (#3264)
- Add a new Storm function, `$lib.vars.type()`, to get the type value of an object. (#3100)
- Add a Storm library, `$lib.pack`, for packing and unpacking structured byte values. (#3261)
- The Storm `$lib.gen()` functions and associated commands now generate stable guid values based on their inputs when making nodes. (#3268)
- Add the `.bazar` TLD to the list of TLDs identified by the Synapse scrape functionality. (#3271)
- Add the View iden to the task identifier for running Storm tasks. (#3247)
- Add performance related sysctl values to the output of the Storm `Cell.getSystemInfo()` and `$lib.cell.getSystemInfo()` APIs. (#3236)
- Update the allowed versions of the `vcrpy` library. Thank you `captainGeech42` for the contribution. (#3204)

17.80.3 Bugfixes

- Ensure the input to the `CoreAPI.storm()` (and related APIs) is a string. (#3255) (#3269)
- Fix a bug in `synapse.tools.aha.enroll` where a user with a `telepath.yaml` file containing an `aha:servers` key with a list of lists failed to enroll a local user. (#3260)
- Fix an issue where Storm functions using `emit` failed to cleanup their sub-runtimes. (#3250)
- Add verification that a Storm function call is being made on a callable object and raise a `StormRuntimeError` if the object cannot be called. Previously invalid calls could raise a `TypeError`. (#3243)
- Fix the order of the Beholder `cron:stop` message firing when a Cron job is stopped. (#3265)

17.80.4 Improved Documentation

- Add a section to the Storm reference for user defined functions in Storm. That can be found at *Storm Reference - Advanced - Functions*. (#3245)
- Update the devops documentation to add a note about the Telepath `aha://` protocol using a `mirror=true` parameter to connect to a service mirror instead of a leader. (#3267)
- Update the `preboot.sh` example script to account for Docker changes introduced in `v2.133.0`.

17.81 v2.142.2 - 2023-07-19

17.81.1 Bugfixes

- Fix an issue which caused the Docker image tags for `vertexproject/synapse-cryotank:v2.141.1`, `vertexproject/synapse-jsonstor:v2.141.1`, and `vertexproject/synapse-stemcell:v2.141.1`, to refer to same image. (#3249)

17.82 v2.142.1 - 2023-07-19

17.82.1 Bugfixes

- Fix an issue which prevented the publication of the Synapse containers with `v2.x.x` tags. (#3248)

17.83 v2.142.0 - 2023-07-19

17.83.1 Automatic Migrations

- Renormalize the `risk:vuln:cvss:v2` and `risk:vuln:cvss:v3` properties. (#3224)
- Migrate the `risk:vuln:name` type from a `str` to a `risk:vulnname` form. (#3227)
- See *Data Migration* for more information about automatic migrations.

17.83.2 Model Changes

- Update to the `it`, `ou`, and `risk` models. (#3224) (#3227) (#3237)
- See *v2.142.0 Model Updates* for more detailed model changes.

17.83.3 Features and Enhancements

- Always convert dictionary keys to their primitive values when working with dictionary objects in Storm. Dictionary objects can no longer have keys set which are mutable objects, such as Nodes. (#3233)
- Add support for octal constants, such as `0o755`, in Storm expressions. (#3231)
- Add additional events to the Behold API message stream for the addition and removal of extended model elements. (#3228)
- Update the `$lib.dmon.add()` variable capture to record variables from embedded query objects. (#3230)
- Add a `.title()` method on Storm strings to get title case formatted strings. (#3242)
- Add a general purpose process pool using forked workers in order to speed up certain processing operations. This includes the Storm operations for JSONSchema parsing, HTML parsing, STIX validation, and XML parsing. (#3033) (#3229)
- Add a new Cell configuration option, `max:users`. This can be set to limit the maximum number of non-`root` users on Cell. (#3244)
- Add an `/api/v1/aha/services` HTTP API to the Aha service. This can be used to get a list of the services registered with Aha. (#3238)
- Add support for Cosign signatures of tagged Synapse containers. See additional information at *Verifying container image signatures*. (#3196)
- Adjust internal names for Storm objects. (#3229)

17.83.4 Bugfixes

- Fix a bug in the scrape for `inet:ipv4` where IP addresses were found when there was leading or trailing numbers around the IP addresses. (#3234)
- Fix a bug where `$lib.model.ext.delForm()` did not check for extended property definitions before deletion. Extended properties on a custom form must be deleted prior to deleting the form. (#3223)
- Always remove the `mirror` configuration option from `cell.yaml` file when provisioning a service via Aha. The previous behavior prevented the correct restoration of a service from a backup which was previously provisioned as a mirror and is being restored as a leader. (#3240)
- Add additional type checking when adding extended model forms and properties to the Cortex. Previously invalid types could raise an `AttributeError`. (#3243)

17.83.5 Improved Documentation

- Update the Storm lift reference to add an example of lifting nodes by the universal `.created` property. (#3245)

17.84 v2.141.0 - 2023-07-07

17.84.1 Model Changes

- Update to the `it` and `lang` models. (#3219)
- See *v2.141.0 Model Updates* for more detailed model changes.

17.84.2 Features and Enhancements

- Update `$lib.infosec.cvss.vectToScore()` to include a normalized CVSS vector in the output. (#3211)
- Optimize the addition and removal of lightweight edges when operating on N1 edges in Storm. (#3214)
- Added `$lib.gen.langByCode`. (#3219)

17.84.3 Bugfixes

- Fix bug with regular expression comparisons for some types. (#3213)
- Fix a `TypeError` being raised when passing a heavy Number object to `$lib.math.number()`. (#3215)
- Fix an issue with the Cell backup space checks. They now properly calculate the amount of free space when the Cell backup directory is configured on a separate volume from the Cell storage directory. (#3216)
- Prevent the `yield` operator from directly emitting nodes into the Storm pipeline if those node objects came from a different view. Nodes previously lifted in this manner must be lifted by calling the `iden()` function on the object to ensure the node being lifted into the pipeline reflects the current view. (#3218)
- Always remove the `mirror` configuration option from `cell.mods.yaml` when provisioning a service via Aha. The previous behavior prevented the correct restoration of a service from a backup which had been changed from being a leader to being a mirror. (#3220)

17.85 v2.140.1 - 2023-06-30

17.85.1 Bugfixes

- Fix a typo which prevented the Synapse package for `v2.140.0` from being published on PyPI. (#3212)

17.86 v2.140.0 - 2023-06-30

17.86.1 Announcement

Synapse now only supports Python 3.11+.

17.86.2 Model Changes

- Update to the `inet`, `file`, and `ou` models. (#3192) (#3202) (#3207)
- See *v2.140.0 Model Updates* for more detailed model changes.

17.86.3 Features and Enhancements

- Synapse now only supports Python 3.11+. The library will now fail to import on earlier Python interpeters, and the published modules on PyPI will no longer install on Python versions < 3.11. (#3156)
- Replace `setup.py` with a `pyproject.toml` file. (#3156) (#3195)
- Usages of `hashlib.md5()` and `hashlib.sha1()` have been updated to add the `usedforsecurity=False` argument. (#3163)
- The Storm `diff` command is now marked as safe for `readonly` execution. (#3207)
- Add a `svc:set` event to the Behold API message stream. This event is fired when a Cortex connects to a Storm Service. (#3205)

17.86.4 Bugfixes

- Catch `ZeroDivisionError` and `decimal.InvalidOperation` errors in Storm expressions and raise a `StormRuntimeError`. (#3203)
- Fix a bug where `synapse.lib.platforms.linux.getTotalMemory()` did not return the correct value in a process running in cgroupsv1 without a maximum memory limit set. (#3198)
- Fix a bug where a Cron job could be created with an invalid Storm query. Cron jobs now have their queries parsed as part of creation to ensure that they are valid Storm. `$lib.cron` APIs now accept heavy Storm query objects as query inputs. (#3201) (#3207)
- Field data sent via Storm `$lib.inet.http` APIs that uses a multipart upload without a valid `name` field now raises a `BadArg` error. Previously this would result in a Python `TypeError`. (#3199) (#3206)

17.86.5 Deprecations

- Remove the deprecated `synapse.common.lockfile()` function. (#3191)

17.87 v2.139.0 - 2023-06-16

17.87.1 Announcement

Due to the introduction of several powerful new APIs and performance improvements, Synapse will be updating to *only* support Python >=3.11. Our current plan is to drop support for Python <=3.10 in ~4 weeks on 2023-06-19. The next release after 2023-06-19 will include changes that are not backward compatible to earlier versions of Python.

If you currently deploy Synapse Open-Source or Synapse Enterprise via the standard docker containers, you will be unaffected. If you install Synapse via PyPI, you will need to ensure that your environment is updated to Python 3.11+.

17.87.2 Model Changes

- Update `it:sec:cpe` normalization to extend truncated CPE2.3 strings. (#3186)

17.87.3 Features and Enhancements

- The `str` type now accepts `float` values to normalize. (#3174)

17.87.4 Bugfixes

- Fix an issue where the `file:bytes:sha256` property set handler could fail during data merging. (#3180)
- Fix an issue where iterating light edges on nodes could result in degraded Cortex performance. (#3186)

17.87.5 Improved Documentation

- Update the Cortex admin guide to include additional examples for setting up user and role permissions. (#3187)

17.88 v2.138.0 - 2023-06-13

17.88.1 Features and Enhancements

- Add `it:sec:cwe` to the list of types identified with scrape APIs. (#3182)
- Update the calculations done by `$lib.infosec.cvss.vectToScore()` to more closely emulate the NVD CVSS calculator. (#3181)

17.88.2 Bugfixes

- Fix an issue with `synapse.tools.storm` where the `!export` command did not use the view specified when starting the tool. (#3184)
- The `synapse.common.getSslCtx()` API now only attempts to load files in the target directory. This avoids confusing errors that may be logged when the target directory contains sub directories. (#3179)
- Fix an edge case in `$lib.infosec.cvss.vectToScore()` when calculating CVSS v2 scores. (#3181)

17.88.3 Deprecations

- Mark the Python function `synapse.common.lockfile()` as deprecated. It will be removed in `v2.140.0`. (#3183)

17.89 v2.137.0 - 2023-06-09

17.89.1 Automatic Migrations

- Migrate any `inet:url` nodes with `:user` and `:passwd` properties which may have been URL encoded. These values are now decoded. (#3169)
- Migrate the storage type for the `file:bytes:mime:pe:imphash` property. (#3173)
- See *Data Migration* for more information about automatic migrations.

17.89.2 Model Changes

- Updates to the `geospace`, `inet`, `infotech`, `ou`, `risk`, and `transport` models. (#3169)
- See *v2.137.0 Model Updates* for more detailed model changes.

17.89.3 Features and Enhancements

- Add a modulo arithmetic operator (`%`) to Storm expression parsing. (#3168)
- Add `$lib.auth.easyperm` Storm library for interacting with objects that use a simplified permissions model. (#3167)
- Add `.vars` attribute to the Storm `auth:user` object. This can be used to access user variables. (#3167)
- Add `$lib.infosec.cvss.vectToScore()` to calculate CVSS scores. (#3171)
- The Storm `delnode` command node now requires the use of `--force` to delete a node which has lightweight edges pointing to it. (#3176)
- The STIX export configuration may now include a `synapse_extension` value set to `$lib.false` to disable the Synapse STIX extension data from being added to objects in the bundle. (#3177)
- Remove whitespace stripping from Storm queries prior to parsing them. This allows any error highlighting information to accurately reflect the query submitted to the Cortex. (#3175)

17.89.4 Bugfixes

- Fix an issue where raising an integer value to a fractional power in Storm was not handled correctly. (#3170)
- Handle a SyntaxError that may occur during Storm parsing due to a change in CPython 3.11.4. (#3170)
- The `inet:url` type now URL decodes the `user` and `passwd` properties when normalizing them. Thank you `captainGeech42` for the bug report. (#2568) (#3169)
- The URL parser in `synapse.lib.urlhelp` now URL decodes the `user` and `passwd` values when parsing URLs. (#3178)

17.89.5 Deprecations

- Mark the Storm functions `$lib.infosec.cvss.saveVectToNode()` and `$lib.infosec.cvss.vectToProps()` as deprecated. (#3178)

17.90 v2.136.0 - 2023-06-02

17.90.1 Model Changes

- Boolean values in the Synapse model now have lowercase `true` and `false` repr values. (#3159)
- The trailing `.` on the taxonomy repr has been removed. (#3159)

17.90.2 Features and Enhancements

- Normalize tag names when performing lift and filter operations. (#3094)
- Add `$lib.compression.bzip2`, `$lib.compression.gzip`, and `$lib.compression.zlib` Storm libraries to assist with compressing and decompressing bytes. (#3155) (#3162)
- Add a new Cell configuration option, `https:parse:proxy:remoteip`. When this is set to `true`, the Cell HTTPS server will parse `X-Forwarded-For` and `X-Real-IP` headers to determine the remote IP of an request. (#3160)

- Update the allowed versions of the `fastjsonschema` and `pycryptodome` libraries. Update the required version of the `vcrpy` library to account for changes in `urllib3`. Remove the pinned requirement for the `requests` library. (#3164)

17.90.3 Bugfixes

- Prevent zero length tag lift operations. (#3094)
- Fix an issue where tag properties with the type `ival`, or `time` types with `ismin` or `ismax` options set, were not properly merged when being set. (#3161)
- Fix a missing `mesg` value on `NoSuchForm` exception raised by the `layer liftByTag()` API. (#3165)

17.91 v2.135.0 - 2023-05-24

17.91.1 Features and Enhancements

- Add a `--index` option to the Storm `auth.user.grant` command. (#3150)
- Add additional type handling in the Storm view and layer `set()` APIs. (#3147)
- Add a new Storm command, `auth.perms.list`, to list all of the permissions registered with the Cortex. (#3135) (#3154)

17.91.2 Bugfixes

- Fix an issue where attempting a tag lift with a variable containing a zero-length string would raise an MDB error. (#3094)
- Fix an issue in the Axon `csvrows()` and `readlines()` APIs where certain exceptions would not be raised. (#3141)
- Fix an issue with the Storm `runas` command which prevented it being used with a privileged Storm runtime. (#3147)
- Fix support for Storm list objects in `$lib.max()` and `$lib.min()`. (#3153)

17.91.3 Improved Documentation

- Update the Cortex admin guide to include the output of the `auth.perms.list` command. (#3135)

17.92 v2.134.0 - 2023-05-17

17.92.1 Model Changes

- Updates to the `risk` model. (#3137)
- See *v2.134.0 Model Updates* for more detailed model changes.

17.92.2 Features and Enhancements

- Add a `--forms` option to the Storm `scrape` command. This can be used to limit the forms that are made from scraping the input text. The `scrape` command now uses the View scrape interface to generate its matches, which may include scrape functionality added via power-ups. The `scrape` command no longer produces warning messages when matched text is not valid for making nodes. (#3127)
- Add a `revs` definition to the STIX export configuration, to allow for adding in reverse relationships. (#3137)

- Add a `--delbytes` option to the Storm `delnode` command. This can be used to delete the bytes from an Axon when deleting a `file:bytes` node. (#3140)
- Add support for printing nice versions of the Storm `model:form`, `model:property`, `model:tagprop`, and `model:type` objects. (#3134) (#3139)

17.92.3 Bugfixes

- Fix an exception that was raised when setting the parent of a View. (#3131) (#3132)
- Fix an issue with the text scrape regular expressions misidentifying the `ftp://` scheme. (#3127)
- Correctly handle `readonly` properties in the Storm `copyto` command. (#3142)
- Fix an issue were partial service backups were not able to be removed. (#3143) (#3145)

17.93 v2.133.1 - 2023-05-09

17.93.1 Bugfixes

- Fix an issue where the Storm query hashing added in `v2.133.0` did not account for handling erroneous surrogate pairs in query text. (#3130)

17.93.2 Improved Documentation

- Update the Storm API Guide to include the `hash` key in the `init` message. (#3130)

17.94 v2.133.0 - 2023-05-08

17.94.1 Model Changes

- Updates to the `risk` model. (#3123)
- See *v2.133.0 Model Updates* for more detailed model changes.

17.94.2 Features and Enhancements

- Update the base Synapse images to use Debian bookworm and use Python 3.11 as the Python runtime. For users which build custom images from our published images, see additional information at *Working with Synapse Images* for changes which may affect you. (#3025)
- Add a `highlight` parameter to BadSyntaxError and some exceptions raised during the execution of a Storm block. This contains detailed information about where an error occurred in the Storm code. (#3063)
- Allow callers to specify an `iden` value when creating a Storm Dmon or a trigger. (#3121)
- Add support for STIX export configs to specify pivots to include additional nodes. (#3122)
- The Storm `auth.user.addrule` and `auth.role.addrule` now have an optional `--index` argument that allows specifying the rule location as a 0-based index value. (#3124)
- The Storm `auth.user.show` command now shows the user's `admin` status on authgates. (#3124)
- Add a `--only-url` flag to the `synapse.tools.aha.provision.service` and `synapse.tools.aha.provision.user` CLI tools. When set, the tool only prints the URL to stdout. (#3125)
- Add additional layer validation in the View schema. (#3128)
- Update the allowed version of the `cryptography`, `coverage`, `idna`, `pycryptodome`, `python-bitcoin`, and `vcrpy` libraries. (#3025)

17.94.3 Bugfixes

- Ensure the CLI tools `synapse.tools.cellauth`, `synapse.tools.csvtool`, and `synapse.tools.easycert` now return 1 on an execution failure. In some cases they previously returned `-1`. (#3118)

17.95 v2.132.0 - 2023-05-02

17.95.1 Features and Enhancements

- Update the minimum required version of the `fastjsonschema`, `lark`, and `pytz` libraries. Update the allowed version of the `packaging` and `scalecodec` libraries. (#3118)

17.95.2 Bugfixes

- Cap the maximum version of the `requests` library until downstream use of that library has been updated to account for changes in `urllib3`. (#3119)
- Properly add parent scope vars to `background` command context. (#3120)

17.96 v2.131.0 - 2023-05-02

17.96.1 Automatic Migrations

- Migrate the `ou:campaign:name` property from a `str` to an `ou:campname` type and create the `ou:campname` nodes as needed. (#3082)
- Migrate the `risk:vuln:type` property from a `str` to a `risk:vuln:type:taxonomy` type and create the `risk:vuln:type:taxonomy` nodes as needed. (#3082)
- See *Data Migration* for more information about automatic migrations.

17.96.2 Features and Enhancements

- Updates to the `dns`, `inet`, `it`, `ou`, `ps`, and `risk` models. (#3082) (#3108) (#3113)

  `inet:dns:answer`
  Add a `mx:priority` property to record the priority of the MX response.

  `inet:dns:dynreg`
  Add a form to record the registration of a domain with a dynamic DNS provider.

  `inet:proto`
  Add a form to record a network protocol name.

  `inet:web:attachment`
  Add a form to record the instance of a file being sent to a web service by an account.

  `inet:web:file`
  Deprecate the `client`, `client:ipv4`, and `client:ipv6` properties in favor of using `inet:web:attachment`.

  `inet:web:logon`
  Remove incorrect `readonly` markings for properties.

  `it:app:snort:rule`
  Add an `id` property to record the snort rule id. Add an `author` property to record contact information for the rule author. Add `created` and `updated` properties to track when the rule was created and last updated. Add an `enabled` property to record if the rule should be used for snort evaluation engines. Add a `family` property to record the software family the rule is designed to detect.

it:prod:softid
Add a form to record an identifier issued to a given host by a specific software application.

ou:campname
Add a form to record the name of campaigns.

ou:campaign
Change the `name` and `names` secondary properties from `str` to `ou:campname` types.

ps:contact
Add a `place:name` to record the name of the place associated with the contact.

risk:threat
Add an `active` property to record the interval of time when the threat cluster is assessed to have been active. Add a `reporter:published` property to record the time that a reporting organization first publicly disclosed the threat cluster.

risk:tool:software
Add a `used` property to record the interval when the tool is assessed to have been deployed. Add a `reporter:discovered` property to record the time that a reporting organization first discovered the tool. Add a `reporter:published` property to record the time that a reporting organization first publicly disclosed the tool.

risk:vuln:soft:range
Add a form to record a contiguous range of software versions which contain a vulnerability.

risk:vuln
Change the `type` property from a `str` to a `risk:vuln:type:taxonomy`.

risk:vuln:type:taxonomy
Add a form to record a taxonomy of vulnerability types.

- Add a new Storm command, `auth.user.allowed` that can be used to check if a user is allowed to use a given permission and why. (#3114)
- Add a new Storm command, `gen.ou.campaign`, to assist with generating or creating `ou:campaign` nodes. (#3082)
- Add a boolean `default` key to the permissions schema definition. This allows a Storm package permission to note what its default value is. (#3099)
- Data model migrations which fail to normalize existing secondary values into their new types now store those values in Node data on the affected nodes and remove those bad properties from the affected nodes. (#3117)

17.96.3 Bugfixes

- Fix an issue with the search functionality in our documentation missing the required jQuery library. (#3111)
- Unique nodes when performing multi-layer lifts on secondary properties without a value. (#3110)

17.96.4 Improved Documentation

- Add a section about managing data model deprecations to the Synapse Admin guide. (#3102)

17.96.5 Deprecations

- Remove the deprecated `synapse.lib.httpapi.HandlerBase.user()` and `synapse.lib.httpapi.HandlerBase.getUserBody()` functions. Remove the deprecated `synapse.axon.AxonFileHandler.axon()` function. (#3115)

17.97 v2.130.2 - 2023-04-26

17.97.1 Bugfixes

- Fix an issue where the `proxy` argument was not being passed to the Axon when attempting to post a file via Storm with the `$lib.inet.http.post()` API. (#3109)
- Fix an issue where adding a readonly layer that does not already exist would raise an error. (#3106)

17.98 v2.130.1 - 2023-04-25

17.98.1 Bugfixes

- Fix a race condition in a Telepath unit test which was happening during CI testing. (#3104)

17.99 v2.130.0 - 2023-04-25

17.99.1 Features and Enhancements

- Updates to the `infotech` model. (#3095)

  `it:host`
  : Add an `ext:id` property for recording an external identifier for a host.

- Add support for deleting node properties by assigning `$lib.undef` to the property to be removed through `$node.props`. (#3098)
- The `Cell.ahaclient` is longer cached in the `synapse.telepath.aha_clients` dictionary. This isolates the Cell connection to Aha from other clients. (#3008)
- When the Cell mirror loop exits, it now reports the current `ready` status to the Aha service. This allows a service to mark itself as "not ready" when the loop restarts and it is a follower, since it may no longer be in the realtime change window. (#3008)
- Update the required versions of the `nbconvert`, `sphinx` and `hide-code` libraries used for building documentation. Increased the allowed ranges for the `pygments` and `jupyter-client` libraries. (#3103)

17.99.2 Bugfixes

- Fix an issue in backtick format strings where single quotes in certain positions would raise a syntax error. (#3096)
- Fix an issue where permissions were not correctly checked when assigning a property value through `$node.props`. (#3098)
- Fix an issue where the Cell would report a static `ready` value to the Aha service upon reconnecting, instead of the current `ready` status. The `Cell.ahainfo` value was replaced with a `Cell.getAhaInfo()` API which returns the current information to report to the Aha service. (#3008)

17.100 v2.129.0 - 2023-04-17

17.100.1 Features and Enhancements

- Updates to the `ou` and `risk` models. (#3080)

  `ou:campaign`
  : Add a `names` property to record alternative names for the campaign. Add `reporter` and `reporter:name` properties to record information about a reporter of the campaign.

risk:attack
: Add `reporter` and `reporter:name` properties to record information about a reporter of the attack.

risk:compromise
: Add `reporter` and `reporter:name` properties to record information about a reporter of the compromise.

risk:vuln
: Add `reporter` and `reporter:name` properties to record information about a reporter of the vulnerability.

- Add leader status to the `synapse.tools.aha.list` tool output. This will only be available if a leader has been registered for the service. (#3078)
- Add support for private values in Storm modules, which are specified by beginning the name with a double underscore (__). These values cannot be dereferenced outside of the module they are declared in. (#3079)
- Update error messages for Axon.wget, Axon.wput, and Axon.postfiles to include more helpful information. (#3077)
- Update `it:semver` string normalization to attempt parsing improperly formatted semver values. (#3080)
- Update Axon to always pass size value when saving bytes. (#3084)

17.100.2 Bugfixes

- Add missing `toprim()` calls on arguments to some `auth:user` and `auth:role` APIs. (#3086)
- Fix the regular expression used to validate custom STIX types. (#3093)

17.100.3 Improved Documentation

- Add sections on user and role permissions to the Synapse Admin guide. (#3073)

17.101 v2.128.0 - 2023-04-11

17.101.1 Automatic Migrations

- Migrate the `file:bytes:mime:pe:imphash` property from a `guid` to a `hash:md5` type and create the `hash:md5` nodes as needed. (#3056)
- Migrate the `ou:goal:name` property from a `str` to a `ou:goalname` type and create the `ou:goalname` nodes as needed. (#3056)
- Migrate the `ou:goal:type` property from a `str` to a `ou:goal:type:taxonomy` type and create the `ou:goal:type:taxonomy` nodes as needed. (#3056)
- See *Data Migration* for more information about automatic migrations.

17.101.2 Features and Enhancements

- Updates to the `belief`, `file`, `lang`, `it`, `meta`, `ou`, `pol`, and `risk` models. (#3056)

  belief:tenet
  : Add a `desc` property to record the description of the tenet.

  file:bytes
  : Change the type of the `mime:pe:imphash` from `guid` to `hash:md5`.

  inet:flow
  : Add a `raw` property which may be used to store additional protocol data about the flow.

it:app:snort:rule
Add a desc property to record a brief description of the snort rule.

ou:goal
Change the type of name from str to ou:goalname. Change the type of type from str to ou:goal:type:taxonomy. Add a names array to record alternative names for the goal. Deprecate the prev property in favor of types.

ou:goalname
Add a form to record the name of a goal.

ou:goalname:type:taxonomy
Add a taxonomy of goal types.

ou:industry
Add a type property to record the industry taxonomy.

ou:industry:type:taxonomy
Add a taxonomy to record industry types.

pol:immigration:status
Add a form to track the immigration status of a contact.

pol:immigration:status:type:taxonomy
Add a taxonomy of immigration types.

risk:attack
Add a detected property to record the first confirmed detection time of the attack. Add a url property to record a URL that documents the attack. Add a ext:id property to record an external identifier for the attack.

risk:compromise
Add a detected property to record the first confirmed detection time of the compromise.

- Add a Storm command copyto that can be used to create a copy of a node from the current view to a different view. (#3061)
- Add the current View iden to the structured log output of a Cortex executing a Storm query. (#3068)
- Update the allowed versions of the lmdb, msgpack, tornado and xxhash libraries. (#3070)
- Add Python 3.11 tests to the CircleCI configuration. Update some unit tests to account for Python 3.11 related changes. (#3070)
- Allow dereferencing from Storm expressions. (#3071)
- Add an ispart parameter to $lib.tags.prefix to skip syn:tag:part normalization of tag names. (#3074)
- Add getEdges(), getEdgesByN1(), and getEdgesByN2() APIs to the layer object. (#3076)

17.101.3 Bugfixes

- Fix an issue which prevented the auth.user.revoke Storm command from executing. (#3069)
- Fix an issue where $node.data.list() only returned the node data from the topmost layer containing node data. It now returns all the node data accessible for the node from the current view. (#3061)

17.101.4 Improved Documentation

- Update the Developer guide to note that the underlying Python runtime in Synapse images may change between releases. (#3070)

17.102 v2.127.0 - 2023-04-05

17.102.1 Features and Enhancements

- Set `Link` high water mark to one byte in preparation for Python 3.11 support. (#3064)
- Allow specifying dictionary keys in Storm with expressions and backtick format strings. (#3065)
- Allow using deref syntax (`*$form`) when lifting by form with tag (`*$form#tag`) and form with tagprop (`*$form#tag:tagprop`). (#3065)
- Add `cron:start` and `cron:stop` messages to the events emitted by the `behold()` API on the Cortex. These events are only emitted by the leader. (#3062)

17.102.2 Bugfixes

- Fix an issue where an Aha service running on a non-default port would not have that port included in the default Aha URLs. (#3049)
- Restore the `view.addNode()` Storm API behavior where making a node on a View object that corresponds to the currently executing view re-used the current Snap object. This allows nodeedits to be emitted from the Storm message stream. (#3066)

17.103 v2.126.0 - 2023-03-30

17.103.1 Features and Enhancements

- Add additional Storm commands to assist with managing Users and Roles in the Cortex. (#2923) (#3054)

  `auth.gate.show`
  Shows the definition for an AuthGate.

  `auth.role.delrule`
  Used to delete a rule from a Role.

  `auth.role.mod`
  Used to modify properties of a Role.

  `auth.role.del`
  Used to delete a Role.

  `auth.role.show`
  Shows the definition for a Role.

  `auth.role.list`
  List all Roles.

  `auth.user.delrule`
  Used to delete a rule from a User.

  `auth.user.grant`
  Used to grant a Role to a User.

  `auth.user.revoke`
  Used to revoke a Role from a User.

  `auth.role.mod`
  Used to modify properties of a User.

  `auth.user.show`
  Shows the definition of a User.

`auth.user.list`
: List all Users.

- Update some of the auth related objects in Storm: (#2923)

  `auth:role`
  : Add `popRule()` and `getRules()` functions. Add a `.gates` accessor to get all of the AuthGates associated with a role.

  `auth:user`
  : Add `popRule()` and `getRules()` functions. Add a `.gates` accessor to get all of the AuthGates associated with a user.

- Add `$lib.auth.textFromRule()`, `$lib.auth.getPermDefs()` and `$lib.auth.getPermDef()` Storm library APIs to assist with working with permissions. (#2923)
- Add a new Storm library function, `$lib.iters.enum()`, to assist with enumerating an iterable object in Storm. (#2923)
- Update the `NoSuchName` exceptions which can be raised by Aha during service provisioning to clarify they are likely caused by re-using the one-time use URL. (#3047)
- Update `gen.ou.org.hq` command to set `ps:contact:org` if unset. (#3052)
- Add an `optional` flag for Storm package dependencies. (#3058)
- Add `.]`, `[.`, `http[:`, `https[:`, `hxxp[:` and `hxxps[:` to the list of known defanging strategies which are identified and replaced during text scraping. (#3057)

17.103.2 Bugfixes

- Fix an issue where passing a non-string value to `$lib.time.parse` with `errok=$lib.true` would still raise an exception. (#3046)
- Fix an issue where context managers could potentially not release resources after exiting. (#3055)
- Fix an issue where variables with non-string names could be passed into Storm runtimes. (#3059)
- Fix an issue with the Cardano regex used for scraping addresses. (#3057)
- Fix an issue where scraping a partial Cardano address could raise an error. (#3057)
- Fix an issue where the Storm API `view.addNode()` checked permissions against the incorrect authgate. This API now only returns a node if the View object is the same as the View the Storm query is executing in. (#3060)

17.103.3 Improved Documentation

- Fix link to Storm tool in Synapse Power-Ups section. (#3053)
- Add Kubernetes deployment examples, which show deploying Synapse services with Aha based provisioning. Add an example showing one mechanism to set `sysctl`'s in a managed Kubernetes deployment. (#3047)

17.104 v2.125.0 - 2023-03-14

17.104.1 Features and Enhancements

- Add a `size()` method on the STIX bundle object. (#3043)
- Update the minimum version of the `aio-socks` library to `0.8.0`. Update some unittests related to SOCKS proxy support to account for multiple versions of the `python-socks` library. (#3044)

17.104.2 Improved Documentation

- Update the Synapse documentation to add PDF and HTMLZip formats.

17.105 v2.124.0 - 2023-03-09

17.105.1 Features and Enhancements

- Added `--try` option to `gen.risk.vuln`, `gen.pol.country`, `gen.pol.country.government`, and `gen.ps.contact.email` commands and their associated Storm functions. (#3030)
- Added `$lib.gen.orgHqByName` and `$lib.gen.langByName`. (#3030)
- Added the configuration option `onboot:optimize` to all services to allow devops to delay service startup and allow LMDB to optimize storage for both size and performance. May also be set by environment variable `SYN_<SERVICE>_ONBOOT_OPTIMIZE=1` (#3001)
- Ensure that `AuthDeny` exceptions include the user iden in the `user` key, and the name in the `username` field. Previously the `AuthDeny` exceptions had multiple identifiers for these fields. (#3035)
- Add an optional `--view` argument to the `synapse.tools.storm` CLI tool. This allows a user to specify their working View for the Storm CLI. This was contributed by captainGeech42. (#2937)
- Updates to `synapse.lib.scope` and the `Scope` class. A `Scope.copy()` method has been added to create a shallow copy of a `Scope`. A module level `clone(task)` function has been added which clones the current task scope to the target `task`. Async Tasks created with `Base.schedCoro()` calls now get a shallow copy of the parent task scope. (#3021)
- Add a new Storm command, `batch`, to assist in processing nodes in batched sets. (#3034)
- Add global permissions, `storm.macro.admin` and `storm.macro.edit`, to allow users to administer or edit macros. (#3037)
- Mark the following Storm APIs as safe to execute in read-only queries: `$lib.auth.users.get()`, `$lib.auth.users.list()`, `$lib.auth.users.byname()`, `$lib.auth.roles.get()`, `$lib.auth.roles.list()`, `$lib.auth.roles.byname()`, `$lib.auth.gates.get()` and `$lib.auth.gates.list()`. (#3038)
- Added `uplink` key to `getCellInfo()`, which indicates whether the Cell is currently connected to an upstream mirror. (#3041)

17.105.2 Bugfixes

- Fix an issue in the Storm grammar where part of a query could potentially be incorrectly parsed as an unquoted case statement. (#3032)
- Fix an issue where exceptions could be raised which contained data that was not JSON serializable. `$lib.raise` arguments must now also be JSON safe. (#3029)
- Fix an issue where a spawned process returning a non-pickleable exception would not be handled properly. (#3036)
- Fix an issue where a locked user could login to a Synapse service on a TLS Telepath connection if the connection presented a trusted client certificate for the locked user. (#3035)
- Fix a bug in `Scope.enter()` where the added scope frame was not removed when the context manager was exited. (#3021)
- Restoring a service via the `SYN_RESTORE_HTTPS_URL` environment variable could timeout when downloading the file. The total timeout for this process has been disabled. (#3042)

17.105.3 Improved Documentation

- Update the Synapse glossary to add terms related to the permissions system. (#3031)
- Update the model docstrings for the `risk` model. (#3027)

17.105.4 Deprecations

- The `ctor` support in `Scope` has been removed. The population of the global default scope with environment variables has been removed. (#3021)

17.106 v2.123.0 - 2023-02-22

17.106.1 Automatic Migrations

- If the `risk:vuln:cvss:av` property equals `V` it is migrated to `P`. (#3013)
- Parse `inet:http:cookie` nodes to populate the newly added `:name` and `:value` properties. (#3015)
- See *Data Migration* for more information about automatic migrations.

17.106.2 Features and Enhancements

- Added the `belief` model which includes the following new forms: (#3015)

  belief:system
  : A belief system such as an ideology, philosophy, or religion.

  belief:tenet
  : A concrete tenet potentially shared by multiple belief systems.

  belief:subscriber
  : A contact which subscribes to a belief system.

  belief:system:type:taxonomy
  : A hierarchical taxonomy of belief system types.

- Added declaration for `risk:compromise -(uses)> ou:technique` light-weight edges. (#3015)
- Updated `inet:http:session` and `inet:http:request` forms to include the following property: (#3015)

  :cookies
  : An array of `inet:http:cookie` values associated with the node.

- Updated the `inet:http:cookie` form to include the following properties: (#3015)

  name
  : The name of the cookie preceding the equal sign.

  value
  : The value of the cookie after the equal sign if present.

- Added logic to allow constructing multiple `inet:http:cookie` nodes by automatically splitting on `;` such as `foo=bar; baz=faz` (#3015)
- Updated `it:log:event` to add the following properties: (#3015)

  type
  : An `it:log:event:type:taxonomy` type for the log entry.

  ext:id
  : An external ID that uniquely identifies this log entry.

product
An it:prod:softver of the product which produced the log entry.

- Updated the risk:compromise form to include the following properties: (#3015)

goal
An ou:goal node representing the assessed primary goal of the compromise.

goals
An array of ou:goal nodes representing additional goals of the compromise.

- Updated risk:attack and risk:compromise forms to deprecate the techniques property in favor of using -(uses)> ou:technique light-weight edges. (#3015)
- Updates to the inet:dns, and media models. (#3005) (#3017)

inet:dns:answer
Remove all read-only flags present on the secondary properties for this form.

media:news
Add an updated property to record last time the news item was updated.

- Updated inet:flow to include the following properties: (#3017)

src:ssh:key
The key sent by the client as part of an SSH session setup.

dst:ssh:key
The key sent by the server as part of an SSH session setup.

src:ssl:cert
The x509 certificate sent by the client as part of an SSL/TLS negotiation.

dst:ssl:cert
The x509 certificate sent by the server as part of an SSL/TLS negotiation.

src:rdp:hostname
The hostname sent by the client as part of an RDP session setup.

src:rdp:keyboard:layout
The keyboard layout sent by the client as part of an RDP session setup.

- Add synapse.utils.stormcov, a Coverage.py plugin for measuring code coverage of Storm files. (#2961)
- Clean up several references to the cell.auth object in HTTP API handlers. Move the logic in /api/v1/auth/onepass/issue API handler to the base Cell. (#2998) (#3004)
- Clarify the error message encountered by a Synapse mirrored service if the mirror gets desynchronized from its upstream service. (#3006)
- Update how read-only properties are handled during merges. The .created property will always be set when merging a node down. If two nodes have other conflicting read-only property values, those will now emit a warning in the Storm runtime. (#2989)
- The Axon.wget() API response now includes HTTP request history, which is added when the API request encounters redirects. The $lib.axon.wget() Storm API now includes information about the original request URL. This data is now used to create inet:urlredir nodes, such as when the Storm wget command is used to retrieve a file. (#3011)
- Ensure that BadTypeValu exceptions raised when normalizing invalid data with the time type includes the value in the exception message. (#3009)
- Add a callback on Slab size expansion to trigger a free disk space check on the related cell. (#3016)
- Add support for choices in Storm command arguments. (#3019)

- Add an optional parameter to the Storm `uniq` command to allow specifying a relative property or variable to operate on rather than node iden. (#3018)
- Synapse HTTP API logs now include the user iden and username when that information is available. For deployments with structured logging enabled, the HTTP path, HTTP status code, user iden, and username are added to that log message. (#3007)
- Add `web_useriden` and `web_username` attributes to the Synapse HTTP Handler class. These are used for HTTP request logging to populate the user iden and username data. These are automatically set when a user authenticates using a session token or via basic authentication. The HTTP Session tracking now tracks the username at the time the session was created. The `_web_user` value, which previously pointed to a heavy HiveUser object, is no longer populated by default. (#3007)
- Add `$lib.inet.http.codereason` Storm API for translating HTTP status codes to reason phrases. `inet:http:resp` objects now also have a `reason` value populated. (#3023)
- Update the minimum version of the `cryptography` library to `39.0.1` and the minimum version of the `pyopenssl` library to `23.0.0`. (#3022)

17.106.3 Bugfixes

- The Storm `wget` command created `inet:urlfile` nodes with the `url` property of the resolved URL from `aiohttp`. This made it so that a user could not pivot from an `inet:url` node which had a URL encoded parameter string to the resulting `inet:urlfile` node. The `inet:urlfile` nodes are now made with the original request URL to allow that pivoting to occur. (#3011)
- The `Axon.wget()` and `$lib.axon.wget()` APIs returned URLs in the `url` field of their responses which did not contain fragment identifiers. These API responses now include the fragment identifier if it was present in the resolved URL. (#3011)
- The Storm `tree` command did not properly handle Storm query arguments which were declared as `storm:query` types. (#3012)
- Remove an unnecessary permission check in the Storm `movenodes` command which could cause the command to fail. (#3002)
- When a user email address was provided to the HTTP API `/api/v1/auth/adduser`, the handler did not properly set the email using change controlled APIs, so that information would not be sent to mirrored cells. The email is now being set properly. (#2998)
- The `risk:vuln:cvss:av` enum incorrectly included `V` instead of `P`. (#3013)
- Fix an issue where the `ismax` specification on time types did not merge time values correctly. (#3017)
- Fix an issue where using a function call to specify the tag in a tagprop operation would not be correctly parsed. (#3020)

17.106.4 Improved Documentation

- Update copyright notice to always include the current year. (#3010)

17.106.5 Deprecations

- The `synapse.lib.httpapi.Handler.user()` and `synapse.lib.httpapi.Handler.getUserBody()` methods are marked as deprecated. These methods will be removed in Synapse `v2.130.0`. (#3007)

17.107 v2.122.0 - 2023-01-27

17.107.1 Features and Enhancements

- Updates to the `biz`, `file`, `lang`, `meta`, `pol`, and `risk` models. (#2984)

  `biz:service`
  Add a `launched` property to record when the operator first made the service available.

  `file:bytes`
  Add `exe:compiler` and `exe:packer` properties to track the software used to compile and encode the file.

  `lang:language`
  Add a new guid form to represent a written or spoken language.

  `lang:name`
  Add a new form to record the name of a language.

  `meta:node`
  Add a `type` property to record the note type.

  `meta:note:type:taxonomy`
  Add a form to record an analyst defined taxonomy of note types.

  `pol:country`
  Correct the `vitals` property type from `ps:vitals` to `pol:vitals`.

  `ps:contact`
  Add a `lang` property to record the language specified for the contact.

  Add a `langs` property to record the alternative languages specified for the contact.

  `ps:skill`
  Add a form to record a specific skill which a person or organization may have.

  `ps:skill:type:taxonomy`
  Add a form to record a taxonomy of skill types.

  `ps:proficiency`
  Add a form to record the assessment that a given contact possesses a specific skill.

  `risk:alert`
  Add a `priority` property that can be used to rank alerts by priority.

  `risk:compromise`
  Add a `severity` property that can be used as a relative severity score for the compromise.

  `risk:threat`
  Add a `type` property to record the type of the threat cluster.

  `risk:threat:type:taxonomy`
  Add a form to record a taxonomy of threat types.

- Add support for Python 3.10 to Synapse. (#2962)
- Update the Synapse docker containers to be built from a Debian based image, instead of an Ubuntu based image. These images now use Python 3.10 as the Python runtime. (#2962)
- Add an optional `--type` argument to the Storm `note.add` command. (#2984)
- Add a Storm command, `gen.lang.language`, to lift or generate a `lang:language` node by name. (#2984)
- Update the allowed versions of the `cbor2` library; and upgrade the versions of `aiostmplib` and `aiohttp-socks` to their latest versions. (#2986)

- The `X-XSS-Protection` header was removed from the default HTTP API handlers. This header is non-standard and only supported by Safari browsers. Service deployments which rely on this header should use the `https:headers` configuration option to inject that header into their HTTP responses. (#2997)

17.107.2 Bugfixes

- Malformed hash values normalized as `file:bytes` raised exceptions which were not properly caught, causing Storm ?= syntax to fail. Malformed values are now properly handled in `file:bytes`. (#3000)

17.107.3 Improved Documentation

- Update the Storm filters user guide to include expression filters (#2997)
- Update Storm type-specific behavior user guide to clarify `guid` deconfliction use cases and some associated best practices. (#2997)
- Update Storm command reference user guide to document `gen.*` commands. (#2997)

17.107.4 Deprecations

- The Cortex APIs `provStacks()` and `getProvStack(iden)` have been removed. (#2995)

17.108 v2.121.1 - 2022-01-23

17.108.1 Bugfixes

- When creating Storm Macros using `v2.121.0`, the creator of the Macro was incorrectly set to the `root` user. This is now set to the user that created the macro using the Storm `macro.set` command or the `$lib.macro.set()` API. (#2993)

17.109 v2.121.0 - 2022-01-20

17.109.1 Automatic Migrations

- Storm Macros stored in the Cortex are migrated from the Hive to the Cortex LMDB slab. (#2973)
- See *Data Migration* for more information about automatic migrations.

17.109.2 Features and Enhancements

- Updates to the `inet` and `ou` models. (#2982) (#2987)

  `inet:dns:soa`
  : The `fqdn`, `ns` and `email` properties had the read-only flag removed from them.

  `ou:org`
  : Add a `goals` property to record the assessed goals of the organization.

- Add extended permissions for Storm Macro functionality using a new simplified permissions system. This allows users to opt into assigning users or roles the permission to read, write, administrate, or deny access to their Macros. These permissions can be set by the Storm `$lib.macro.grant()` API. (#2973)
- Add extended information about a Storm Macro, including its creation time, update time, and a description. The Macro name, description and Storm can now be set via the Storm `$lib.macro.mod()` API. (#2973)
- Allow users and Power-Ups to store graph projection definitions in the Cortex. Graph projections have the same simplified permissions system applied to them as introduced for Storm Macros. Storm users can now also load a

stored graph projection into a running Storm query. These new features are exposed via the Storm `$lib.graph` APIs. (#2914)

- The disk space required to make the backup of a Synapse service is now checked prior to a live backup being made. If there is insufficient storage to make the backup on the volume storing the backup, a LowSpace exception will be raised. (#2990)

17.109.3 Bugfixes

- When normalizing the `inet:email` type, an unclear Python `ValueError` could have been raised to a user. This is now caught and a specific `BadTypeValu` exception is raised. (#2982)
- The `synapse.exc.StormRaise` exception caused an error when recreating the exception on the client side of a Telepath connection. This exception will now raise properly on the caller side. (#2985)
- When using the Storm `diff` command to examine a forked View, if a node was deleted out from the base layer and edited in the fork, an exception would be raised. This situation is now properly handled. (#2988)

17.109.4 Improved Documentation

- Update the Storm User Guide section on variables for clarity. (#2968)
- Correct Provenance API deprecation notice from `v2.221.0` to `v2.122.0`. (#2981)

17.110 v2.120.0 - 2023-01-11

17.110.1 Features and Enhancements

- Update to the `risk` models. (#2978)

  `risk:threat`
  : Add a `merge:time` and `merged:isnow` properties to track when a threat cluster was merged with another threat cluster.

  `risk:alert`
  : Add an `engine` property to track the software engine that generated the alert.

- Add events for `trigger:add`, `trigger:del`, and `trigger:set` to the Beholder API. (#2975)

17.110.2 Bugfixes

- Fix an infinite loop in `synapse.tools.storm` when using the tool in an environment without write access to the history file. (#2977)

17.111 v2.119.0 - 2023-01-09

17.111.1 Features and Enhancements

- Updates to the `biz`, `econ`, `ou`, and `risk` models. (#2931)

  `biz:listing`
  : Add a form to track a specific product or service listed for sale at a given price by a specific seller.

  `biz:service`
  : Add a form to track a service performed by a specific organization.

  `biz:service:type`
  : Add a form to record an analyst defined taxonomy of business services.

biz:bundle
Add a `service` property to record the service included in the bundle.

Deprecate the `deal` and `purchase` secondary properties in favor of `econ:receipt:item` to represent bundles being sold.

biz:product
Add a `price:currency` property to denote the currency of the prices.

Add a `maker` property to represent the contact information for the maker of a product.

Deprecate the `madeby:org`, `madeby:orgname`, `madeby:orgfqdn` properties in favor of using the new `maker` property.

econ:receipt:item
Add a form to represent a line item included as part of a purchase.

econ:acquired
Deprecate the form in favor of an `acquired` light edge.

ou:campaign
Add a `budget` property to record the budget allocated for the campaign.

Add a `currency` property to record the currency of the `econ:price` secondary properties.

Add a `result:revenue` property to record the revenue resulting from the campaign.

Add a `result:pop` property to record the count of people affected by the campaign.

risk:alert:verdict:taxonomy
Add a form to record an analyst defined taxonomy of the origin and validity of an alert.

risk:alert
Add a `benign` property to record if the alert has been confirmed as benign or malicious.

Add a `verdict` property to record the analyst verdict taxonomy about why an alert is marked as benign or malicious.

- Annotate the following light edges. (#2931)

  acquired
  When used with an `econ:purchase` node, the edge indicates the purchase was used to acquire the target node.

  ipwhois
  When used with an `inet:whois:iprec` node and `inet:ipv4` or `inet:ipv6` nodes, the edge indicates the source IP whois record describes the target IP address.

- Add a new Cell configuration option, `limit:disk:free`. This represents the minimum percentage of free disk space on the volume hosting a Synapse service that is required in order to start up. This value is also monitored every minute and will disable the Cell Nexus if the free space drops below the specified value. This value defaults to five percent (`5 %`) free disk space. (#2920)

17.111.2 Improved Documentation

- Add a Devops task related to configuration of the free space requirement. (#2920)

17.112 v2.118.0 - 2023-01-06

17.112.1 Features and Enhancements

- Updates to the `inet`, `pol`, and `ps` models. (#2970) (#2971)

inet:tunnel
Add a form to represent the specific sequence of hosts forwarding connections, such as a VPN or proxy.

inet:tunnel:type:taxonomy
Add a form to record an analyst defined taxonomy of network tunnel types.

pol:country
Add a `government` property to represent the organization for the government of the country.

ps:contact
Add a `type` property to record the taxonomy of the node. This may be used for entity resolution.

ps:contact:type:taxonomy
Add a form to record an analyst defined taxonomy of contact types.

- Add the following Storm commands to help with analyst generation of several guid node types: (#2970)

gen.it.prod.soft
Lift (or create) an `it:prod:soft` node based on the software name.

gen.ou.industry
Lift (or create) an `ou:industry` node based on the industry name.

gen.ou.org
Lift (or create) an `ou:org` node based on the organization name.

gen.ou.org.hq
Lift (or create) the primary `ps:contact` node for the ou:org based on the organization name.

gen.pol.country
Lift (or create) a `pol:country` node based on the 2 letter ISO-3166 country code.

gen.pol.country.government
Lift (or create) the `ou:org` node representing a country's government based on the 2 letter ISO-3166 country code.

gen.ps.contact.email
Lift (or create) the `ps:contact` node by deconflicting the email and type.

gen.risk.threat
Lift (or create) a `risk:threat` node based on the threat name and reporter name.

gen.risk.tool.software
Lift (or create) a `risk:tool:software` node based on the tool name and reporter name.

gen.risk.vuln
Lift (or create) a `risk:vuln` node based on the CVE.

- Add `$lib.gen.riskThreat()`, `$lib.gen.riskToolSoftware()`, `$lib.gen.psContactByEmail()`, and `$lib.gen.polCountryByIso2()` Storm API functions to assist in generating `risk:threat`, `risk:tool:software`, `ps:contact` and `pol:country` nodes. (#2970)
- Update the CRL bundled within Synapse to revoke the `The Vertex Project Code Signer 00` key. (#2972)

17.112.2 Bugfixes

- Fix an issue in the Axon `csvrows()` and `readlines()` APIs which could cause the Axon service to hang. (#2969)

17.113 v2.117.0 - 2023-01-04

17.113.1 Automatic Migrations

- The `risk:tool:software:soft:names` and `risk:tool:software:techniques` properties are migrated to being unique arrays. (#2950)
- See *Data Migration* for more information about automatic migrations.

17.113.2 Features and Enhancements

- Updates to the `risk` model. (#2950)

  `risk:tool:software`
  : The `soft:names` and `techniques` properties are converted into sorted and uniqued arrays.

- Add support to the Cortex `addStormPkg()` and `$lib.pkg.add()` APIs to load Storm Packages which have been signed to allow cryptographic signature verification. Root CA and intermediate CA certificates have been embedded into Synapse to allow for verification of Rapid Power-Ups signed by The Vertex Project. (#2940) (#2957) (#2963)
- Update `synapse.tools.genpkg` to add optional code signing to Storm packages that it creates. (#2940)
- Update `synapse.tools.genpkg` to require the packages it produces will be JSON compatible when serialized, to avoid possible type coercion issues introduced by the Python `json` library. (#2958)
- Update `synapse.tools.easycert` to allow for creating code signing certificates and managing certificate revocation lists (CRLs). (#2940)
- Add the Nexus index (`nexsindx`) value to the data returned by the `getCellInfo()` APIs. (#2949)
- Allow the Storm backtick format strings to work with multiline strings. (#2956)
- The Storm `Bytes.json()` method now raises exceptions that are `SynErr` subclasses when encountering errors. This method has been updated to add optional `encoding` and `errors` arguments, to control how data is deserialized. (#2945)
- Add support for registering an OAuth2 provider in the Cortex and having user tokens automatically refreshed in the background. These APIs are exposed in Storm under the `$lib.inet.http.oauth.v2` library. (#2910)
- STIX validation no longer caches any downloaded files it may use when attempting to validate STIX objects. (#2966)
- Modified the behavior of Storm emitter functions to remove the read-ahead behavior. (#2953)

17.113.3 Bugfixes

- Fix some error messages in the Snap which did not properly add variables to the message. (#2951)
- Fix an error in the `synapse.tools.aha.enroll` command example. (#2948)
- Fix an error with the `merge` command creating `No form named None` warnings in the Cortex logs. (#2952)
- Fix the Storm `inet:smtp:message` getter and setter for the `html` property so it will correctly produce HTML formatted messages. (#2955)
- Several `certdir` APIs previously allowed through `openssl.crypto.X509StoreContextError` and `openssl.crypto.Error` exceptions. These now raise Synapse `BadCertVerify` and `BadCertBytes` exceptions. (#2940)
- Fix an issue where a Storm package's `modconf` values were mutable. (#2964)

17.113.4 Improved Documentation

- Removed outdated Kubernetes related devops documentation as it is in the process of being rewritten. (#2948)

17.113.5 Deprecations

- The Cortex APIs `provStacks()` and `getProvStack(iden)` and the corresponding Cortex configuration option `provenance:en` have been marked as deprecated and are planned to be removed in `v2.122.0`. (#2682)

17.114 v2.116.0 - 2022-12-14

17.114.1 Automatic Migrations

- The `ou:contract:award:price` and `ou:contract:budget:price` properties are migrated from `econ:currency` to `econ:price` types. (#2943)
- See *Data Migration* for more information about automatic migrations.

17.114.2 Features and Enhancements

- Updates to the `ou` model. (#2943)

  `ou:contract`
  : The `award:price` and `budget:price` properties had their types changed from `econ:currency` to `econ:price`. Add a `currency` secondary property to record the currency of the `econ:price` values.

17.114.3 Bugfixes

- The `synapse.tools.genpkg` tool could raise a Python `TypeError` when the specified package file did not exist. It now raises a `NoSuchFile` exception. (#2941)
- When a service is provisioned with an `aha:provision` URL placed in a `cell.yaml` file, that could create an issue when a mirror is deployed from that service, preventing it from starting up a second time. Services now remove the `aha:provision` key from a `cell.yaml` file when they are booted from a mirror if the URL does not match the boot URL. (#2939)
- When deleting a node from the Cortex, secondary properties defined as arrays were not checked for their references to other nodes. These references are now properly checked prior to node deletion. (#2942)

17.114.4 Improved Documentation

- Add a Devops task for stamping custom users into Synapse containers to run services with arbitrary user and group id values. (#2921)
- Remove an invalid reference to `insecure` mode in HTTP API documentation. (#2938)

17.115 v2.115.1 - 2022-12-02

17.115.1 Features and Enhancements

- Patch release to include an updated version of the `pytest` library in containers.

17.116 v2.115.0 - 2022-12-01

17.116.1 Automatic Migrations

- The `inet:flow:dst:softnames` and `inet:flow:dst:softnames` properties are migrated from `it:dev:str` to `it:prod:softname` types. (#2930)
- See *Data Migration* for more information about automatic migrations.

17.116.2 Features and Enhancements

- Updates to the `inet` model. (#2930)

  `inet:flow`
  : The `dst:softnames` and `src:softnames` properties had their types changed from `it:dev:str` values to `it:prod:softname`.

- Add support for secondary property pivots where the target property is an array type. (#2922)
- The Storm API `$lib.bytes.has()` now returns a false value when the input is null. (#2924)
- When unpacking loop values in Storm, use the primitive value when the item being unpacked is a Storm primitive. (#2928)
- Add a `--del` option to the `synapse.tools.moduser` tool to allow removing a user from a service. (#2933)
- Add entrypoint hooks to the Aha, Axon, Cortex, Cryotank, and JsonStor containers that allow a user to hook the container boot process. (#2919)
- Temporary files created by the Axon, Cortex and base Cell class are now created in the cell local `tmp` directory. In many deployments, this would be located in `/vertex/storage/tmp`. (#2925)
- Update the allowed versions of the `cbor2` and `pycryptodome` libraries. For users installing `synapse[dev]`, `coverage`, `pytest`, `pytest-cov` and `pytest-xdist` are also updated to their latest versions. (#2935)

17.116.3 Bugfixes

- When a Storm Dmon definition lacked a `view` iden, it would previously default to using the Cortex default view. Dmons now prefer to use the user default view before using the Cortex default view. This situation would only happen with Dmons created via the Telepath API where the `view` iden was not provided in the Dmon definition. (#2929)
- Non-integer mask values provided to `inet:cidr4` types now raise a `BadTypeValu` exception. (#2932)
- Fix an incorrect call to `os.unlink` in `synapse.tools.aha.enroll`. (#2926)

17.116.4 Improved Documentation

- Update the automation section of the Synapse User guide, expanding upon the use of cron jobs and triggers across views and forks. (#2917)

17.117 v2.114.0 - 2022-11-15

17.117.1 Features and Enhancements

- Updates to the `crypto` model. (#2909)

  `crypto:key`
  : Add `iv` and `mode` properties to record initialization vectors and cipher modes used with a key.

- Allow the creator for Cron jobs and the user for Triggers to be set. This can be used to effectively change the ownership of these automation elements. (#2908)
- When Storm package `onload` queries produce print, warning, or error messages, those now have the package name included in the message that is logged. (#2913)
- Update the Storm package schema to allow declaring configuration variables. (#2880)

17.117.2 Bugfixes

- The `delCertPath()` APIs in `synapse.lib.easycert` no longer attempt to create a file path on disk when removing the reference count to a certificate path. (#2907)
- Fix error handling when Axon is streaming files with the `readlines()` and `csvrows()` APIs. (#2911)
- The Storm `trigger.list` command failed to print triggers which were created in a Cortex prior to `v2.71.0`. These triggers no longer generate an exception when listed. (#2915)
- Fix an error in the HTTP API example documentation for the `requests` example. (#2918)

17.117.3 Improved Documentation

- Add a Devops task to enable the Python warnings filter to log the use of deprecated Synapse APIs. Python APIs which have been deprecated have had their docstrings updated to reflect their deprecation status. (#2905)

17.118 v2.113.0 - 2022-11-04

17.118.1 Automatic Migrations

- The `risk:tool:software:type` property is migrated to the `risk:tool:software:taxonomy` type. (#2900)
- See *Data Migration* for more information about automatic migrations.

17.118.2 Features and Enhancements

- Updates to the `inet`, `infotech`, `media`, `meta`, `ou`, and `risk` models. (#2897) (#2900) (#2903)

  `inet:email:message:link`
  Add a `text` property to record the displayed hypertext link if it was not a raw URL.

  `inet:web:acct`
  Add a `banner` property representing the banner image for the account.

  `inet:web:mesg`
  Add a `deleted` property to mark if a message was deleted.

  `inet:web:post:link`
  Add a form to record a link contained in the post text.

  `it:mitre:attack:group`
  Add an `isnow` property to record the potential for MITRE groups to be deprecated and renamed.

  `it:mitre:attack:software`
  Add an `isnow` property to record the potential for MITRE software to be deprecated and renamed.

  `it:prod:soft:taxonomy`
  Add a form to record an analyst defined taxonomy of software.

  `it:prod:soft`
  Add a `type` property to record the taxonomy of the software. Deprecated the `techniques` property in favor of the `uses` light edge.

it:sec:cve
Deprecated the desc, url and references properties in favor of using the risk:vuln:cve:desc, risk:vuln:cve:url, and risk:vuln:cve:references properties.

media:news
Add a topics array property to record a list of relevant topics in the article.

media:topic
Add a form for recording different media topics.

meta:rule
Add a url property to record a URL that documents as rule.

Add an ext:id property to record an external identifier for the rule.

meta:sophistication
Add a form to record sophistication score with named values: very low, low, medium, high, and very high.

ou:campaign
Add a sophistication property to record the assessed sophistication of a campaign.

Deprecate the techniques property in favor of using the uses light edge.

ou:hasgoal
Deprecate the ou:hasgoal form in favor of using the ou:org:goals property.

ou:org
Deprecate the techniques property in favor of using the uses light edge.

ou:technique
Add a sophistication property to record the assessed sophistication of a technique.

risk:alert
Add a url property for a URL that documents the alert.

Add an ext:id property to record an external ID for the alert.

risk:attack
Add a sophistication property to record the assessed sophistication of an attack.

risk:availability
Add a taxonomy for availability status values.

risk:threat
Add a sophistication property to record the assessed sophistication of a threat cluster.

Deprecate the techniques property in favor of the uses light edge.

risk:tool:software
Add an availability property to record the assessed availability of the tool.

Add a sophistication property to record the assessed sophistication of the software.

Migrate the type property to risk:tool:software:taxonomy.

Deprecate the techniques property in favor of the uses light edge.

risk:tool:software:taxonomy
Rename the type risk:tool:taxonomy to risk:tool:software:taxonomy.

risk:vuln
Add a mitigated property to record if a mitigation or fix is available for the vulnerability.

Add an exploited property to record if the vulnerability has been exploited in the wild.

Add `timeline:discovered`, `timeline:published`, `timeline:vendor:notified`, `timeline:vendor:fixed`, and `timeline:exploited` properties to record the timeline for significant events on a vulnerability.

Add `cve:desc`, `cve:url`, and `cve:references` secondary properties to record information about the CVE associated with a vulnerability.

Add `nist:nvd:source` to record the name of the organization which reported the vulnerability in the NVD.

Add `nist:nvd:published` and `nist:nvd:modified` to record when the vulnerability was first published, and later modified, in the NVD.

Add `cisa:kev:name`, `cisa:kev:desc`, `cisa:kev:action`, `cisa:kev:vendor`, `cisa:kev:product`, `cisa:kev:added`, `cisa:kev:duedate` properties to record information about the CISA KEV database entry for the vulnerability.

- Annotate the following light edges. (#2900)

  seen
  When used with `meta:source` nodes, the edge indicates the target node was observed by the source node.

  stole
  When used with a `risk:compromise` node, the edge indicates the target node was stolen or copied as a result of the compromise.

  targets
  When used with `risk:attack`, the edge indicates the target node is targeted by the attack.

  When used with `risk:attack` and `ou:industry` nodes, the edge indicates the attack targeted the industry

  When used with `risk:threat`, the edge indicates the target node is targeted by the threat cluster.

  When used with `risk:threat` and `ou:industry` nodes, the edge indicates the threat cluster targets the industry.

  uses
  When used with `ou:campaign` and `ou:technique` nodes, the edge indicates the campaign used a given technique.

  When used with `ou:org` and `ou:technique` nodes, the edge indicates the organization used a given technique.

  When used with `risk:threat`, the edge indicates the target node was used to facilitate the attack.

  When used with `risk:attack` and `ou:technique` nodes, the edge indicates the attack used a given technique.

  When used with `risk:attack` and `risk:vuln` nodes, the edge indicates the attack used the vulnerability.

  When used with `risk:tool:software`, the edge indicates the target node is used by the tool.

  When used with `risk:tool:software` and `ou:technique` nodes, the edge indicates the tool uses the technique.

  When used with `risk:tool:software` and `risk:vuln` nodes, the edge indicates the tool used the vulnerability.

  When used with `risk:threat`, the edge indicates the target node was used by threat cluster.

  When used with `risk:threat` and `ou:technique` nodes, the edge indicates the threat cluster uses the technique.

  When used with `risk:threat` and `risk:vuln` nodes, the edge indicates the threat cluster uses the vulnerability.

- Add `$lib.gen.vulnByCve()` to help generate `risk:vuln` nodes for CVEs. (#2903)
- Add a unary negation operator to Storm expression syntax. (#2886)
- Add `$lib.crypto.hmac.digest()` to compute RFC2104 digests in Storm. (#2902)
- Update the Storm `inet:http:resp.json()` method to add optional `encoding` and `errors` arguments, to control how data is deserialized. (#2898)
- Update the Storm `bytes.decode()` method to add an optional `errors` argument, to control how errors are handled when decoding data. (#2898)
- Logging of role and user permission changes now includes the authgate iden for the changes. (#2891)

17.118.3 Bugfixes

- Catch `RecursionError` exceptions that can occur in very deep Storm pipelines. (#2890)

17.118.4 Improved Documentation

- Update the Storm reference guide to explain backtick format strings. (#2899)
- Update `guid` section on Storm type-specific behavior doc with some additional guid generation examples. (#2901)
- Update Storm control flow documentation to include `init`, `fini`, and `try` / `catch` examples. (#2901)
- Add examples for creating extended model forms and properties to the Synapse admin guide. (#2904)

17.119 v2.112.0 - 2022-10-18

17.119.1 Features and Enhancements

- Add `--email` as an argument to `synapse.tools.moduser` to allow setting a user's email address. (#2891)
- Add support for `hxxp[s]:` prefixes in scrape functions. (#2887)
- Make the SYNDEV_NEXUS_REPLAY resolution use `s_common.envbool()` in the `SynTest.withNexusReplay()` helper. Add `withNexusReplay()` calls to all test helpers which make Cells which previously did not have it available. (#2889) (#2890)
- Add implementations of `getPermDef()` and `getPermDefs()` to the base Cell class. (#2888)

17.119.2 Bugfixes

- Fix an idempotency issue in the JsonStor multiqueue implementation. (#2890)

17.119.3 Improved Documentation

- Add Synapse-GCS (Google Cloud Storage) Advanced Power-Up to the Power-Ups list.

17.120 v2.111.0 - 2022-10-12

17.120.1 Features and Enhancements

- Update the Storm grammar to allow specifying a tag property with a variable. (#2881)
- Add log messages for user and role management activities in the Cell. (#2877)

- The logging of service provisioning steps on Aha and when services were starting up was previously done at the `DEBUG` level. These are now done at the `INFO` level. (#2883)
- The `vertexproject/synapse:` docker images now have the environment variable `SYN_LOG_LEVEL` set to `INFO`. Previously this was `WARNING`. (#2883)

17.120.2 Bugfixes

- Move the Nexus `runMirrorLoop` task to hang off of the Telepath Proxy and not the Telepath client. This results in a faster teardown of the `runMirrorLoop` task during Nexus shutdown. (#2878)
- Remove duplicate tokens presented to users in Storm syntax errors. (#2879)
- When bootstrapping a service mirror with Aha provisioning, the `prov.done` file that was left in the service storage directory was the value from the upstream service, and not the service that has been provisioned. This resulted in `NoSuchName` exceptions when restarting mirrors. The bootstrapping process now records the correct value in the `prov.done` file. (#2882)

17.121 v2.110.0 - 2022-10-07

17.121.1 Features and Enhancements

- Updates to the `geo` model. (#2872)

  `geo:telem`
  : Add an `accuracy` property to record the accuracy of the telemetry reading.

- Add Nexus support to the Axon, to enable mirrored Axon deployments. (#2871)
- Add Nexus support for HTTP API sessions. (#2869)
- Add support for runtime string formatting in Storm. This is done with backtick (`` ` ``) encapsulated strings. An example of this is `$world='world' $lib.print(`hello {$world}`)` (#2870) (#2875)
- Expose user profile storage on the `auth:user` object, with the `profile` ctor. (#2876)
- Storm package command names are now validated against the same regex used by the grammar. The `synapse.tools.genpkg` tool now validates the compiled package against the same schema used by the Cortex. (#2864)
- Add `$lib.gen.newsByUrl()` and `$lib.gen.softByName()` to help generate `media:news` and `it:prod:soft` nodes, respectively. (#2866)
- Add a new realtime event stream system to the Cell, accessible remotely via `CellApi.behold()` and a websocket endpoint, `/api/v1/behold`. This can be used to get realtime changes about services, such as user creation or modification events; or layer and view change events in the Cortex. (#2851)
- Update stored user password hashing to use PBKDF2. Passwords are migrated to this format as successful user logins are performed. (#2868)
- Add the ability to restore a backup tarball from a URL to the Cell startup process. When a Cell starts via `initFromArgv()`, if the environment variable `SYN_RESTORE_HTTPS_URL` is present, that value will be used to retrieve a tarball via HTTPS and extract it to the service local storage, removing any existing data in the directory. This is done prior to any Aha based provisioning. (#2859)

17.121.2 Bugfixes

- The embedded Axon inside of a Cortex (used when the `axon` config option is not set) did not properly have its cell parent set to the Cortex. This has been corrected. (#2857)
- Fix a typo in the `cron.move` help. (#2858)

17.121.3 Improved Documentation

- Update Storm and Storm HTTP API documentation to show the set of `opts` and different types of message that may be streamed by from Storm APIs. Add example HTTP API client code to the Synapse repository. (#2834)
- Update the Data Model and Analytical model background documentation. Expand on the discussion of light edges use. Expand discussion of tags versus forms, linking the two via `:tag` props. (#2848)

17.121.4 Deprecations

- The Cortex HTTP API endpoint `/api/v1/storm/nodes` has been marked as deprecated. (#2682)
- Add deprecation notes to the help for the Storm `splice.undo` and `splice.list` commands. (#2861)
- Provisional Telepath support for Consul based lookups was removed. (#2873)

17.122 v2.109.0 - 2022-09-27

17.122.1 Features and Enhancements

- Add a `format()` API to `str` variables in Storm. (#2849)
- Update the Telepath user resolution for TLS links to prefer resolving users by the Cell `aha:network` over the certificate common name. (#2850)
- Update all Synapse tools which make telepath connections to use the `withTeleEnv()` helper. (#2844)
- Update the Telepath and HTTPs TLS listeners to drop RSA based key exchanges and disable client initiated renegotiation. (#2845)
- Update the minimum allowed versions of the `aioimaplib` and `oauthlib` libraries. (#2847) (#2854)

17.122.2 Bugfixes

- Correct default Telepath `cell://` paths in Synapse tools. (#2853)
- Fix typos in the inline documentation for several model elements. (#2852)
- Adjust expression syntax rules in Storm grammar to remove incorrect whitespace sensitivity in certain expression operators. (#2846)

17.122.3 Improved Documentation

- Update Storm and Storm HTTP API documentation to show the set of `opts` and different types of message that may be streamed by from Storm APIs. Add example HTTP API client code to the Synapse repository. (#2834)
- Update the Data Model and Analytical model background documentation. Expand on the discussion of light edges use. Expand discussion of tags versus forms, linking the two via `:tag` props. (#2848)

17.123 v2.108.0 - 2022-09-12

17.123.1 Features and Enhancements

- Update the Telepath TLS connections to require a minimum TLS version of 1.2. (#2833)
- Update the Axon implementation to use the `initServiceStorage()` and `initServiceRuntime()` methods, instead of overriding `__anit__`. (#2837)
- Update the minimum allowed versions of the `aiosmtplib` and `regex` libraries. (#2832) (#2841)

17.123.2 Bugfixes

- Catch `LarkError` exceptions in all Storm query parsing modes. (#2840)
- Catch `FileNotFound` errors in `synapse.tools.healthcheck`. This could be caused by the tool running during container startup, and prior to a service making its Unix listening socket available. (#2836)
- Fix an issue in `Axon.csvrows()` where invalid data would cause processing of a file to stop. (#2835)
- Address a deprecation warning in the Synapse codebase. (#2842)
- Correct the type of `syn:splice:splice` to be `data`. Previously it was `str`. (#2839)

17.123.3 Improved Documentation

- Replace `livenessProbe` references with `readinessProbe` in the Kubernetes documentation and examples. The `startupProbe.failureThreshold` value was increased to its maximum value. (#2838)
- Fix a typo in the Rapid Power-Up documentation. (#2831)

17.124 v2.107.0 - 2022-09-01

17.124.1 Automatic Migrations

- Migrate the `risk:alert:type` property to a `taxonomy` type and create new nodes as needed. (#2828)
- Migrate the `pol:country:name` property to a `geo:name` type and create new nodes as needed. (#2828)
- See *Data Migration* for more information about automatic migrations.

17.124.2 Features and Enhancements

- Updates to the `geo`, `inet`, `media`, `pol`, `proj`, and `risk` models. (#2828) (#2829)

  `geo:area`
  Add a new type to record the size of a geographic area.

  `geo:place:taxonomy`
  Add a form to record an analyst defined taxonomy of different places.

  `geo:place`
  Add a `type` property to record the taxonomy of a place.

  `inet:web:memb`
  This form has been deprecated.

  `inet:web:member`
  Add a guid form that represents a web account's membership in a channel or group.

  `media:news:taxonomy`
  Add a form to record an analyst defined taxonomy of different types or sources of news.

  `media:news`
  Add a `type` property to record the taxonomy of the news. Add an `ext:id` property to record an external identifier provided by a publisher.

  `pol:vitals`
  Add a guid form to record the vitals for a country.

  `pol:country`
  Add `names`, `place`, `dissolved` and `vitals` secondary properties. The `name` is changed from a `str` to a `geo:name` type. Deprecate the `pop` secondary property.

`pol:candidate`
: Add an `incumbent` property to note if the candidate was an incumbent in a race.

`proj`
: Add missing docstrings to the `proj` model forms.

`risk:alert:taxonomy`
: Add a form to record an analyst defined taxonomy of alert types.

`risk:alert`
: The `type` property is changed from a `str` to the `risk:alert:taxonomy` type.

- Add ** as a power operator for Storm expression syntax. (#2827)
- Add a new test helper, `synapse.test.utils.StormPkgTest` to assist with testing Rapid Power-Ups. (#2819)
- Add `$lib.axon.metrics()` to get the metrics from the Axon that the Cortex is connected to. (#2818)
- Add `pack()` methods to the `auth:user` and `auth:role` objects. This API returns the definitions of the User and Role objects. (#2823)
- Change the Storm Package `require` values to log debug messages instead of raising exceptions if the requirements are not met. Add a `$lib.pkg.deps()` API that allows inspecting if a package has its dependencies met or has conflicts. (#2820)

17.124.3 Bugfixes

- Prevent `None` objects from being normalized as tag parts from variables in Storm. (#2822)
- Avoid intermediate conversion to floats during storage operations related to Synapse Number objects in Storm. (#2825)

17.124.4 Improved Documentation

- Add Developer documentation for writing Rapid Power-Ups. (#2803)
- Add the `synapse.tests.utils` package to the Synapse API autodocs. (#2819)
- Update Devops documentation to note the storage requirements for taking backups of Synapse services. (#2824)
- Update the Storm `min` and `max` command help to clarify their usage. (#2826)

17.125 v2.106.0 - 2022-08-23

17.125.1 Features and Enhancements

- Add a new tool, `synapse.tools.axon2axon`, for copying the data from one Axon to another Axon. (#2813) (#2816)

17.125.2 Bugfixes

- Subquery filters did not update runtime variables in the outer scope. This behavior has been updated to make subquery filter behavior consistent with regular subqueries. (#2815)
- Fix an issue with converting the Number Storm primitive into its Python primitive. (#2811)

17.126 v2.105.0 - 2022-08-19

17.126.1 Features and Enhancements

- Add a Number primitive to Storm to facilitate fixed point math operations. Values in expressions which are parsed as floating point values will now be Numbers by default. Values can also be cast to Numbers with `$lib.math.number()`. (#2762)
- Add `$lib.basex.encode()` and `$lib.basex.decode()` for encoding and decoding strings using arbitrary charsets. (#2807)
- The tag removal operator (`-#`) now accepts lists of tags to remove. (#2808)
- Add a `$node.difftags()` API to calculate and optionally apply the difference between a list of tags and those present on a node. (#2808)
- Scraped Ethereum addresses are now returned in their EIP55 checksummed form. This change also applies to lookup mode. (#2809)
- Updates to the `mat`, `ps`, and `risk` models. (#2804)

  `mass`
  Add a type for storing mass with grams as a base unit.

  `ps:vitals`
  Add a form to record statistics and demographic data about a person or contact.

  `ps:person`
  Add a `vitals` secondary property to record the most recent known vitals for the person.

  `ps:contact`
  Add a `vitals` secondary property to record the most recent known vitals for the contact.

  `risk:tool:taxonomy`
  Add a form to record an analyst defined taxonomy of different tools.

  `risk:tool:software`
  Add a form to record software tools used in threat activity.

  `risk:threat`
  Add `reporter`, `reporter:name`, `org:loc`, `org:names`, and `goals` secondary properties.

- Annotate the following light edges. (#2804)

  `uses`
  When used with `risk:threat` nodes, the edge indicates the target node is used by the source node.

17.126.2 Bugfixes

- Fix language used in the `model.deprecated.check` command. (#2806)
- Remove the `-y` switch in the `count` command. (#2806)

17.127 v2.104.0 - 2022-08-09

17.127.1 Automatic Migrations

- Migrate *crypto:x509:cert:serial* from *str* to *hex* type. Existing values which cannot be converted as integers or hex values will be moved into nodedata under the key `migration:0_2_10` as `{'serial': value}` (#2789)
- Migrate `ps:contact:title` to the `ou:jobtitle` type and create `ou:jobtitle` nodes. (#2789)

- Correct hugenum property index values for values with more than 28 digits of precision. (#2766)
- See *Data Migration* for more information about automatic migrations.

17.127.2 Features and Enhancements

- Updates to the `crypto` and `ps` models. (#2789)

  `crypto:x509:cert`
  The `serial` secondary property has been changed from a `str` to a `hex` type.

  `ps:contact`
  The type of the `title` secondary property has been changed from a `str` to an `ou:jobtitle`.

- Add `$lib.hex.toint()`, `$lib.hex.fromint()`, `$lib.hex.trimext()` and `$lib.hex.signext()` Storm APIs for handling hex encoded integers. (#2789)
- Add `set()` and `setdefault()` APIs on the SynErr exception class. Improve support for unpickling SynErr exceptions. (#2797)
- Add logging configuration to methods which are called in spawned processes, and log exceptions occurring in the processes before tearing them down. (#2795)

17.127.3 Bugfixes

- BadTypeValu errors raised when normalizing a tag timestamp now include the name of the tag being set. (#2797)
- Correct a CI issue that prevented the v2.103.0 Docker images from being published. (#2798)

17.127.4 Improved Documentation

- Update data model documentation. (#2796)

17.128 v2.103.0 - 2022-08-05

17.128.1 Features and Enhancements

- Updates to the `it`, `ou`, and `risk` models. (#2778)

  `it:prod:soft`
  Add a `techniques` secondary property to record techniques employed by the author of the software.

  `ou:campaign`
  Add a `techniques` secondary property to record techniques employed by the campaign.

  `ou:org`
  Add a `techniques` secondary property to record techniques employed by the org.

  `ou:technique`
  Add a form to record specific techniques used to achieve a goal.

  `ou:technique:taxonomy`
  Add a form to record an analyst defined taxonomy of different techniques.

  `risk:attack`
  Add a `techniques` secondary property to record techniques employed during the attack. Deprecate the following secondary properties, in favor of using light edges.

  - `target`
  - `target:host`

- target:org
- target:person
- target:place
- used:email
- used:file
- used:host
- used:server
- used:software
- used:url
- used:vuln
- via:email
- via:ipv4
- via:ipv6
- via:phone

risk:compromise
Add a techniques secondary property to record techniques employed during the compromise.

risk:threat
Add a form to record a threat cluster or subgraph of threat activity attributable to one group.

- Annotate the following light edges. (#2778)

  targets
  When used with ou:org, ou:campaign, risk:threat, or risk:attack nodes, the edge indicates the target node was targeted by the source node.

  uses
  When used with an ou:campaign or risk:attack node, the edge indicates the target node is used by the source node.

- Change the behavior of the Storm count command to consume nodes. If the previous behavior is desired, use the --yield option when invoking the count command. (#2779)
- Add $lib.random.int() API to Storm for generating random integers. (#2783)
- Add a new tool, synapse.tools.livebackup for taking a live backup of a service. (#2788)
- The Storm $lib.jsonstor.cacheset() API now returns a dict containing the path and time. The $lib.jsonstor.cacheget() API now has an argument to retrieve the entire set of enveloped data. (#2790)
- Add a HTTP 404 handler for the Axon v1/by/sha256/<sha256> endpoint which catches invalid <sha256> values. (#2780)
- Add helper scripts for doing bulk Synapse Docker image builds and testing. (#2716)
- Add aha:\\ support to synapse.tools.csvtool. (#2791)

17.128.2 Bugfixes

- Ensure that errors that occur when backing up a service are logged prior to tearing down the subprocess performing the backup. (#2781)
- Add missing docstring for $lib.stix.import. (#2786)

- Allow setting tags on a Node from a Storm `List` object. (#2782)

17.128.3 Improved Documentation

- Remove `synapse-google-ct` from the list of Rapid Power-Ups. (#2779)
- Add developer documentation for building Synapse Docker containers. (#2716)
- Fix spelling errors in model documentation. (#2782)

17.128.4 Deprecations

- The `vertexproject/synapse:master-py37` and `vertexproject/synapse:v2.x.x-py37` Docker containers are no longer being built. (#2716)

17.129 v2.102.0 - 2022-07-25

17.129.1 Features and Enhancements

- Updates to the `crypto`, `geo`, `inet`, `mat`, `media`, `ou`, `pol`, and `proj` models. (#2757) (#2771)

  `crypto:key`
  Add `public:md5`, `public:sha1`, and `public:sha256` secondary properties to record those hashes for the public key. Add `private:md5`, `private:sha1`, and `private:sha256` secondary properties to record those hashes for the public key.

  `geo:nloc`
  The `geo:nloc` form has been deprecated.

  `geo:telem`
  Add a new form to record a the location of a given node at a given time. This replaces the use of `geo:nloc`.

  `it:sec:c2:config`
  Add a `proxies` secondary property to record proxy URLS used to communicate to a C2 server. Add a `listens` secondary property to record urls the software should bind. Add a `dns:resolvers` secondary property to record DNS servers the software should use. Add a `http:headers` secondary property to record HTTP headers the software should use.

  `it:exec:query`
  Add a new form to record an instance of a query executed on a host.

  `it:query`
  Add a new form to record query strings.

  `mat:type`
  Add a taxonomy type to record taxonomies of material specifications or items.

  `mat:item`
  Add a `type` secondary property to record the item type.

  `mat:spec`
  Add a `type` secondary property to record the item type.

  `media:news`
  Add a `publisher` secondary property to record the org that published the news. Add a `publisher:name` secondary property to record the name of the org. Deprecate the `org` secondary property.

  `ou:campaign`
  Add a `conflict` secondary property to record the primary conflict associated the campaign.

ou:conflict
Add a new form to record a conflict between two or more campaigns which have mutually exclusive goals.

ou:contribution
Add a new form to represent contributing material support to a campaign.

pol:election
Add a new form to record an election.

pol:race
Add a new form to record indivdual races in an election.

pol:office
Add a new form to record an appointed or elected office.

pol:term
Add a new form to record the term in office for an individual.

pol:candidate
Add a form to record a candidate for a given race.

pol:pollingplace
Add a form to record the polling locations for a given election.

proj:ticket
Add a `ext:creator` secondary form to record contact information from and external system.

- Annotate the following light edges. (#2757)

  about
  A light edge created by the Storm `note.add` command, which records the relationship between a `meta:note` node and the target node.

  includes
  When used with a `ou:contribution` node, the edge indicates the target node was the contribution made.

  has
  When used with a `meta:ruleset` and `meta:rule` node, indicates the ruleset contains the rule.

  matches
  When used with a `meta:rule` node, the edge indicates the target node matches the rule.

  refs
  A light edge where the source node refers to the target node.

  seenat
  When used with a `geo:telem` target node, the edge indicates the source node was seen a given location.

  uses
  When used with a `ou:org` node, the edge indicates the target node is used by the organization.

- Commonly used light edges are now being annotated in the model, and are available through Cortex APIs which expose the data model. (#2757)
- Make Storm command argument parsing errors into exceptions. Previously the argument parsing would cause the Storm runtime to be torn down with `print` messages, which could be missed. This now means that automations which have a invalid Storm command invocation will fail loudly. (#2769)
- Allow a Storm API caller to set the task identifier by setting the `task` value in the Storm `opts` dictionary. (#2768) (#2774)
- Add support for registering and exporting custom STIX objects with the `$lib.stix` Storm APIS. (#2773)
- Add APIS and Storm APIs for enumerating mirrors that have been registered with AHA. (#2760)

17.129.2 Bugfixes

- Ensure that auto-adds are created when merging part of a View when using the Storm `merge --apply` command. (#2770)
- Add missing support for handling timezone offsets without colon separators when normalizing `time` values. `time` values which contain timezone offsets and not enough data to resolve minute level resolution will now fail to parse. (#2772)
- Fix an issue when normalizing `inet:url` values when the host value was the IPv4 address `0.0.0.0`. (#2771)
- Fix an issue with the Storm `cron.list` command, where the command failed to run when a user had been deleted. (#2776)

17.129.3 Improved Documentation

- Update the Storm user documentation to include the Embedded Property syntax, which is a shorthand (`::`) that can be used to reference properties on adjacent nodes. (#2767)
- Update the Synapse Glossary. (#2767)
- Update Devops documentation to clarify the Aha URLs which end with``...`` are intentional. (#2775)

17.130 v2.101.1 - 2022-07-14

17.130.1 Bugfixes

- Fix an issue where the Storm `scrape` command could fail to run with inbound nodes. (#2761)
- Fix broken links in documentation. (#2763)
- Fix an issue with the Axon `AxonHttpBySha256V1` API handler related to detecting `Range` support in the Axon. (#2764)

17.131 v2.101.0 - 2022-07-12

17.131.1 Automatic Migrations

- Create nodes in the Cortex for the updated properties noted in the data model updates listed below.
- Axon indices are migrated to account for storing offset information to support the new offset and size API options.
- See *Data Migration* for more information about automatic migrations.

17.131.2 Features and Enhancements

- Updates to the `crypto`, `infotech`, `ps`, and `transport` models. (#2720) (#2738) (#2739) (#2747)

  `crypto:smart:effect:minttoken`
  Add a new form to model smart contract effects which create non-fungible tokens.

  `crypto:smart:effect:burntoken``
  Add a new form to model smart contract effects which destroy non-fungible tokens.

  `crypto:smart:effect:proxytoken`
  Add a new form that tracks grants for a non-owner address the ability to manipulate a specific non-fungible token.

`crypto:smart:effect:proxytokenall`
: Add a new form that tracks grants for a non-owner address the ability to manipulate all of the non-fungible tokens.

`crypto:smart:effect:proxytokens`
: Add a new form that tracks grants for a non-owner address to manipulate fungible tokens.

`it:av:signame`
: Add a new form to track AV signature names. Migrate `it:av:filehit:sig:name` and `it:av:sig:name` to use the new form.

`it:exec:proc`
: Add a `name` secondary property to track the display name of a process. Add a `path:base` secondary property to track the basename of the executable for the process.

`ps:contact`
: Add an `orgnames` secondary property to track an array of orgnames associated with a contact.

`transport:sea:vessel`
: Add `make` and `model` secondary properties to track information about the vessel.

- Add a new Storm command, `movenodes`, that can be used to move a node entirely from one layer to another. (#2714)
- Add a new Storm library, `$lib.gen`, to assist with creating nodes based on secondary property based deconfliction. (#2754)
- Add a `sorted()` method to the `stat:tally` object, to simplify handling of tallied data. (#2748)
- Add a new Storm function, `$lib.mime.html.totext()`, to extract inner tag text from HTML strings. (#2744)
- Add Storm functions `$lib.crypto.hashes.md5()`, `$lib.crypto.hashes.sha1()`, `$lib.crypto.hashes.sha256()` and `$lib.crypto.hashes.sha512()` to allow hashing bytes directly in Storm. (#2743)
- Add an `Axon.csvrows()` API for streaming CSV rows from an Axon, and a corresponding `$lib.axon.csvrows()` Storm API. (#2719)
- Expand Synapse requirements to include updated versions of the `pycryptome`, `pygments`, and `scalecodec` modules. (#2752)
- Add range support to `Axon.get()` to read bytes from a given offset and size. The `/api/v1/axon/files/by/sha256/<SHA-256>` HTTP API has been updated to support a `Range` header that accepts a `bytes` value to read a subset of bytes that way as well. (#2731) (#2755) (#2758)

17.131.3 Bugfixes

- Fix `$lib.time.parse()` when `%z` is used in the format specifier. (#2749)
- Non-string form-data fields are now serialized as JSON when using the `Axon.postfiles()` API. (#2751) (#2759)
- Fix a byte-alignment issue in the `Axon.readlines()` API. (#2719)

17.132 v2.100.0 - 2022-06-30

17.132.1 Features and Enhancements

- Support parsing CVSS version 3.1 prefix values. (#2732)

17.132.2 Bugfixes

- Normalize tag value lists in `snap.addTag()` to properly handle JSON inputs from HTTP APIs. (#2734)
- Fix an issue that allowed multiple concurrent streaming backups to occur. (#2725)

17.132.3 Improved Documentation

- Add an entry to the devops task documentation for trimming Nexus logs. (#2730)
- Update the list of available Rapid Power-Ups. (#2735)

17.133 v2.99.0 - 2022-06-23

17.133.1 Features and Enhancements

- Add an extensible STIX 2.1 import library, `$lib.stix.import`. The function `$lib.stix.import.ingest()` can be used to STIX bundles into a Cortex via Storm. (#2727)
- Add a Storm `uptime` command to display the uptime of a Cortex or a Storm Service configured on the Cortex. (#2728)
- Add `--view` and `--optsfile` arguments to `synapse.tools.csvtool`. (#2726)

17.133.2 Bugfixes

- Fix an issue getting the maximum available memory for a host running with Linux cgroupsv2 apis. (#2728)

17.134 v2.98.0 - 2022-06-17

17.134.1 Features and Enhancements

- Updates to the `econ` model. (#2717)

  `econ:acct:balance`
  : Add `total:received` and `total:sent` properties to record total currency sent and received by the account.

- Add additional debug logging for Aha provisioning. (#2722)
- Adjust whitespace requirements on Storm grammar related to tags. (#2721)
- Always run the function provided to the Storm `divert` command per node. (#2718)

17.134.2 Bugfixes

- Fix an issue that prevented function arguments named `func` in Storm function calls. (#2715)
- Ensure that active coroutines have been cancelled when changing a Cell from active to passive status; before starting any passive coroutines. (#2713)
- Fix an issue where `Nexus._tellAhaReady` was registering with the Aha service when the Cell did not have a proper Aha service name set. (#2723)

17.135 v2.97.0 - 2022-06-06

17.135.1 Features and Enhancements

- Add an `/api/v1/aha/provision/service` HTTP API to the Aha service. This can be used to generate `aha:provision` URLs. (#2707)
- Add `proxy` options to `$lib.inet.http` Storm APIs, to allow an admin user to specify an alternative (or to disable) proxy setting. (#2706)
- Add a `--tag` and `--prop` option to the Storm `diff` command. Update the Storm `merge` command examples to show more real-world use cases. (#2710)
- Add the ability to set the layers in a non-forked view with the `$view.set(layers, $iden)` API on the Storm view object. (#2711)
- Improve Storm parser logic for handling list and expression syntax. (#2698) (#2708)

17.135.2 Bugfixes

- Improve error handling of double quoted strings in Storm when null characters are present in the raw query string. This situation now raises a BadSyntax error instead of an opaque Python ValueError. (#2709)
- Fix unquoted JSON keys which were incorrectly allowed in Storm JSON style expression syntax. (#2698)
- When merging layer data, add missing permission checks for light edge and node data changes. (#2671)

17.136 v2.96.0 - 2022-05-31

17.136.1 Features and Enhancements

- Updates to the `transport` model. (#2697)

  `velocity`
  : Add a new base type to record velocities in millimeters/second.

  `transport:direction`
  : Add a new type to indicate a direction of movement with respect to true North.

  `transport:air:telem`
  : Add `:course` and `:heading` properties to record the direction of travel. Add `:speed`, `:airspeed` and `:verticalspeed` properties to record the speed of travel.

  `transport:sea:telem`
  : Add `:course` and `:heading` properties to record the direction of travel. Add a `:speed` property to record the speed of travel. Add `:destination`, `:destination:name` and `:destination:eta` to record information about the destination.

- Restore the precedence of environment variables over `cell.yaml` options during Cell startup. API driven overrides are now stored in the `cell.mods.yaml` file. (#2699)
- Add `--dmon-port` and `--https-port` options to the `synapse.tools.aha.provision.service` tool in order to specify fixed listening ports during provisioning. (#2703)
- Add the ability of `synapse.tools.moduser` to set user passwords. (#2695)
- Restore the call to the `recover()` method on the Nexus during Cell startup. (#2701)
- Add `mesg` arguments to `NoSuchLayer` exceptions. (#2696)
- Make the LMDB slab startup more resilient to a corrupted `cell.opts.yaml` file. (#2694)

17.136.2 Bugfixes

- Fix missing variable checks in Storm. (#2702)

17.136.3 Improved Documentation

- Add a warning to the deployment guide about using Docker on Mac OS. (#2700)

17.137 v2.95.1 - 2022-05-24

17.137.1 Bugfixes

- Fix a regression in the Telepath `aha://` update from `v2.95.0`. (#2693)

17.138 v2.95.0 - 2022-05-24

17.138.1 Features and Enhancements

- Add a `search` mode to Storm. The `search` mode utilizes the Storm search interface to lift nodes. The `lookup` mode no longer uses the search interface. (#2689)
- Add a `?mirror=true` flag to `aha://` Telepath URLs which will cause the Aha service lookups to prefer using a mirror of the service rather than the leader. (#2681)
- Add `$lib.inet.http.urlencode()` and `$lib.inet.http.urldecode()` Storm APIs for handling URL encoding. (#2688)
- Add type validation for all Cell configuration options throughout the lifetime of the Cell and all operations which modify its configuration values. This prevents invalid values from being persisted on disk. (#2687) (#2691)

17.138.2 Bugfixes

- Fix an issue where the = sign in the Storm grammar was assigned an anonymous terminal name by the grammar parser. This caused an issue with interpreting various syntax errors. (#2690)

17.139 v2.94.0 - 2022-05-18

17.139.1 Automatic Migrations

- Re-normalize the migrated properties noted in the data model updates listed below. See *Data Migration* for more information about automatic migrations.

17.139.2 Features and Enhancements

- Updates to the `crypto`, `infotech`, `ou`, and `person` models. (#2620) (#2684)

  `crypto:algorithm`
  : Add a form to represent a named cryptography algorithm.

  `crypto:key`
  : Add a form to represent a cryptographic key and algorithm.

  `crypto:smart:effect:transfertoken`
  : Add a form to represent the effect of transferring ownership of a non-fungible token.

  `crypto:smart:effect:transfertokens`
  : Add a form to represent the effect of transferring multiple fungible tokens.

crypto:smart:effect:edittokensupply
Add a form to represent the increase or decrease in the supply of fungible tokens.

it:prod:softname
Add a form to represent a software name.

it:host
Add a :os:name secondary property.

it:mitre:attack:software
Migrate the :name and :names properties to it:prod:softname type.

it:prod:soft
Migrate the :name and :names properties to it:prod:softname type.

it:prod:softver
Deprecate the :software:name property. Migrate the :name and :names properties to it:prod:softname type.

it:app:yara:rule
Add a :family property to represent the software family the rule is designed to detect.

it:sec:c2:config
Add a form to represent C2 configuration data.

ou:campaign
Add a :org:name property to represent the name of the organization responsible the campaign. Add a :org:fqdn property to represent the fqdn of the organization responsible the campaign. Add a :team property to represent the team responsible for the campaign.

ou:team
Add a form to represent a team within an organization.

ou:industry
Migrate the :name property to ou:industryname type. Add a :names property for alternative names.

ou:industryname
Add a form to represent the name of an industry.

ou:position
Add a :team property to represent the team associated with a given position.

ps:contact
Add a :crypto:address property to represent the crypto currency address associated with the contact.

- Add $lib.copy() to Storm. This allows making copies of objects which are compatible with being serialized with msgpack. (#2678)
- Remove *print* events from the Storm *limit* command. (#2674)

17.139.3 Bugfixes

- Fix an issue where client certificates presented in Telepath ssl connections could fallback to resolving users by a prefix. This was not intended to be allowed when client certificates are used with Telepath. (#2675)
- Fix an issue where node:del triggers could fail to fire when adding nodeedits directly to a view or snap. (#2654)
- Fix header escaping when generating autodoc content for Synapse Cells. (#2677)
- Assorted unit tests fixes to make tests more stable. (#2680)
- Fix an issue with Storm function argument parsing. (#2685)

17.139.4 Improved Documentation

- Add an introduction to Storm libraries and types. (#2670) (#2683)
- Fix small typos and corrections in the devops documentation. (#2673)

17.140 v2.93.0 - 2022-05-04

17.140.1 Features and Enhancements

- Updates to the `inet` and `infotech` models. (#2666)

  `:sandbox:file`
  : Add a `sandbox:file` property to record an initial sample from a sandbox environment to the following forms:

    ```
    it:exec:proc  it:exec:thread  it:exec:loadlib  it:exec:mmap  it:exec:mutex
    it:exec:pipe  it:exec:url  it:exec:bind  it:exec:file:add  it:exec:file:del
    it:exec:file:read  it:exec:file:write  it:exec:reg:del  it:exec:reg:get
    it:exec:reg:set
    ```

  `it:host:activity`
  : Update the interface to add a `sandbox:file` property to record an initial sample from a sandbox environment.

- Changed primary Storm parser to a LALR compatible syntax to gain 80x speed up in parsing Storm queries (#2649)
- Added service provisioning API to AHA service and associated tool `synapse.tools.aha.provision.service` and documentation to make it easy to bootstrap Synapse services using service discovery and SSL client-side certificates to identify service accounts. (#2641)
- Added user provisioning API to AHA service and associated tools `synapse.tools.aha.provision.user` and `synapse.tools.aha.enroll` to make it easy to bootstrap new users with SSL client-side certificates and AHA service discovery configuration. (#2641)
- Added automatic mirror initialization logic to Synapse services to enable new mirrors to be initilized dynamically via AHA provisioning rather than from a pre-existing backup. (#2641)
- Added `handoff()` API to Synapse services to allow mirrors to be gracefully promoted to leader. (#2641)
- Added `synapse.tools.promote` to allow easy promotion of mirror to leader using the new `handoff()` API. (#2641)
- Added `aha:provision` configuration to Synapse services to allow them to automatically provision and self-configure using AHA. (#2641)
- Adjusted Synapse service configuration preference to allow runtime settings to be stored in `cell.yaml`. (#2641)
- Added optional `certhash` parameter to telepath `ssl://` URLs to allow cert-pinning behavior and automatic trust of provisioning URLs. (#2641)
- Added `synapse.tools.moduser` and `synapse.tools.modrole` commands to modernize and ease user/role management from within Synapse service docker containers. (#2641)
- Add `$lib.jsonstor.cacheget()` and `lib.jsonstor.cacheset()` functions in Storm to easily implement data caching in the JSONStor. (#2662)
- Add a `params` option to `$lib.inet.http.connect()` to pass parameters when creating Websocket connections in Storm. (#2664)

17.140.2 Bugfixes

- Added `getCellRunId()` API to Synapse services to allow them to detect incorrect mirror configurations where they refer to themselves. (#2641)
- Ensure that CLI history files can be read and written upon starting interactive CLI tools. (#2660)
- Assorted unit tests fixes to make tests more stable. (#2656) (#2665)
- Fix several uses of Python features which are formally deprecated and may be removed in future Python versions. (#2668)

17.140.3 Improved Documentation

- Added new Deployment Guide with step-by-step production ready deployment instructions (#2641)
- Refactored Devops Guide to give task-oriented instructions on performing common devops tasks. (#2641)
- Added new minimal Admin Guide as a place for documenting Cortex admin tasks. (#2641)
- Updated Getting Started to direct users to synapse-quickstart instructions. (#2641)
- Added `easycert` tool documentation. (#2641)
- Removed `cmdr` tool documentation to emphasize newer tools such as `storm`. (#2641)
- Update the list of available Advanced and Rapid Power-Ups. (#2667)

17.141 v2.92.0 - 2022-04-28

17.141.1 Features and Enhancements

- Update the allowed versions of the `pyopenssl` and `pytz` libraries. (#2657) (#2658)

17.141.2 Bugfixes

- When setting ival properties, they are now properly merged with existing values. This only affected multi-layer views. (#2655)

17.142 v2.91.1 - 2022-04-24

17.142.1 Bugfixes

- Fix a parsing regression in inet:url nodes related to unencoded "@" symbols in URLs. (#2653)

17.143 v2.91.0 - 2022-04-21

17.143.1 Features and Enhancements

- Updates to the `inet` and `infotech` models. (#2634) (#2644) (#2652)

  `inet:url`
  : The `inet:url` type now recognizes various `file:///` values from RFC 8089.

  `it:sec:cve`
  : The `it:sec:cve` type now replaces various Unicode dashes with hyphen characters when norming. This allows a wider range of inputs to be accepted for the type. Scrape related APIs have also been updated to match on this wider range of inputs.

- The Cell now uses `./backup` as a default path for storing backups in, if the `backup:dir` path is not set. (#2648)
- Add POSIX advisory locking around the Cell `cell.guid` file, to prevent multiple processes from attempting to start a Cell from the same directory. (#2642)
- Change the default `SLAB_COMMIT_WARN` time from 5 seconds to 1 second, in order to quickly identify slow storage performance. (#2630)
- Change the Cell `iterBackupArchive` and `iterNewBackupArchive` routines to always log exceptions they encounter, and report the final log message at the appropriate log level for success and failure. (#2629)
- When normalizing the `str` types, when `onespace` is specified, we skip the `strip` behavior since it is redundant. (#2635)
- Log exceptions raised by Cell creation in `initFromArgv`. Catch `lmdb.LockError` when opening a LMDB database and re-raise an exception with a clear error message. (#2638)
- Update schema validation for Storm packages to ensure that cmd arguments do not have excess fields in them. (#2650)

17.143.2 Bugfixes

- Adjust comma requirements for the JSON style list and dictionary expressions in Storm. (#2636)
- Add Storm query logging in a code execution path where it was missing. (#2647)
- Tuplify the output of `synapse.tools.genpkg.loadPkgProto` to ensure that Python list constructs `[...]` do not make it into Power-Up documentation. (#2646)
- Fix an issue with heavy Stormtypes objects where caching was preventing some objects from behaving in a dynamic fashion as they were intended to. (#2640)
- In norming `int` values, when something is outside of the minimum or maximum size of the type, we now include the string representation of the valu instead of the raw value. (#2643)
- Raise a `NotReady` exception when a client attempts to resolve an `aha://` URL and there have not been any `aha` servers registered. (#2645)

17.143.3 Improved Documentation

- Update Storm command reference to add additional commands. (#2633)
- Expand Stormtypes API documentation. (#2637) (#2639)

17.144 v2.90.0 - 2022-04-04

17.144.1 Features and Enhancements

- Updates to the `meta` and `infotech` models. (#2624)

  `meta:rule`
  : Add a new form for generic rules, which should be linked to the nodes they match with a `matches` light edge.

  `meta:ruleset`
  : Add `:author`, `:created`, and `:updated` secondary properties.

  `it:app:yara:rule`
  : Add `:created` and `:updated` secondary properties.

- Add a new Docker image `vertexproject/synapse-jsonstor`. (#2627)

- Allow passing a version requirement string to `$lib.import()`. (#2626)

17.144.2 Bugfixes

- Fix an issue where using a regex lift on an array property could incorrectly yield the same node multiple times. (#2625)

17.144.3 Improved Documentation

- Update documentation regarding mirroring to be clearer about whether a given cell supports it. (#2619)

17.145 v2.89.0 - 2022-03-31

17.145.1 Features and Enhancements

- Update the `meta` model. (#2621)

  `meta:ruleset`
  : Add a new form to denote the collection of a set of nodes representing rules, which should be linked together with a `has` light edge.

- Add additional filter options for the Storm `merge` command. (#2615)
- Update the `BadSyntaxError` exception thrown when parsing Storm queries to additionally include line and column when available. Fix an issue where a `!` character being present in the exception text could truncate the output. (#2618)

17.146 v2.88.0 - 2022-03-23

17.146.1 Automatic Migrations

- Re-normalize the `geo:place:name`, `crypto:currency:block:hash`, and `crypto:currency:transaction:hash` values to account for their modeling changes. Migrate `crypto:currency:transaction:input` and `crypto:currency:transaction:output` values to the secondary properties on the respective `crypto:payment:input` and `crypto:payment:output` nodes to account for the modeling changes. Make `geo:name` nodes for `geo:place:name` secondary properties to account for the modeling changes. See *Data Migration* for more information about automatic migrations.

17.146.2 Features and Enhancements

- Several updates for the `crypto`, `geospace`, `inet`, and `meta` models. (#2594) (#2608) (#2611) (#2616)

  `crypto:payment:input`
  : Add a secondary property `:transaction` to denote the transaction for the payment.

  `crypto:payment:output`
  : Add a secondary property `:transaction` to denote the transaction for the payment.

  `crypto:currency:block`
  : Change the type of the `:hash` property from a `0x` prefixed `str` to a `hex` type.

  `crypto:currency:transaction`
  : Change the type of the `:hash` property from a `0x` prefixed `str` to a `hex` type. Deprecate the `:inputs` and `:outputs` secondary properties.

  `geo:place`
  : Change the type of the `:name` secondary property to `geo:name`.

inet:web:channel
Add a new form to denote a channel within a web service or instance.

inet:web:instance
Add a new form to track an instance of a web service, such as a channel based messaging platform.

inet:web:mesg
Add `:channel`, `:place`, and `:place:name` secondary properties.

inet:web:post
Add `:channel` and `:place:name` secondary properties.

meta:event
Add a new form to denote an analytically relevant event in a curated timeline.

meta:event:taxonomy
Add a new form to represent a taxonomy of `meta:event:type` values.

meta:timeline
Add a new form to denote a curated timeline of analytically relevant events.

meta:timeline:taxonomy
Add a new form to represent a taxonomy of `meta:timeline:type` values.

- Add support for `$lib.len()` to count the length of emitter or generator functions. (#2603)
- Add support for scrape APIs to handle text that has been defanged with `\\.` characters. (#2605)
- Add a `nomerge` option to View objects that can be set to prevent merging a long lived fork. (#2614)
- Add `liftByProp()` and `liftByTag()` methods to the Stormtypes `layer` objects. These allow lifting of nodes based on data stored in a specific layer. (#2613)
- Expand Synapse requirements to include updated versions of the `pygments` library. (#2602)

17.146.3 Improved Documentation

- Fix the example regular expressions used in the `$lib.scrape.genMatches()` Storm library API examples. (#2606)

17.147 v2.87.0 - 2022-03-18

17.147.1 Features and Enhancements

- Several updates for the `inet` and `meta` models. (#2589) (#2592)

  inet:ssl:jarmhash
  Add a form to record JARM hashes.

  inet:ssl:jarmsample
  Add a form to record JARM hashes being present on a server.

  meta:note
  Add a form for recording free text notes.

- Update the Synapse docker containers to be built from a Ubuntu based image, instead of a Debian based image. (#2596)
- Add a Storm `note.add` command that creates a `meta:note` node to record freeform text, and links that node to the input nodes using a `about` light edge. (#2592)
- Support non-writeable or non-existing directories within Synapse `certdir` directories. (#2590)

- Add an optional `tick` argument to the `synapse.lib.lmdbslab.Hist.add()` function. This is exposed internally for Axon implementations to use. (#2593)
- Expand Synapse requirements to include updated versions of the `pycryptome`, `pygments`, `scalecodec` and `xxhash` modules. (#2598)

17.147.2 Bugfixes

- Fix an issue where the StormDmon stop/start status was not properly being updated in the runtime object, despite being properly updated in the Hive. (#2598)
- Calls to `addUnivProp()` APIs when the universal property name already exists now raise a `DupPropName` exception. (#2601)

17.148 v2.86.0 - 2022-03-09

17.148.1 Automatic Migrations

- Migrate secondary properties in Cortex nodes which use `hugenum` type to account for updated ranges. See *Data Migration* for more information about automatic migrations.

17.148.2 Features and Enhancements

- Extend the number of decimal places the `hugenum` type can store to 24 places, with a new maximum value of 730750818665451459101842. (#2584) (#2586)
- Update `fastjsonschema` to version `2.15.3`. (#2581)

17.148.3 Bugfixes

- Add missing read-only flags to secondary properties of Comp type forms which were computed from the primary property of the node. This includes the following: (#2587)
  - `crypto:currency:address:coin`
  - `crypto:currency:address:iden`
  - `crypto:currency:block:coin`
  - `crypto:currency:block:offset`
  - `crypto:currency:client:coinaddr`
  - `crypto:currency:client:inetaddr`
  - `crypto:currency:smart:token:contract`
  - `crypto:currency:smart:token:tokenid`
  - `crypto:x509:revoked:crl`
  - `crypto:x509:revoked:cert`
  - `crypto:x509:signedfile:cert`
  - `crypto:x509:signedfile:file`
  - `econ:acquired:item`
  - `econ:acquired:purchase`
  - `inet:dns:query:client`

- inet:dns:query:name
- inet:dns:query:type
- inet:whois:contact:type
- inet:wifi:ap:bssid
- inet:wifi:ap:ssid
- mat:itemimage:file
- mat:itemimage:item
- mat:specimage:file
- mat:specimage:spec
- ou:id:number:type
- ou:id:number:value
- ou:hasgoal:goal
- ou:hasgoal:org
- tel:mob:cell:carrier
- tel:mob:cell:carrier:mcc
- tel:mob:cell:carrier:mnc
- tel:mob:cell:cid
- tel:mob:cell:lac

- Fix an issue where Layers configured with writeback mirrors did not properly handle results which did not have any changes. (#2583)

17.148.4 Improved Documentation

- Fix spelling issues in documentation and API docstrings. (#2582) (#2585)

17.149 v2.85.1 - 2022-03-03

17.149.1 Bugfixes

- Fix a permission enforcement issue in autoadd mode that allowed users with view read permissions to add automatically detected and validated nodes but make no further edits. (#2579)
- Log errors encountered in the Layer mirror loop which don't have a local caller waiting on the change. (#2580)

17.150 v2.85.0 - 2022-03-03

17.150.1 Features and Enhancements

- Several updates for the crypto, geo, inet, it, ps and risk models. (#2570) (#2573) (#2574)

  crypto:payment:input
  : Add a new form to record payments made into a transaction.

  crypto:payment:output
  : Add a new form to record payments receieved from a transaction.

crypto:currency:transaction
: Add `inputs` and `outputs` array secondary properties to record inputs and outputs for a given transaction.

geo:name
: Add a new form representing an unstructured place name or address.

geo:place
: Add a `names` secondary property which is an array of `geo:name` values.

inet:flow
: Add `dst:txcount`, `src:txcount`, `tot:txcount` and `tot:txbytes` secondary properties.

it:exec:proc
: Add an `account` secondary property as a `it:account` type. Mark the `user` secondary property as deprecated.

ps:contact
: Add `birth:place`, `birth:place:loc`, `birth:place:name`, `death:place`, `death:place:loc` and `death:place:name` secondary properties.

risk:compromise
: Add a `theft:price` secondary property to represent value of stolen assets.

- Embed Cron, StormDmon, and Trigger iden values and automation types into the Storm runtime when those automations are run. This information is populated in a dictionary variable named `$auto`. (#2565)
- Add `$lib.crypto.coin.ethereum.eip55()` to convert an Ethereum address to a checksummed address. (#2577)
- Add a `default` argument to the `$lib.user.allowed()` and `allowed()` method on `user` StormType. (#2570)
- Add a `inaugural` configuration key to the base `Cell` class. This can currently be used to bootstrap roles, permissions, and users in a Cell upon the first time it is started. (#2570)
- De-duplicate nodes when running the Storm `lookup` mode to lift nodes. (#2567)
- Add a test helper that can be used to isolate the `synapse.lib.certdir.certdir` singleton behavior via context manager. (#2564)

17.150.2 Bugfixes

- Calls to `addFormProp()` APIs when the property name already exists now raise a `DupPropName` exception. (#2566)
- Do not allow Storm `macro`'s to be created that have names greater than 492 characters in length. (#2569)
- Fix a bug in the scrape logic for Ethereum where the regular expression matched on `0X` prefixed strings but the validation logic did not account for that uppercase character. (#2575)

17.150.3 Improved Documentation

- Add documentation for the `$auto` variable embedded into the Cron, StormDmon, and Trigger automations. Add documentation for variables representing the form, node value, properties and tags which are responsible for Triggers running. (#2565)

17.151 v2.84.0 - 2022-02-22

17.151.1 Features and Enhancements

- Add `$lib.time.toUTC()` to adjust a local epoch milliseconds time to UTC. (#2550)

- Add a optional `timeout` argument to `$lib.service.wait()`. The function now returns `$lib.true` if the service is available, or `$lib.false` if the service does not become available during the timeout window. (#2561)
- Update the `Layer.verify()` routines to add verification of tagprop and array indexes in layers. These routines are in a beta status and are subject to change. (#2560)
- Update the Cortex's connection to a remote Axon to use a Telepath Client. (#2559)

17.152 v2.83.0 - 2022-02-17

17.152.1 Features and Enhancements

- Add `:ip:proto` and `:ip:tcp:flags` properties to the `inet:flow` form. (#2554)
- Add `$lib.log.debug()`, `$lib.log.info()`, `$lib.log.warning()`, and `$lib.log.error()` Stormtypes APIs. These allow a user to send log messages to the Cortex logging output directly.
- Update the `synapse.tools.genpkg` tool to support using files with the `.storm` extension. This is enabled by adding the following option to a Storm package definition. (#2555)

```
genopts:
  dotstorm: true
```

- Add form and prop values to `BadTypeValu` exceptions when raised during node edit generation. (#2552)

17.152.2 Bugfixes

- Correct a race condition in the `CoreApi.syncLayersEvents` and `CoreApi.syncIndexEvents` APIs. (#2553)

17.152.3 Improved Documentation

- Remove outdated documentation related to making `CoreModule` classes. (#2556)

17.153 v2.82.1 - 2022-02-11

17.153.1 Bugfixes

- Re-order node edit validation to only check read-only status of properties if the value would change. (#2547)
- Raise the correct exception when parsing invalid time values, like `0000-00-00`. (#2548)
- Disable node caching for `StormDmon` runtimes to avoid potential cache coherency issues. (#2549)

17.154 v2.82.0 - 2022-02-10

17.154.1 Features and Enhancements

- Add an `addNode()` API to the Stormtypes `view` object. This allows the programmatic creation of a node with properties being set in a transactional fashion. (#2540)
- Add support to Storm for creating JSON style list and dictionary objects. (#2544)
- The `AhaCell` now bootstraps TLS CA certificates for the configured `aha:network` value, a host certificate for the `aha:name` value, and a user certificate for the `aha:admin` value. (#2542)
- Add `mesg` arguments to all exceptions raised in `synapse.lib.certdir`. (#2546)

17.154.2 Improved Documentation

- Fix some missing and incorrect docstrings for Stormtypes. (#2545)

17.154.3 Deprecations

- Telepath APIs and Storm commands related to `splices` have been marked as deprecated. (#2541)

17.155 v2.81.0 - 2022-01-31

17.155.1 Features and Enhancements

- The `it:sec:cpe` now recognizes CPE 2.2 strings during type normalization. CPE 2.2 strings will be upcast to CPE 2.3 and the 2.2 string will be added to the `:v2_2` secondary property of `it:sec:cpe`. The Storm hotfix `$lib.cell.hotFixesApply()` can be used to populate the `:v2_2` property on existing `it:sec:cpe` nodes where it is not set. (#2537) (#2538) (#2539)
- Setting properties on nodes may now take a fast path if the normed property has no subs, no autoadds and is not a locked property. (#2539)

17.155.2 Bugfixes

- Fix an issue with `Ival` `norm()` routines when norming a tuple or list of values. The max value returned previously could have exceeded the value of the future marker `?`, which would have been then caused an a `BadTypeValu` exception during node edit construction. This is is now caught during the initial `norm()` call. (#2539)

17.156 v2.80.1 - 2022-01-26

17.156.1 Bugfixes

- The embedded JsonStor added to the Cortex in `v2.80.0` needed to have a stable iden for the Cell and and auth subsystem. This has been added. (#2536)

17.157 v2.80.0 - 2022-01-25

17.157.1 Features and Enhancements

- Add a triple quoted string `'''` syntax to Storm for defining multiline strings. (#2530)
- Add a JSONStor to the Cortex, and expose that in Storm for storing user related content. (#2530) (#2513)
- Add durable user notifications to Storm that can be used to send and receive messages between users. (#2513)
- Add a `leaf` argument to `$node.tags()` that causes the function to only return the leaf tags. (#2535)
- Add an error message in the default help text in pure Storm commands when a user provides additional arguments or switches, in addition to the `--help` switch. (#2533)
- Update `synapse.tools.genpkg` to automatically bundle Optic workflows from files on disk. (#2531)
- Expand Synapse requirements to include updated versions of the `packaging`, `pycryptome` and `scalecodec` modules. (#2534)

17.157.2 Bugfixes

- Add a missing `tostr()` call to the Storm `background` query argument. (#2532)

17.158 v2.79.0 - 2022-01-18

17.158.1 Features and Enhancements

- Add `$lib.scrape.ndefs()` and `$lib.scrape.context()` to scrape text. The `ndefs()` API yields a unique set of node form and value pairs, while the `context()` API yields node form, value, and context information for all matches in the text. (#2508)
- Add `:name` and `:desc` properties to the `it:prod:softver` form. (#2528)
- Update the `Layer.verify()` routines to reduce false errors related to array types. The method now takes a dictionary of configuration options. These routines are in a beta status and are subject to change. (#2527)
- Allow setting a View's parent if does not have an existing parent View and only has a single layer. (#2515)
- Add `hxxp[:\\]` and `hxxps[:\\]` to the list of known defanging strategies which are identified and replaced during text scraping. (#2526)
- Expand Synapse requirements to include updated versions of the `typing-extensions` module. (#2525)

17.158.2 Bugfixes

- Storm module interfaces now populate `modconf` data when loaded. (#2508)
- Fix a missing keyword argument from the `AxonApi.wput()` method. (#2527)

17.158.3 Deprecations

- The `$lib.scrape()` function has been deprecated in favor the new `$lib.scrape` library functions. (#2508)

17.159 v2.78.0 - 2022-01-14

17.159.1 Automatic Migrations

- Migrate Cortex nodes which may have been skipped in an earlier migration due to missing tagprop indexes. See *Data Migration* for more information about automatic migrations.

17.159.2 Features and Enhancements

- Expand Synapse requirements to include updated versions of the `base58`, `cbor2`, `lmdb`, `pycryptodome`, `PyYAML`, `xxhash`. (#2520)

17.159.3 Bugfixes

- Fix an issue with the Tagprop migration from `v2.42.0` where a missing index could have resulted in Layer storage nodes not being updated. (#2522) (#2523)
- Fix an issue with `synapse.lib.platforms.linux.getTotalMemory()` when using a process segregated with the Linux cgroups2 API. (#2517)

17.159.4 Improved Documentation

- Add devops instructions related to automatic data migrations for Synapse components. (#2523)
- Update the model deprecation documentation for the `it:host:model` and `it:host:make` properties. (#2521)

17.160 v2.77.0 - 2022-01-07

17.160.1 Features and Enhancements

- Add Mach-O metadata support the file model. This includes the following new forms: `file:mime:macho:loadcmd`, `file:mime:macho:version`, `file:mime:macho:uuid`, `file:mime:macho:segment`, and `file:mime:macho:section`. (#2503)
- Add `it:screenshot`, `it:prod:hardware`, `it:prod:component`, `it:prod:hardwaretype`, and `risk:mitigation` forms to the model. Add `:hardware` property to `risk:hasvuln` form. Add `:hardware` property to `it:host` form. The `:manu` and `:model` secondary properties on `it:host` have been deprecated. (#2514)
- The `guid` type now strips hyphen (`-`) characters when doing norm. This allows users to provide external UUID / GUID strings for use. (#2514)
- Add a `Axon.postfiles()` to allow POSTing files as multi-part form encoded files over HTTP. This is also exposed through the `fields` argument on the Storm `$lib.inet.http.post()` and `$lib.inet:http:request` APIs. (#2516)
- Add `.yu` ccTLD to the list of TLDs identified by the Synapse scrape functionality. (#2518)
- Add `mesg` arguments to all instances of `NoSuchProp` exceptions. (#2519)

17.161 v2.76.0 - 2022-01-04

17.161.1 Features and Enhancements

- Add `emit` and `stop` keywords to Storm. The `emit` keyword is used in functions to make them behave as generators, which can yield arbitrary values. The `stop` keyword can be used to prematurely end a function which is `emit`'ing values. (#2475)
- Add Storm Module Interfaces. This allows Storm Package authors to define common module interfaces, so that multiple modules can implement the API convention to provide a consistent set of data across multiple Storm modules. A `search` convention is added to the Cortex, which will be used in `lookup` mode when the `storm:interface:search` configuration option is set. (#2475)
- Storm queries in `lookup` mode now fire `look:miss` events into the Storm message stream when the lookup value contains a valid node value, but the node is not present in the current View. (#2475)
- Add a `:host` secondary property to `risk:hasvuln` form to record `it:host` instances which have a vulnerability. (#2512)
- Add `synapse.lib.scrape` support for identifying `it:sec:cve` values. (#2509)

17.161.2 Bugfixes

- Fix an `IndexError` that can occur during `Layer.verify()` routines. These routines are in a beta status and are subject to change. (#2507)
- Ensure that parameter and header arguments passed to Storm `$lib.inet.http` functions are cast into strings values. (#2510)

17.162 v2.75.0 - 2021-12-16

This release contains an automatic data migration that may cause additional startup time on the first boot. This is done to unique array properties which previously were not uniqued. Deployments with startup or liveliness probes should have those disabled while this upgrade is performed to prevent accidental termination of the Cortex process. Please ensure you have a tested backup available before applying this update.

17.162.1 Features and Enhancements

- Update the following array properties to be unique sets, and add a data model migration to update the data at rest: (#2469)
  - `biz:rfp:requirements`
  - `crypto:x509:cert:ext:sans`
  - `crypto:x509:cert:ext:crls`
  - `crypto:x509:cert:identities:fqdns`
  - `crypto:x509:cert:identities:emails`
  - `crypto:x509:cert:identities:ipv4s`
  - `crypto:x509:cert:identities:ipv6s`
  - `crypto:x509:cert:identities:urls`
  - `crypto:x509:cert:crl:urls`
  - `inet:whois:iprec:contacts`
  - `inet:whois:iprec:links`
  - `inet:whois:ipcontact:roles`
  - `inet:whois:ipcontact:links`
  - `inet:whois:ipcontact:contacts`
  - `it:account:groups`
  - `it:group:groups`
  - `it:reveng:function:impcalls`
  - `it:reveng:filefunc:funccalls`
  - `it:sec:cve:references`
  - `risk:vuln:cwes`
  - `tel:txtmesg:recipients`
- Add Layer index verification routines, to compare the Layer indices against the stored data for Nodes. This is exposed via the `.verify()` API on the Stormtypes `layer` object. These routines are in a beta status and are subject to change. (#2488)
- The `.json()` API on `inet:http:resp` now raises a `s_exc.BadJsonText` exception, which can be caught with the Storm `try ... catch` syntax. (#2500)
- Add `$lib.inet.ipv6.expand()` to expand an IPv6 address to its long form. (#2502)
- Add `hasPathObj()`, `copyPathObj()` and `copyPathObjs()` APIs to the `JsonStor`. (#2438)
- Allow setting a custom title when making documentation for Cell `confdefs` with the `synapse.tools.autodoc` tool. (#2504)

- Update the minimum version of the `aiohttp` library to `v3.8.1`. (#2495)

17.162.2 Improved Documentation

- Add content previously hosted at `commercial.docs.vertex.link` to the mainline Synapse documentation. This includes some devops information related to orchestration, information about Advanced and Rapid Power-Ups, information about the Synapse User Interface, as well as some support information. (#2498) (#2499) (#2501)
- Add `Synapse-Malshare` and `Synapse-TeamCymru` Rapid Power-Ups to the list of available Rapid Power-Ups. (#2506)
- Document the `jsonlines` option for the `api/v1/storm` and `api/v1/storm/nodes` HTTP APIs. (#2505)

17.163 v2.74.0 - 2021-12-08

17.163.1 Features and Enhancements

- Add `.onion` and `.bit` to the TLD list used for scraping text. Update the TLD list from the latest IANA TLD list. (#2483) (#2497)
- Add support for writeback mirroring of layers. (#2463) (#2489)
- Add `$lib.scrape()` Stormtypes API. This can be used to do programmatic scraping of text using the same regular expressions used by the Storm `scrape` command and the `synapse.lib.scrape` APIs. (#2486)
- Add a `jsonlines` output mode to Cortex streaming HTTP endpoints. (#2493)
- Add a `--raw` argument to the Storm `pkg.load` command. This loads the raw JSON response as a Storm package. (#2491)
- Add a `blocked` enum to the `proj:ticket:status` property to represent a blocked ticket. (#2490)

17.163.2 Bugfixes

- Fix a behavior with `$path` losing variables in pure Storm command execution. (#2492)

17.163.3 Improved Documentation

- Update the description of the Storm `scrape` command. (#2494)

17.164 v2.73.0 - 2021-12-02

17.164.1 Features and Enhancements

- Add a Storm `runas` command. This allows admin users to execute Storm commands as other users. (#2473)
- Add a Storm `intersect` command. This command produces the intersection of nodes emitted by running a Storm query over all inbound nodes to the `intersect` command. (#2480)
- Add `wait` and `timeout` parameters to the `Axon.hashes()` and `$lib.axon.list()` APIs. (#2481)
- Add a `readonly` flag to `synapse.tools.genpkg.loadPkgProto()` and `synapse.tools.genpkg.tryLoadPkgProto()` APIs. If set to `True` this will open files in read only mode. (#2485)
- Allow Storm Prim objects to be capable of directly yielding nodes when used in `yield` statements. (#2479)
- Update the StormDmon subsystem to add debug log information about state changes, as well as additional data for structured logging output. (#2455)

17.164.2 Bugfixes

- Catch a fatal application error that can occur in the Cortex if the forked process pool becomes unusable. Previously this would cause the Cortex to appear unresponsive for executing Storm queries; now this causes the Cortex to shut down gracefully. (#2472)
- Fix a Storm path variable scoping issue where variables were improperly scoped when nodes were passed into pure Storm commands. (#2459)

17.165 v2.72.0 - 2021-11-23

17.165.1 Features and Enhancements

- Update the cron subsystem logs to include the cron name, as well as adding additional data for structured logging output. (#2477)
- Add a `sort_keys` argument to the `$lib.yaml.save()` Stormtype API. (#2474)

17.165.2 Bugfixes

- Update the `asyncio-socks` version to a version which has a pinned version range for the `python-socks` dependency. (#2478)

17.166 v2.71.1 - 2021-11-22

17.166.1 Bugfixes

- Update the `PyOpenSSL` version to `21.0.0` and pin a range of modern versions of the `cryptography` which have stronger API compatibility. This resolves an API compatibility issue with the two libraries which affected SSL certificate generation. (#2476)

17.167 v2.71.0 - 2021-11-19

17.167.1 Features and Enhancements

- Add support for asynchronous triggers. This mode of trigger operation queues up the trigger event in the View for eventual processing. (#2464)
- Update the crypto model to add a `crypto:smart:token` form to represent a token managed by a smart contract. (#2462)
- Add `$lib.axon.readlines()` and `$lib.axon.jsonlines()` to Stormtypes. (#2468)
- Add the Storm `mode` to the structured log output of a Cortex executing a Storm query. (#2466)

17.167.2 Bugfixes

- Fix an error when converting Lark exceptions to Synapse `BadSyntaxError`. (#2471)

17.167.3 Improved Documentation

- Revise the Synapse documentation layout. (#2460)
- Update type specific behavior documentation for `time` types, including the recently added wildcard time syntax. (#2467)
- Sort the Storm Type documentation by name. (#2465)

- Add 404 handler pages to our documentation. (#2461) (#2470)

17.167.4 Deprecations

- Remove `$path.trace()` objects. (#2445)

17.168 v2.70.1 - 2021-11-08

17.168.1 Bugfixes

- Fix an issue where `$path.meta` data was not being properly serialized when heavy Stormtype objects were set on the `$path.meta` dictionary. (#2456)
- Fix an issue with Stormtypes `Str.encode()` and `Bytes.decode()` methods when handling potentially malformed Unicode string data. (#2457)

17.168.2 Improved Documentation

- Update the Storm Control Flow documentation with additional examples. (#2443)

17.169 v2.70.0 - 2021-11-03

17.169.1 Features and Enhancements

- Add `:dst:handshake` and `src:handshake` properties to `inet:flow` to record text representations of the handshake strings of a given connection. (#2451)
- Add a `proj:attachment` form to the `project` model to represent attachments to a given `proj:ticket`. (#2451)
- Add a implicit wildcard behavior to the `time` type when lifting or filtering nodes. Dates ending in a * are converted into ranges covering all possible times in them. For example, `.created=202101*` would lift all nodes created on the first month of 2021. (#2446)
- Add the following `$lib.time` functions to chop information from a time value. (#2446)
  - `$lib.time.year()`
  - `$lib.time.month()`
  - `$lib.time.day()`
  - `$lib.time.hour()`
  - `$lib.time.minute()`
  - `$lib.time.second()`
  - `$lib.time.dayofweek()`
  - `$lib.time.dayofmonth()`
  - `$lib.time.monthofyear()`
- Add `List.extend()`, `List.slice()`, `Str.find()`, and `Str.size()` functions to Stormtypes. (#2450) (#2451)
- Add `$lib.json.schema()` and a `json:schema` object to Stormtypes. These can be used to validate arbitrary data JSON structures in Storm using JSON Schema. (#2448)
- Update syntax checking rules and address deprecation warnings for strings in the Synapse codebase. (#2426)

17.170 v2.69.0 - 2021-11-02

17.170.1 Features and Enhancements

- Add support for building Optic Workflows for Storm Packages in the `synapse.tools.genpkg` tool. (#2444)
- The `synapse.tools.storm` CLI tool now prints out node properties in precedence order. (#2449)
- Update the global Stormtypes registry to better track types when they are added or removed. (#2447)

17.171 v2.68.0 - 2021-10-29

17.171.1 Features and Enhancements

- Add `crypto:currency:transaction`, `crypto:currency:block`, `crypto:smart:contract` and `econ:acct:balanc` forms. (#2423)
- Add `$lib.hex.decode()` and `$lib.hex.encode()` Stormtypes functions to encode and decode hexidecimal data as bytes. Add `slice()` and `unpack()` methods to the Storm Bytes object. (#2441)
- Add `$lib.yaml` and `$lib.xml` Stormtypes libraries for interacting with YAML and XML text, respectively. (#2434)
- Add a Storm `version` command to show the user the current version of Synapse the Cortex is using. (#2440)

17.171.2 Bugfixes

- Fix overzealous `if` statement caching in Storm. (#2442)

17.172 v2.67.0 - 2021-10-27

17.172.1 Features and Enhancements

- Add `$node.addEdge()` and `$node.delEdge()` APIs in Storm to allow for programatically setting edges. Add a `reverse` argument to `$node.edges()` that allows traversing edges in reverse. (#2351)

17.172.2 Bugfixes

- Fix a pair of regressions related to unicode/IDNA support for scraping and normalizing FQDNs. (#2436)

17.172.3 Improved Documentation

- Add documentation for the Cortex `api/v1/storm/call` HTTP API endpoint. (#2435)

17.173 v2.66.0 - 2021-10-26

17.173.1 Features and Enhancements

- Improve unicode/IDNA support for scraping and normalizing FQDNs. (#2408)
- Add `$lib.inet.http.ouath` to support OAuth based workflows in Storm, starting with OAuth v1.0 support. (#2413)
- Replace `pysha3` requirement with `pycryptodome`. (#2422)
- Add a `tls:ca:dir` configuration option to the Cortex and Axon. This can be used to provide a directory of CA certificate files which are used in Storm HTTP API and Axon wget/wput APIs. (#2429)

17.173.2 Bugfixes

- Catch and raise bad ctors given in RStorm `storm-cortex` directives. (#2424)
- Fix an issue with the `cron.at` command not properly capturing the current view when making the Cron job. (#2425)
- Disallow the creation of extended properties, universal properties, and tag properties which are not valid properties in the Storm grammar. (#2428)
- Fix an issue with `$lib.guid()` missing a `toprim()` call on its input. (#2421)

17.173.3 Improved Documentation

- Update our Cell devops documentation to note how to replace the TLS keypair used by the built in webserver with third party certificates. (#2432)

17.174 v2.65.0 - 2021-10-16

17.174.1 Features and Enhancements

- Add support for interacting with IMAP email servers though Storm, using the `$lib.inet.imap.connect()` function. This returns a object that can be used to delete, read, and search emails in a given IMAP mailbox. (#2399)
- Add a new Storm command, `once`. This command can be used to 'gate' a node in a Storm pipeline such that the node only passes through the command exactly one time for a given named 'gate'. The gate information is stored in nodedata, so it is inspectable and subject to all other features that apply to nodedata. (#2404)
- Add a `:released` property to `it:prod:softver` to record when a software version was released. (#2419)
- Add a `tryLoadPkgProto` convenience function to the `synapse.tools.genpkg` for Storm service package generation with inline documentation. (#2414)

17.174.2 Bugfixes

- Add `asyncio.sleep(0)` calls in the `movetag` implementation to address some possible hot-loops. (#2411)
- Clarify and sanitize URLS in a Aha related log message i `synapse.telepath`. (#2415)

17.174.3 Improved Documentation

- Update our `fork` definition documentation. (#2409)
- Add documentation for using client-side TLS certificates in Telepath. (#2412)
- Update the Storm CLI tool documentation. (#2406)
- The Storm types and Storm library documentation now automatically links from return values to return types. (#2410)

17.175 v2.64.1 - 2021-10-08

17.175.1 Bugfixes

- Add a retry loop in the base `Cell` class when attempting to register with an `Aha` server. (#2405)
- Change the behavior of `synapse.common.yamlload()` to not create files when the expected file is not present on disk, and open existing files in read-only mode. (#2396)

17.176 v2.64.0 - 2021-10-06

17.176.1 Features and Enhancements

- Add support for scraping the following cryptocurrency addresses to the `synapse.lib.scrape` APIs and Storm `scrape` command. (#2387) (#2401)
  - Bitcoin
  - Bitcoin Cash
  - Ethereum
  - Ripple
  - Cardano
  - Polkadot

  The internal cache of regular expressions in the `synapse.lib.scrape` library is also now a private member; API users should use the `synapse.lib.scrape.scrape()` function moving forward.
- Add `:names` property to the `it:mitre:attack:software` form. (#2397)
- Add a `:desc` property to the `inet:whois:iprec` form. (#2392)
- Added several new Rstorm directives. (#2359) (#2400)
  - `storm-cli` - Runs a Storm query with the Storm CLI tool
  - `storm-fail` - Toggles whether or not the following Storm command should fail or not.
  - `storm-multiline` - Allows embedding a multiline Storm query as a JSON encoded string for future execution.
  - `storm-vcr-callback` - Allows specifying a custom callback which a VCR object is sent too.

17.176.2 Bugfixes

- Fix a missing `toprim()` call when loading a Storm package directly with Storm. (#2359)
- Fix a caching issue where tagprops were not always being populated in a `Node` tagprop dictionary. (#2396)
- Add a `mesg` argument to a few `NoSuchVar` and `BadTypeValu` exceptions. (#2403)

17.176.3 Improved Documentation

- Storm reference docs have been converted from Jupyter notebook format to Synapse `.rstorm` format, and now display examples using the Storm CLI tool, instead of the Cmdr CLI tool. (#2359)

17.177 v2.63.0 - 2021-09-29

17.177.1 Features and Enhancements

- Add a `risk:attacktype` taxonomy to the risk model. Add `:desc` and `:type` properties to the `risk:attack` form. (#2386)
- Add `:path` property to the `it:prod:softfile` form. (#2388)

17.177.2 Bugfixes

- Fix the repr for the``auth:user`` Stormtype when printing a user object in Storm. (#2383)

17.178 v2.62.1 - 2021-09-22

17.178.1 Bugfixes

- Fix an issue in the Nexus log V1 to V2 migration code which resulted in LMDB file copies being made instead of having directories renamed. This can result in a sparse file copy of the Nexus log, resulting in a condition where the volume containing the Cell directory may run out of space. (#2374)

17.179 v2.62.0 - 2021-09-21

17.179.1 Features and Enhancements

- Add APIs to support trimming, rotating and culling Nexus logs from Cells with Nexus logging enabled. These operations are distributed to downstream consumers, of the Nexus log (e.g. mirrors). For the Cortex, this can be invoked in Storm with the `$lib.cell.trimNexsLog()` Stormtypes API. The Cortex devops documentation contains more information about Nexus log rotation. (#2339) (#2371)
- Add `.size()` API to the Stormtypes `storm:query` object. This will run the query and return the number of nodes it would have yielded. (#2363)

17.179.2 Improved Documentation

- Document the tag glob meanings on the Stormtypes `$node.tags()` API. (#2368)

17.180 v2.61.0 - 2021-09-17

17.180.1 Features and Enhancements

- Add a `!export` command to the Storm CLI to save query results to a `.nodes` file. (#2356)
- Add `$lib.cell.hotFixesCheck()` and `$lib.cell.hotFixesApply()` Stormtypes functions. These can be used to apply optional hotfixes to a Cortex on demand by an admin. (#2348)
- Add `$lib.infosec.cvss.calculateFromProps()` to allow calculating a CVSS score from a dictionary of CVSS properties. (#2353)
- Add `$node.data.has()` API to Stormtypes to allow easy checking if a node has nodedata for a given name. (#2350)

17.180.2 Bugfixes

- Fix for large return values with `synapse.lib.coro.spawn()`. (#2355)
- Fix `synapse.lib.scrape.scrape()` capturing various common characters used to enclose URLs. (#2352)
- Ensure that generators being yielded from are always being closed. (#2358)
- Fix docstring for `str.upper()` in Stormtypes. (#2354)

17.180.3 Improved Documentation

- Add link to the Power-Ups blog post from the Cortex dev-ops documentation. (#2357)

17.181 v2.60.0 - 2021-09-07

17.181.1 Features and Enhancements

- Add new `risk:compromise` and `risk:compromisetype` forms. Add `attacker`, `compromise`, and `target` secondary properties to the `risk:attack` form. (#2348)

17.181.2 Bugfixes

- Add a missing `wait()` call when calling the `CoreApi.getAxonUpload()` and `CoreApi.getAxonBytes()` Telepath APIs. (#2349)

17.181.3 Deprecations

- Deprecate the `actor:org`, `actor:person`, `target:org` and `target:person` properties on `risk:attack` in favor of new `attacker` and `target` secondary properties. Deprecate the `type` property on `ou:campaign` in favor of the `camptype` property. (#2348)

17.182 v2.59.0 - 2021-09-02

17.182.1 Features and Enhancements

- Add a new Storm command, `pkg.docs`, to enumerate any documentation that has been bundled with a Storm package. (#2341)
- Add support for manipulating `'proj:comment` nodes via Stormtypes. (#2345)
- Add `Axon.wput()` and `$lib.axon.wput()` to allow POSTing a file from an Axon to a given URL. (#2347)
- Add `$lib.export.toaxon()` to allow exporting a `.nodes` file directly to an Axon based on a given storm query and opts. (#2347)
- The `synapse.tools.feed` tool now accepts a `--view` argument to feed data to a specific View. (#2342)
- The `synapse.tools.feed` tool now treats `.nodes` files as msgpack files for feeding data to a Cortex. (#2343)
- When the Storm `help` command has an argument without any matching commands, it now prints a helpful message. (#2338)

17.182.2 Bugfixes

- Fix a caching issue between `$lib.lift.byNodeData()` and altering the existing node data on a given node. (#2344)
- Fix an issue with backups were known lmdbslabs could be omitted from being treated as lmdb databases, resulting in inefficient file copies being made. (#2346)

17.183 v2.58.0 - 2021-08-26

17.183.1 Features and Enhancements

- Add `!pushfile`, `!pullfile`, and `!runfile` commands to the `synapse.tools.storm` tool. (#2334)

- Add multiname SNI support to `ssl://` listening configurations for the Daemon. (#2336)
- Add a new Cortex HTTP API Endpoint, `/api/v1/feed`. This can be used to add nodes to the Cortex in bulk. (#2337)
- Refactor the `syn.nodes` feed API implementation to smooth out the ingest rate. (#2337)
- Sort the Storm Package commands in documentation created by `synpse.tools.autodoc` alphabetically. (#2335)

17.183.2 Deprecations

- Deprecate the `syn.splices` and `syn.nodedata` feed API formats. (#2337)

17.184 v2.57.0 - 2021-08-24

17.184.1 Features and Enhancements

- Add a basic `synapse.tools.storm` CLI tool. This can be used to connect to a Cortex via Telepath and directly execute Storm commands. (#2332)
- Add an `inet:http:session` form to track the concept of a prolonged session a user may have with a webserver across multiple HTTP requests. Add an `:success` property to the `ou:campaign` form to track if a campaign was sucessful or not. Add an `:goal` property to the `risk:attack` form to track the specific goal of the attack. Add an `:desc` property to the `proj:project` form to capture a description of the project. (#2333)

17.184.2 Bugfixes

- Fix an issue with `synapse.lib.rstorm` where multiline node properties could produce RST which did not render properly. (#2331)

17.184.3 Improved Documentation

- Clean up the documentation for the Storm `wget` command. (#2325)

17.185 v2.56.0 - 2021-08-19

17.185.1 Features and Enhancements

- Refactor some internal Axon APIs for downstream use. (#2330)

17.185.2 Bugfixes

- Resolve an ambiguity in the Storm grammar with yield statement and dollar expressions inside filter expression. There is a slight backwards incompatibility with this change, as dollar expressions insider of filter expressions now require a $ prepended where before it was optional. (#2322)

17.186 v2.55.0 - 2021-08-18

17.186.1 Features and Enhancements

- Add `$node.props.set()` Stormtypes API to allow programmatically setting node properties. (#2324)
- Deny non-runtsafe invocations of the following Storm commands: (#2326)
  - `graph`

  - iden
  - movetag
  - parallel
  - tee
  - tree

- Add a `Axon.hashset()` API to get the md5, sha1, sha256 and sha512 hashes of file in the Axon. This is exposed in Stormtypes via the `$lib.bytes.hashset()` API. (#2327)
- Add the `synapse.servers.stemcell` server and a new Docker image, `vertexproject/synaspe-stemcell`. The Stemcell server is similar to the `synapse.servers.cell` server, except it resolves the Cell ctor from the `cell:ctor` key from the `cell.yaml` file, or from the `SYN_STEM_CELL_CTOR` environment variable. (#2328)

17.187 v2.54.0 - 2021-08-05

17.187.1 Features and Enhancements

- Add `storm-envvar` directive to RST preprocessor to include environment variables in `storm-pre` directive execution context. (#2321)
- Add new `diff` storm command to allow users to easily lift the set of nodes with changes in the top layer of a forked view. Also adds the `--no-tags` option to the `merge` command to allow users to omit `tag:add` node edits and newly constructed `syn:tag` nodes when merging selected nodes. (#2320)
- Adds the following properties to the data model: (#2319)
  - `biz:deal:buyer:org`
  - `biz:deal:buyer:orgname`
  - `biz:deal:buyer:orgfqdn`
  - `biz:deal:seller:org`
  - `biz:deal:seller:orgname`
  - `biz:deal:seller:orgfqdn`
  - `biz:prod:madeby:org`
  - `biz:prod:madeby:orgname`
  - `biz:prod:madeby:orgfqdn`
  - `ou:opening:posted`
  - `ou:opening:removed`
  - `ou:org:vitals`
- Updates `storm-mock-http` to support multiple HTTP requests/responses in RST preprocessor. (#2317)

17.188 v2.53.0 - 2021-08-05

This release contains an automatic data migration that may cause additional startup time on the first boot. This is done to unique array properties which previously were not uniqued. Deployments with startup or liveliness probes should have those disabled while this upgrade is performed to prevent accidental termination of the Cortex process. Please ensure you have a tested backup available before applying this update.

17.188.1 Features and Enhancements

- Add an `embeds` option to Storm to allow extracting additional data when performing queries. (#2314)
- Enforce node data permissions at the Layer boundary. Remove the `node.data.get` and `node.data.list` permissions. (#2311)
- Add `auth.self.set.email`, `auth.self.set.name`, `auth.self.set.passwd` permissions on users when changing those values. These permissions default to being allowed, allowing a rule to be created that can deny users from changing these values. (#2311)
- Add `$lib.inet.smtp` to allow sending email messages from Storm. (#2315)
- Warn if a LMDB commit operation takes too long. (#2316)
- Add new data types, `taxon` and `taxonomy`, to describe hierarchical taxonomies. (#2312)
- Add a new Business Development model. This allows tracking items related to contract, sales, and purchasing lifecycles. This adds the following new forms to the data model: `biz:dealtype`, `biz:prodtype`, `biz:dealstatus`, `biz:rfp`, `biz:deal`, `biz:bundle`, `biz:product`, and `biz:stake`. The Org model is also updated to add new forms for supporting parts of the business lifecycle, adding `ou:jobtype`, `ou:jobtitle`, `ou:employment`, `ou:opening`, `ou:vitals`, `ou:camptype`, and `ou:orgtype`, `ou:conttype` forms. The Person model got a new form, `ps:workhist`. (#2312)
- Add a `:deleted` property to `inet:web:post`. (#2312)
- Update the following array properties to be unique sets, and add a data model migration to update the data at rest: (#2312)
  - `edu:course:prereqs`
  - `edu:class:assistants`
  - `ou:org:subs`
  - `ou:org:names`
  - `ou:org:dns:mx`
  - `ou:org:locations`
  - `ou:org:industries`
  - `ou:industry:sic`
  - `ou:industry:subs`
  - `ou:industry:isic`
  - `ou:industry:naics`
  - `ou:preso:sponsors`
  - `ou:preso:presenters`
  - `ou:conference:sponsors`
  - `ou:conference:event:sponsors`
  - `ou:conference:attendee:roles`
  - `ou:conference:event:attendee:roles`
  - `ou:contract:types`
  - `ou:contract:parties`
  - `ou:contract:requirements`

- ou:position:reports
- ps:person:names
- ps:person:nicks
- ps:persona:names
- ps:persona:nicks
- ps:education:classes
- ps:contactlist:contacts

17.188.2 Bugfixes

- Prevent renaming the `all` role. (#2313)

17.188.3 Improved Documentation

- Add documentation about Linux kernel parameteres which can be tuned to affect Cortex performance. (#2316)

17.189 v2.52.1 - 2021-07-30

17.189.1 Bugfixes

- Fix a display regression when enumerating Cron jobs with the Storm `cron.list` command. (#2309)

17.190 v2.52.0 - 2021-07-29

17.190.1 Features and Enhancements

- Add a new specification for defining input forms that a pure Storm command knows how to natively handle. (#2301)
- Add `Lib.reverse()` and `Lib.sort()` methods to Stormtypes API. (#2306)
- Add `View.parent` property in Stormtypes API. (#2306)
- Support Telepath Share objects in Storm. (#2293)
- Allow users to specify a view to run a cron job against, move a cron job to a new view, and update permission check for adding/moving cron jobs to views. (#2292)
- Add CPE and software name infomation to the `inet:flow` form. Add `it:av:prochit`, `it:exec:thread`, `it:exec:loadlib`, `it:exec:mmap`, `it:app:yara:procmatch` forms to the infotech model. Add `:names` arrays to `it:prod:soft` and `it:prod:softver` forms to assist in entity resolution of software. Add a `risk:alert` form to the risk model to allow for capturing arbitrary alerts. (#2304)
- Allow Storm packages to specify other packages they require and possible conflicts would prevent them from being installed in a Cortex. (#2307)

17.190.2 Bugfixes

- Specify the View when lifting `syn:trigger` runt nodes. (#2300)
- Update the scrape URL regular expression to ignore trailing periods and commas. (#2302)
- Fix a bug in Path scope for nodes yielding by pure Storm commands. (#2305)

17.191 v2.51.0 - 2021-07-26

17.191.1 Features and Enhancements

- Add a `--size` option to the Storm `divert` command to limit the number of times the generator is iterated. (#2297)
- Add a `perms` key to the pure Storm command definition. This allows for adding intuitive permission boundaries for pure Storm commands which are checked prior to command execution. (#2297)
- Allow full properties with comparators when specifying the destination or source when walking light edges. (#2298)

17.191.2 Bugfixes

- Fix an issue with LMDB slabs not being backed up if their directories did not end in `.lmdb`. (#2296)

17.192 v2.50.0 - 2021-07-22

17.192.1 Features and Enhancements

- Add `.cacheget()` and `cacheset()` APIs to the Storm `node:data` object for easy caching of structured data on nodes based on time. (#2290)
- Make the Stormtypes unique properly with a Set type. This does disallow the use of mutable types such as dictionaries inside of a Set. (#2225)
- Skip executing non-runtsafe commands when there are no inbound nodes. (#2291)
- Add `asroot:perms` key to Storm Package modules. This allows package authors to easily declare permissions their packages. Add Storm commands `auth.user.add`, `auth.role.add`, `auth.user.addrule`, `auth.role.addrule`, and `pkg.perms.list` to help with some of the permission management. (#2294)

17.193 v2.49.0 - 2021-07-19

17.193.1 Features and Enhancements

- Add a `iden` parameter when creating Cron jobs to allow the creation of jobs with stable identifiers. (#2264)
- Add `$lib.cell` Stormtypes library to allow for introspection of the Cortex from Storm for Admin users. (#2285)
- Change the Telepath Client connection loop error logging to log at the Error level instead of the Info level. (#2283)
- Make the tag part normalization more resilient to data containing non-word characters. (#2289)
- Add `$lib.tags.prefix()` Stormtypes to assist with normalizing a list of tags with a common prefix. (#2289)
- Do not allow the Storm `divert` command to work with non-generator functions. (#2282)

17.193.2 Bugfixes

- Fix an issue with Storm command execution with non-runtsafe options. (#2284)
- Log when the process pool fails to initialize. This may occur in certain where CPython multiprocessing primitives are not completely supported. (#2288)
- In the Telepath Client, fix a race condition which could have raised an AttributeError in Aha resolutions. (#2286)
- Prevent the reuse of a Telepath Client object when it has been fini'd. (#2286)

- Fix a race condition in the Aha server when handling distributed changes which could have left the service in a desynchronized state. (#2287)

17.193.3 Improved Documentation

- Update the documentation for the `synapse.tools.feed` tool. (#2279)

17.194 v2.48.0 - 2021-07-13

17.194.1 Features and Enhancements

- Add a Storm `divert` command to ease the implementation of `--yield` constructs in Storm commands. This optionally yields nodes from a generator, or yields inbound nodes, while still ensuring the generator is conusmed. (#2277)
- Add Storm runtime debug tracking. This is a boolean flag that can be set or unset via `$lib.debug`. It can be used by Storm packages to determine if they should take extra actions, such as additional print statements, without needing to track additional function arguments in their implementations. (#2278)

17.194.2 Bugfixes

- Fix an ambiguity in the Storm grammar. (#2280)
- Fix an issue where form autoadds could fail to be created in specific cases of the model. (#2273)

17.195 v2.47.0 - 2021-07-07

17.195.1 Features and Enhancements

- Add `$lib.regex.replace()` Stormtypes API to perform regex based replacement of string parts. (#2274)
- Add universal properties to the dictionary returned by `Cortex.getModelDict()` as a `univs` key. (#2276)
- Add additional `asyncio.sleep(0)` statements to `Layer._storNodeEdits` to improve Cortex responsiveness when storing large numbers of edits at once. (#2275)

17.196 v2.46.0 - 2021-07-02

17.196.1 Features and Enhancements

- Update the Cortex `storm:log:level` configuration value to accept string values such as `DEBUG`, `INFO`, etc. The default log level for Storm query logs is now `INFO` level. (#2262)
- Add `$lib.regex.findall()` Stormtypes API to find all matching parts of a regular expression in a given string. (#2265)
- Add `$lib.inet.http.head()` Stormtypes API to perform easy HEAD requests, and `allow_redirects` arguments to existing `lib.inet.http` APIs to allow controlling the redirect behavior. (#2268)
- Add `$lib.storm.eval()` API to evaluate Storm values from strings. (#2269)
- Add `getSystemInfo()` and `getBackupInfo()` APIS to the Cell for getting useful system information. (#2267)
- Allow lists in rstorm bodies. (#2261)
- Add a `:desc` secondary property to the `proj:sprint` form. (#2261)

- Call _normStormPkg in all loadStormPkg paths, move validation to post normalization and remove mutation in validator (#2260)
- Add `SYN_SLAB_COMMIT_PERIOD` environment variable to control the Synapse slab commit period. Add `layer:lmdb:max_replay_log` Cortex option to control the slab replay log size. (#2266)
- Update Ahacell log messages. (#2270)

17.196.2 Bugfixes

- Fix an issue where the `Trigger.pack()` method failed when the user that created the trigger had been deleted. (#2263)

17.196.3 Improved Documentation

- Update the Cortex devops documentation for the Cortex to document the Storm query logging. Update the Cell devops documentation to explain the Cell logging and how to enable structured (JSON) logging output. (#2262)
- Update Stormtypes API documentation for `bool`, `proj:epic`, `proj:epics`, `proj:ticket`, `proj:tickets`, `proj:sprint`, `proj:sprints`, `proj:project`, `stix:bundle` types. (#2261)

17.197 v2.45.0 - 2021-06-25

17.197.1 Features and Enhancements

- Add a application level process pool the base Cell implemenation. Move the processing of Storm query text into the process pool. (#2250) (#2259)
- Minimize the re-validation of Storm code on Cortex boot. (#2257)
- Add the `ou:preso` form to record conferences and presentations. Add a `status` secondary property to the `it:mitre:attack:technique` form to track if techniques are current, deprecated or withdrawn. (#2254)

17.197.2 Bugfixes

- Remove incorrect use of `cmdopts` in Storm command definitions unit tests. (#2258

17.198 v2.44.0 - 2021-06-23

This release contains an automatic data migration that may cause additional startup time on the first boot. This only applies to a Cortex that is using user defined tag properties or using `ps:person:name` properties. Deployments with startup or liveliness probes should have those disabled while this upgrade is performed to prevent accidental termination of the Cortex process. Please ensure you have a tested backup available before applying this update.

17.198.1 Features and Enhancements

- Add a `.move()` method on Stormtypes `trigger` objects to allow moving a Trigger from one View to another View. (#2252)
- When the Aha service marks a service as down, log why that service is being marked as such. (#2255)
- Add `:budget:price` property to the `ou:contract` form. Add `:settled` property to the `econ:purchase` form. (#2253

17.198.2 Bugfixes

- Make the array property `ps:person:names` a unique array property. (#2253
- Add missing tagprop key migration for the bybuidv3 index. (#2256)

17.199 v2.43.0 - 2021-06-21

17.199.1 Features and Enhancements

- Add a `.type` string to the Stormtypes `auth:gate` object to allow a user to identify the type of auth gate it is. (#2238)
- Add `$lib.user.iden` reference to the Stormtype `$lib.user` to get the iden of the current user executing Storm code. (#2236)
- Add a `--no-build` option to `synapse.tools.genpkg` to allow pushing an a complete Storm Package file. (#2231) (#2232) (#2233)
- The Storm `movetag` command now checks for cycles when setting the `syn:tag:isnow` property. (#2229)
- Deprecate the `ou:org:has` form, in favor of using light edges for storing those relationships. (#2234)
- Add a `description` property to the `ou:industry` form. (#2239)
- Add a `--name` parameter to the Storm `trigger.add` command to name triggers upon creation. (#2237)
- Add `regx` to the `BadTypeValu` exception of the `str` type when a regular expression fails to match. (#2240)
- Consolidate Storm parsers to a single Parser object to improve startup time. (#2247)
- Improve error logging in the Cortex `callStorm()` and `storm()` APIs. (#2243)
- Add `from:contract`, `to:contract`, and `memo` properties to the `econ:acct:payment` form. (#2248)
- Improve the Cell backup streaming APIs link cleanup. (#2249)

17.199.2 Bugfixes

- Fix issue with grabbing the incorrect Telepath link when performing a Cell backup. (#2246)
- Fix missing `toprim` calls in `$lib.inet.http.connect()`. (#2235)
- Fix missing Storm command form hint schema from the Storm Package schema. (#2242)

17.199.3 Improved Documentation

- Add documentation for deprecated model forms and properties, along with modeling alternatives. (#2234)
- Update documentation for the Storm `help` command to add examples of command substring matching. (#2241)

17.200 v2.42.2 - 2021-06-11

17.200.1 Bugfixes

- Protect against a few possible RuntimeErrors due to dictionary sizes changing during iteration. (#2227)
- Fix StormType `Lib` lookups with imported modules which were raising a `TypeError` instead of a `NoSuchName` error. (#2228)
- Drop old Storm Packages if they are present when re-adding them. This fixes an issue with runtime updates leaving old commands in the Cortex. (#2230)

17.201 v2.42.1 - 2021-06-09

17.201.1 Features and Enhancements

- Add a `--no-docs` option to the `synapse.tools.genpkg` tool. When used, this not embed inline documentation into the generated Storm packages. (#2226)

17.202 v2.42.0 - 2021-06-03

17.202.1 Features and Enhancements

- Add a `--headers` and `--parameters` arguments to the Storm `wget` command. The default headers now includes a browser like UA string. (#2208)
- Add the ability to modify the name of a role via Storm. (#2222)

17.202.2 Bugfixes

- Fix an issue in the JsonStor cell where there were missing fini calls. (#2223)
- Add a missing timeout to an `getAhaSvc()` call. (#2224)
- Change how tagprops are serialized to avoid a issue with sending packed nodes over HTTP APIs. This changes the packed node structure of tagprops from a dictionary keyed with `(tagname, propertyname)` to a dictionary keyed off of the `tagname`, which now points to a dictionary containing the `propertyname` which represents the value of the tagprop. (*#2221* <https://github.com/vertexproject/synapse/pull/2221>`_)

17.203 v2.41.1 - 2021-05-27

17.203.1 Bugfixes

- Add PR `#2117` to bugfix list in CHANGLOG.rst for v2.41.0 :D

17.204 v2.41.0 - 2021-05-27

17.204.1 Features and Enhancements

- Add an `it:cmd` form and update the `it:exec:proc:cmd` property to use it. This release includes an automatic data migration on startup to update the `it:exec:proc:cmd` on any existing `it:exec:proc` nodes. (#2219)

17.204.2 Bugfixes

- Fix an issue where passing a Base object to a sub-runtime in Storm did not correctly increase the reference count. (#2216)
- Fix an issue where the `tee` command could potentially run the specified queries twice. (#2218)
- Fix for rstorm using mock when the HTTP body is bytes. (#2217)

17.205 v2.40.0 - 2021-05-26

17.205.1 Features and Enhancements

- Add a `--parallel` switch to the `tee` Storm command. This allows for all of the Storm queries provided to the `tee` command to execute in parallel, potentially producing a mixed output stream of nodes. (#2209)

- Convert the Storm Runtime object in a Base object, allowing for reference counted Storm variables which are made from Base objects and are properly torn down. (#2203)
- Add `$lib.inet.http.connect()` method which creates a Websocket object inside of Storm, allowing a user to send and receive messages over a websocket. (#2203)
- Support pivot join operations on tags. (#2213)
- Add `stormrepr()` implementation for `synapse.lib.stormtypes.Lib`, which allows for `$lib.print()` to display useful strings for Storm Libraries and imported modules. (#2212)
- Add a storm API top updated a user name. (#2214)

17.205.2 Bugfixes

- Fix the logger name for `synapse.lib.aha`. (#2210)
- Log `ImportError` exceptions in `synapse.lib.dyndeps.getDynMod`. This allows easier debugging when using the `synapse.servers.cell` server when running custom Cell implementations. (#2211)
- Fix an issue where a Storm command which failed to set command arguments successfully would not teardown the Storm runtime. (#2212)

17.206 v2.39.1 - 2021-05-21

17.206.1 Bugfixes

- Fix an issue with referencing the Telepath user session object prior to a valid user being set. (#2207)

17.207 v2.39.0 - 2021-05-20

17.207.1 Features and Enhancements

- Add more useful output to Storm when printing heavy objects with `$lib.print()`. (#2185)
- Check rule edits for roles against provided authgates in Storm. (#2199)
- Add `Str.rsplit()` and maxsplit arguments to `split()/rsplit()` APIs in Storm. (#2200)
- Add default argument values to the output of Storm command help output. (#2198)
- Add a `syn:tag:part` Type and allow the `syn:tag` type to normalize a list of tag parts to create a tag string. This is intended to be used with the `$lib.cast()` function in Storm. (#2192)
- Add debug logging to the Axon for reading, writing, or deleting of blobs. (#2202)
- Add a timeout argument to the `$lib.inet.http` functions. The functions will all now always return a `inet:http:resp` object; if the `.code` is -1, an unrecoverable exception occurred while making the request. (#2205)
- Add support for embedding a logo and documentation into a Storm Package. (#2204)

17.207.2 Bugfixes

- Fix export filters to correctly filter tagprops. (#2196)
- Fix an issue with Hotcount which prevented it from storing negative values. (#2197)
- Fix an issue where `hideconf` configuration values were being included in autodoc output. (#2199)

17.208 v2.38.0 - 2021-05-14

17.208.1 Features and Enhancements

- Remove trigger inheritance from Views. Views will now only execute triggers which are created inside of them. (#2189)
- Remove read-only property flags from secondary properties on `file:bytes` nodes. (#2191)
- Add a simple `it:log:event` form to capture log events. (#2195)
- Add structured logging as an option for Synapse Cells. When enabled, this produces logs as JSONL sent to stderr. This can be set via the `SYN_LOG_STRUCT` environment variable, or adding the `--structured-logging` command line switch. (#2179)
- Add a `nodes.import` command to import a `.nodes` file from a URL. (#2186)
- Allow the `desc` key to View and Layer objects in Storm. This can be used to set descriptions for these objects. (#2190)
- Use the gateiden in Storm auth when modifying rules; allowing users to share Views and Layers with other users. (#2194)

17.208.2 Bugfixes

- Fix an issue with Storm Dmon deletion not behaving properly in mirror configurations. (#2188)
- Explicitly close generators in Telepath where an exception has caused the generator to exit early. (#2183)
- Fix an issue where a trigger owner not having access to a view would cause the Storm pipeline to stop. (#2189)

17.209 v2.37.0 - 2021-05-12

17.209.1 Features and Enhancements

- Add a `file:mime:image` interface to the Synapse model for recording MIME specific metadata from image files. (#2187)
- Add `file:mime:jpg`, `file:mime:tiff`, `file:mime:gif` and `file:mime:png` specific forms for recording metadata of those file types. (#2187)
- Add `$lib.pkg.has()` Stormtype API to check for for the existence of a given Storm package by name. (#2182)
- All `None / $lib.null` as input to setting a user password. This clears the password and prevents a user from being able to login. (#2181)
- Grab any Layer push/pull offset values when calling `Layer.pack()`. (#2184)
- Move the retrieval of `https:headers` from HTTP API handlers into a function so that downstream implementers can redirect where the extra values are retrieved from. (#2187)

17.209.2 Bugfixes

- Fix an issue which allowed for deleted Storm Packages to be retrieved from memory. (#2182)

17.210 v2.36.0 - 2021-05-06

17.210.1 Features and Enhancements

- Add `risk:vuln` support to the default Stix 2.1 export, and capture vulnerability information used by threat actors and in campaigns. Add the ability to validate Stix 2.1 bundles to ensure that they are Stix 2.1 CS02 compliant. Add the ability to lift Synapse nodes based on bundles which were previously exported from Synapse. The lift feature only works with bundles created with Synapse v2.36.0 or greater. (#2174)
- Add a `Str.upper()` function for uppercasing strings in Storm. (#2174)
- Automatically bump a user's StormDmon's when they are locked or unlocked. (#2177)
- Add Storm Package support to `synapse.tools.autodocs` and update the rstorm implementation to capture additional directives. (#2172)
- Tighten lark-parser version requirements. (#2175)

17.210.2 Bugfixes

- Fix reported layer size to represent actual disk usage. (#2173)

17.211 v2.35.0 - 2021-04-27

17.211.1 Features and Enhancements

- Add `:issuer:cert` and `:selfsigned` properties to the `crypto:x509:cert` form to enable modeling X509 certificate chains. (#2163)
- Add a `https:headers` configuration option to the Cell to allow setting arbitrary HTTP headers for the Cell HTTP API server. (#2164)
- Update the Cell HTTP API server to have a minimum TLS version of v1.2. Add a default `/robots.txt` route. Add `X-XSS=Protection` and `X-Content-Type-Options` headers to the default HTTP API responses. (#2164)
- Update the minimum version of LMDB to `1.2.1`. (#2169)

17.211.2 Bugfixes

- Improve the error message for Storm syntax error handling. (#2162)
- Update the layer byarray index migration to account for arrays of `inet:fqdn` values. (#2165) (#2166)
- Update the `vertexproject/synapse-aha`, `vertexproject/synapse-axon`, `vertexproject/synapse-cortex`, and `vertexproject/synapse-cryotank` Docker images to use `tini` as a default entrypoint. This fixes an issue where signals were not properly being propagated to the Cells. (#2168)
- Fix an issue with enfanged indicators which were not properly being lifted by Storm when operating in `lookup` mode. (#2170)

17.212 v2.34.0 - 2021-04-20

17.212.1 Features and Enhancements

- Storm function definitions now allow keyword arguments which may have default values. These must be read-only values. (#2155) (#2157)

- Add a `getCellInfo()` API to the `Cell` and `CellAPI` classes. This returns metadata about the cell, its version, and the currently installed Synapse version. Cell implementers who wish to expose Cell specific version information must adhere to conventiosn documented in the API docstrings of the function. (#2151)
- Allow external Storm modules to be added in genpkg definitions. (#2159)

17.212.2 Bugfixes

- The `$lib.layer.get()` Stormtypes returned the top layer of the default view in the Cortex when called with no arguments, instead of the top layer of the current view. This now returns the top layer of the current view. (#2156)
- Avoid calling `applyNodeEdit` when editing a tag on a Node and there are no edits to make. (#2161)

17.212.3 Improved Documentation

- Fix typo in docstrings from `$lib.model.tags` Stormtypes. (#2160)

17.213 v2.33.1 - 2021-04-13

17.213.1 Bugfixes

- Fix a regression when expanding list objects in Storm. (#2154)

17.214 v2.33.0 - 2021-04-12

17.214.1 Features and Enhancements

- Add CWE and CVSS support to the `risk:vuln` form. (#2143)
- Add a new Stormtypes library, `$lib.infosec.cvss`, to assist with parsing CVSS data, computing scores, and updating `risk:vuln` nodes. (#2143)
- Add ATT&CK, CWD, and CPE support to the IT model. (#2143)
- Add `it:network`, `it:domain`, `it:account`, `it:group` and `it:login` guid forms to model common IT concepts. (#2096)
- Add a new model, `project`, to model projects, tickets, sprints and epics. The preliminary forms for this model include `proj:project`, `proj:sprint`, `proj:ticket`, `proj:comment`, and `projec:project`. (#2096)
- Add a new Stormtypes library, `$lib.project`, to assist with using the project model. The API is provisional. (#2096)
- Allow lifting `guid` types with the prefix (`^=`) operator. (#2096)
- Add `ou:contest:result:url` to record where to find contest results. (#2144)
- Allow subquery as a value in additional places in Storm. This use must yield exactly one node. Secondary property assignments to array types may yield multiple nodes. (#2137)
- Tighten up Storm iterator behavior on the backend. This should not have have user-facing changes in Storm behavior. (#2148) (#2096)
- Update the Cell backup routine so that it blocks the ioloop less. (#2145)
- Expose the remote name and version of Storm Services in the `service.list` command. (#2149)
- Move test deprecated model elements into their own Coremodule. (#2150)
- Update `lark` dependency. (#2146)

17.214.2 Bugfixes

- Fix incorrect grammer in model.edge commands. (#2147)
- Reduce unit test memory usage. (#2152)
- Pin `jupyter-client` library. (#2153)

17.215 v2.32.1 - 2021-04-01

17.215.1 Features and Enhancements

- The Storm `$lib.exit()` function now takes message arguments similar to `$lib.warn()` and fires that message into the run time as a `warn` prior to stopping the runtime. (#2138)
- Update `pygments` minimum version to `v2.7.4`. (#2139)

17.215.2 Bugfixes

- Do not allow light edge creation on runt nodes. (#2136)
- Fix backup test timeout issues. (#2141)
- Fix the `synapse.lib.msgpack.en()` function so that now raises the correct exceptions when operating in fallback mode. (#2140)
- Fix the `Snap.addNodes()` API handling of deprecated model elements when doing bulk data ingest. (#2142)

17.216 v2.32.0 - 2021-03-30

17.216.1 Features and Enhancements

- Increase the verbosity of logging statements related to Cell backup operations. This allows for better visibility into what is happening while a backup is occurring. (#2124)
- Add Telepath and Storm APIs for setting all the roles of a User at once. (#2127)
- Expose the Synapse package commit hash over Telepath and Stormtypes. (#2133)

17.216.2 Bugfixes

- Increase the process spawn timeout for Cell backup operations. Prevent the Cell backup from grabbing lmdb transactions for slabs in the cell local tmp directory. (#2124)

17.217 v2.31.1 - 2021-03-25

17.217.1 Bugfixes

- Fix a formatting issue preventing Python packages from being uploaded to PyPI. (#2131)

17.218 v2.31.0 - 2021-03-24

17.218.1 Features and Enhancements

- Add initial capability for exporting STIX 2.1 from the Cortex. (#2120)

- Refactor how lift APIs are implemented, moving them up to the Cortex itself. This results in multi-layer lifts now yielding nodes in a sorted order. (#2093) (#2128)
- Add `$lib.range()` Storm function to generate ranges of integers. (#2122)
- Add an `errok` option to the `$lib.time.parse()` Storm function to allow the function to return `$lib.null` if the time string fails to parse. (#2126)
- Don't execute Cron jobs, Triggers, or StormDmons for locked users. (#2123) (#2129)
- The `git` commit hash is now embedded into the `synapse.lib.version` module when building PyPi packages and Docker images. (#2119)

17.218.2 Improved Documentation

- Update Axon wget API documentation to note that we always store the body of the HTTP response, regardless of status code. (#2125)

17.219 v2.30.0 - 2021-03-17

17.219.1 Features and Enhancements

- Add `$lib.trycast()` to allow for Storm control flow based on type normalization. (#2113)

17.219.2 Bugfixes

- Resolve a bug related to pivoting to a secondary property that is an array value. (#2111)
- Fix an issue with Aha and persisting the online state of services upon startup. (#2103)
- Convert the type of `inet:web:acct:singup:client:ipv6` from a `inet:ipv4` to an `inet:ipv6`. (#2114)
- Fix an idempotency issue when deleting a custom form. (#2112)

17.219.3 Improved Documentation

- Update README.rst. (#2115) (#2117) (#2116)

17.220 v2.29.0 - 2021-03-11

This release includes a Cortex storage Layer bugfix. It does an automatic upgrade upon startup to identify and correct invalid array index values. Depending on time needed to perform this automatic upgrade, the Cortex may appear unresponsive. Deployments with startup or liveliness probes should have those disabled while this upgrade is performed to prevent accidental termination of the Cortex process.

17.220.1 Features and Enhancements

- Add a `reverse` argument to `$lib.sorted()` to allow a Storm user to easily reverse an iterable item. (#2109)
- Update minimum required versions of Tornado and PyYAML. (#2108)

17.220.2 Bugfixes

- Fix an issue with Array property type deletion not properly deleting values in the `byarray` index. This requires an automatic data migration done at Cortex startup to remove extra index values which may be present in the index. (#2104) (#2106)

- Fix issues with using the Storm ?= operator with types which can generate multiple values from a given input string when making nodes. (#2105) (#2107)

17.220.3 Improved Documentation

- Add Devops documentation explaining our Docker container offerings. (#2104) (#2110)

17.221 v2.28.1 - 2021-03-08

17.221.1 Bugfixes

- Fix `$lib.model.prop()` API when called with a universal property. It now returns `$lib.null` instead of raising an exception. (#2100)
- Fix the streaming backup API when used with Telepath and SSL. (#2101)

17.221.2 Improved Documentation

- Add API documentation for the Axon. (#2098)
- Update the Storm pivot reference documentation. (#2101)

17.222 v2.28.0 - 2021-02-26

17.222.1 Features and Enhancements

- Add `String.reverse()` Stormtypes API to reverse a string. (#2086)
- Add Cell APIs for streaming compressed backups. (#2084) (#2091)
- Refactor `snap.addNodes()` to reduce the transaction count. (#2087) (#2090)
- Add `$lib.axon.list()` Stormtypes API to list hashes in an Axon. (#2088)
- Add user permissions requirements for Aha CSR signing. (#2089)
- Add `aha:svcinfo` configuration option for the base Cell. (#2089)
- Add interfaces to the output of `model.getModelDefs()` and the `getModelDict()` APIs. (#2092)
- Update pylmdb to `v1.1.1`. (#2076)

17.222.2 Bugfixes

- Fix incorrect permissions check in the `merge --diff` Storm command. (#2085)
- Fix service teardown issue in Aha service on fini. (#2089)
- Fix possible `synapse.tools.cmdr` teardown issue when using Aha. (#2089)
- Cast `synapse_minversion` from Storm Packages into a tuple to avoid packages added with HTTP endpoints from failing to validate. (#2095)

17.222.3 Improved Documentation

- Add documentation for the Aha discovery service. (#2089)
- Add documentation for assigning secondary properties via subquery syntax. (#2097)

17.223 v2.27.0 - 2021-02-16

17.223.1 Features and Enhancements

- Allow property assignment and array operations from subqueries. (#2072)
- Add APIs to the Axon to allow the deletion of blobs via Telepath and HTTP APIs. (#2080)
- Add a `str.slice()` stormtypes method to allow easy string slicing. (#2083)
- Modularize the Storm HTTP API handlers. (#2082)

17.223.2 Bugfixes

- Fix Agenda events which were not being properly tracked via the Nexus. (#2078)

17.223.3 Improved Documentation

- Add documentation for the Cortex `/api/v1/storm/export` HTTP endpoint. This also included documentation for the scrub option in Storm. (#2079)
- Add a Code of Conduct for Synapse. (#2081)

17.224 v2.26.0 - 2021-02-05

17.224.1 Features and Enhancements

- Add Storm commands for easily adding, deleting, and listing layer push and pull configurations. (#2071)

17.224.2 Bugfixes

- Fix `layer.getPropCount()` API for universal properties. (#2073)
- Add a missing async yield in `Snap.addNodes()`. (#2074)
- Constrain lmdb version due to unexpected behavior in `v1.1.0`. (#2075)

17.224.3 Improved Documentation

- Update user docs for Storm flow control and data model references. (#2066)

17.225 v2.25.0 - 2021-02-01

17.225.1 Features and Enhancements

- Implement tag model based pruning behavior for controlling how individual tag trees are deleted from nodes. (#2067)
- Add model interfaces for defining common sets of properties for forms, starting with some file mime metadata. (#2040)
- Add `file:mime:msdoc`, `file:mime:msxls`, `file:mime:msppt`, and `file:mime:rtf` forms. (#2040)
- Tweak the ival normalizer to auto-expand intervals with a single element. (#2070)
- Removed the experimental `spawn` feature of the Storm runtime. (#2068)

17.225.2 Bugfixes

- Add a missing async yield statement in `View.getEdgeVerbs()`. (#2069)

17.225.3 Improved Documentation

- Correct incorrect references to the `synapse.tools.easycert` documentation. (#2065)

17.226 v2.24.0 - 2021-01-29

17.226.1 Features and Enhancements

- Add support for storing model metadata for tags and support for enforcing tag trees using regular expressions. (#2056)
- Add `ou:contest:url` secondary property. (#2059)
- Add `synapse.lib.autodoc` to collect some Storm documentation helpers into a single library. (#2034)
- Add `tag.prune` Storm command to remove parent tags when removing a leaf tag from a node. (#2062)
- Update the `msgpack` Python dependency to version `v1.0.2`. (#1735)
- Add logs to Cell backup routines. (#2060)
- Export the Layer iterrows APIs to the CoreApi. (#2061)

17.226.2 Bugfixes

- Do not connect to Aha servers when they are not needed. (#2058)
- Make the array property `ou:org:industries` a unique array property. (#2059)
- Add permission checks to the Storm `movetag` command. (#2063)
- Add permissions checks to the Storm `edges.del` command. (#2064)

17.226.3 Improved Documentation

- Add documentation for the `synapse.tools.genpkg` utility, for loading Storm packages into a Cortex. (#2057)
- Refactor the Stormtypes documentation generation to make it data driven. (#2034)

17.227 v2.23.0 - 2021-01-21

17.227.1 Features and Enhancements

- Add support for ndef based light edge definitions in the `syn.nodes` feed API. (#2051) (#2053)
- Add ISIC codes to the `ou:industry` form. (#2054) (#2055)
- Add secondary properties `:loc`, `:latlong`, and `:place` to the `inet:web:action` and `inet:web:logon` forms. (#2052)
- Add secondary property `:enabled` to the form `it:app:yara:rule`. (#2052)
- Deprecate the `file:string` and `ou:member` forms, in favor of using light edges for storing those relationships. (#2052)

17.228 v2.22.0 - 2021-01-19

17.228.1 Features and Enhancements

- Allow expression statements to be used in Storm filters. (#2041)
- Add `file:subfile:path` secondary property to record the path a file was stored in a parent file. The corresponding `file:subfile:name` property is marked as deprecated. (#2043)
- Make the Axon `wget()` timeout a configurable parameter. (#2047)
- Add a `Cortex.exportStorm()` on the Cortex which allows for exporting nodes from a Storm query which can be directly ingested with the `syn.nodes` feed function. If the data is serialized using msgpack and stored in a Axon, it can be added to a Cortex with the new `Cortex.feedFromAxon()` API. A new HTTP API, `/api/v1/storm/export`, can be used to get a msgpacked file using this export interface. (#2045)

17.228.2 Bugfixes

- Fix issues in the Layer push and pull loop code. (#2044) (#2048)
- Add missing `toprim()` and `tostr()` calls for the Stormtypes Whois guid generation helpers. (#2046)
- Fix behavior in the Storm lookup mode which failed to lookup some expected results. (#2049)
- Fix `$lib.pkg.get()` return value when the package is not present. (#2050)

17.229 v2.21.1 - 2021-01-04

17.229.1 Bugfixes

- Fix a variable scoping issue causing a race condition. (#2042)

17.230 v2.21.0 - 2020-12-31

17.230.1 Features and Enhancements

- Add a Storm `wget` command which will download a file from a URL using the Cortex Axon and yield `inet:urlfile` nodes. (#2035)
- Add a `--diff` option to the `merge` command to enumerate changes. (#2037)
- Allow StormLib Layer API to dynamically update a Layer's logedits setting. (#2038)
- Add StormLib APIs for adding and deleting extended model properties, forms and tag properties. (#2039)

17.230.2 Bugfixes

- Fix an issue with the JsonStor not created nested entries properly. (#2036)

17.231 v2.20.0 - 2020-12-29

17.231.1 Features and Enhancements

- Correct the StormType `Queue.pop()` API to properly pop and return only the item at the specified index or the next entry in the Queue. This simplifies the intent behind the `.pop()` operation; and removes the `cull` and `wait` parameters which were previously on the method. (#2032)

17.231.2 Bugfixes

- Use `resp.iter_chunked` in the Axon `.wget()` API to improve compatibility with some third party libraries. (#2030)
- Require the use of a msgpack based deepcopy operation in handling storage nodes. (#2031)
- Fix for ambiguous whitespace in Storm command argument parsing. (#2033)

17.232 v2.19.0 - 2020-12-27

17.232.1 Features and Enhancements

- Add APIs to remove decommissioned services from AHA servers.
- Add (optional) explicit network parameters to AHA APIs. (#2029)
- Add cell.isCellActive() API to differentiate leaders/mirrors. (#2028)
- Add pop() method to Storm list objects. (#2027)

17.232.2 Bugfixes

- Fix bug in dry-run output of new merge command. (#2026)

17.233 v2.18.1 - 2020-12-24

17.233.1 Bugfixes

- Make syncIndexEvents testing more resiliant
- Make syncIndexEvents yield more often when filtering results (#2025)
- Update push/pull tests to use new waittask() API
- Raise clear errors in ambiguous use of node.tagglobs() API
- Update model docs and examples for geo:latitude and geo:longitude
- Support deref form names in storm node add expressions (#2024)
- Update tests to normalize equality comparison values (#2023)

17.234 v2.18.0 - 2020-12-23

17.234.1 Features and Enhancements

- Added axon.size() API and storm plumbing (#2020)

17.234.2 Bugfixes

- Fix active coro issue uncovered with cluster testing (#2021)

17.235 v2.17.1 - 2020-12-22

17.235.1 Features and Enhancements

- Added (BETA) RST pre-processor to embed Storm output into RST docs. (#1988)

- Added a `merge` command to allow per-node Layer merge operations to be done. (#2009)
- Updated storm package format to include a semver version string. (#2016)
- Added telepath proxy getPipeline API to minimize round-trip delay. (#1615)
- Added Node properties iteration and setitem APIs to storm. (#2011)

17.235.2 Bugfixes

- Fixes for active coro API and internal layer API name fixes. (#2018)
- Allow :prop -+> * join syntax. (#2015)
- Make getFormCount() API return a primitive dictionary. (#2014)
- Make StormVarListError messages more user friendly. (#2013)

17.236 v2.17.0 - 2020-12-22

`2.17.0` was not published due to CI issues.

17.237 v2.16.1 - 2020-12-17

17.237.1 Features and Enhancements

- Allow the `matchdef` used in the `Layer.syncIndexEvents()` API to match on tagprop data. (#2010)

17.237.2 Bugfixes

- Properly detect and raise a client side exception in Telepath generators when the underlying Link has been closed. (#2008)
- Refactor the Layer push/push test to not reach through the Layer API boundary. (#2012)

17.237.3 Improved Documentation

- Add documentation for Storm raw pivot syntax. (#2007)
- Add documentation for recently added Storm commands. (#2007)
- General cleanup and clarifications. (#2007)

17.238 v2.16.0 - 2020-12-15

17.238.1 Features and Enhancements

- Replaced the View sync APIs introduced in `v2.14.0` with Layer specific sync APIs. (#2003)
- Add `$lib.regex.matches()` and `$lib.regex.search()` Stormtypes APIs for performing regular expression operations against text in Storm. (#1999) (#2005)
- Add `synapse.tools.genpkg` for generating Storm packages and loading them into a Cortex. (#2004)
- Refactored the StormDmon implementation to use a single async task and allow the Dmons to be restarted via `$lib.dmon.bump(iden)`. This replaces the outer task / inner task paradigm that was previously present. Also add the ability to persistently disable and enable a StomDmon. (#1998)
- Added `aha://` support to the `synapse.tools.pushfile` and `synapse.tools.pullfile` tools. (#2006)

17.238.2 Bugfixes

- Properly handle whitespace in keyword arguments when calling functions in Storm. (#1997)
- Fix some garbage collection issues causing periodic pauses in a Cortex due to failing to close some generators used in the Storm Command AST node. (#2001) (#2002)
- Fix scope based permission checks in Storm. (#2000)

17.239 v2.15.0 - 2020-12-11

17.239.1 Features and Enhancements

- Add two new Cortex APIs: `syncIndexEvents` and `syncLayerEvents` useful for external indexing. (#1948) (#1996)
- LMDB Slab improvements: Allow dupfixed dbs, add `firstkey` method, inline `_ispo2`, add HotCount deletion. (#1948)
- Add method to merge sort sorted async generators. (#1948)

17.239.2 Bugfixes

- Ensure parent FQDN exists even in out-of-order node edit playback. (#1995)

17.240 v2.14.2 - 2020-12-10

17.240.1 Bugfixes

- Fix an issue with the new layer push / pull code. (#1994)
- Fix an issue with the url sanitization function when the path contains an `@` character. (#1993)

17.241 v2.14.1 - 2020-12-09

17.241.1 Features and Enhancements

- Add a `/api/v1/active` HTTP API to the Cell that can be used as an unauthenticated liveliness check. (#1987)
- Add `$lib.pip.gen()` Stormtypes API for ephemeral queues and bulk data access in Storm. (#1986)
- Add a `$lib.model.tagprop()` Stormtypes API for retrieving Tagprop definitions. (#1990)
- Add efficient View and Layer push/pull configurations. (#1991) (#1992)
- Add `getAhaUrls()` to the Aha service to prepare for additional service discovery. (#1989)
- Add a `/api/v1/auth/onepass/issue` HTTP API for an admin to mint a one-time password for a Cell user. (#1982)

17.241.2 Bugfixes

- Make `aha://` urls honor local paths. (#1985)

17.242 v2.14.0 - 2020-12-09

`2.14.0` was not published due to CI issues.

17.243 v2.13.0 - 2020-12-04

17.243.1 Features and Enhancements

- Add `$lib.pkg.get()` StormTypes function to get the Storm Package definition for a given package by name. (#1983)

17.243.2 Bugfixes

- The user account provisioned by the `aha:admin` could be locked out. Now, upon startup, if they have been locked out or had their admin status removed, they are unlocked and admin is reset. (#1984)

17.244 v2.12.3 - 2020-12-03

17.244.1 Bugfixes

- Prevent OverflowError exceptions which could have resulted from lift operations with integer storage types. (#1980)
- Remove `inet:ipv4` norm routine wrap-around behavior for integers which are outside the normal bounds of IPv4 addresses. (#1979)
- Fix `view.add` and fork related permissions. (#1981)
- Read `telepath.yaml` when using the `synapse.tools.cellauth` tool. (#1981)

17.245 v2.12.2 - 2020-12-01

This release also includes the changes from v2.12.1, which was not released due to an issue with CI pipelines.

17.245.1 Bugfixes

- Add the missing API `getPathObjs` on the JsonStorCell. (#1976)
- Fix the HasRelPropCond AST node support for Storm pivprop operations. (#1972)
- Fix support for the `aha:registry` config parameter in a Cell to support an array of strings. (#1975)
- Split the `Cortex.addForm()` Nexus handler into two parts to allow for safe event replay. (#1978)
- Stop forking a large number of child layers in a View persistence test. (#1977)

17.246 v2.12.1 - 2020-12-01

17.246.1 Bugfixes

- Add the missing API `getPathObjs` on the JsonStorCell. (#1976)
- Fix the HasRelPropCond AST node support for Storm pivprop operations. (#1972)
- Fix support for the `aha:registry` config parameter in a Cell to support an array of strings. (#1975)

17.247 v2.12.0 - 2020-11-30

17.247.1 Features and Enhancements

- Add a `onload` paramter to the `stormpkg` definition. This represents a Storm query which is executed every time the `stormpkg` is loaded in a Cortex. (#1971) (#1974)
- Add the ability, in Storm, to unset variables, remove items from dictionaries, and remove items from lists. This is done via assigning `$lib.undef` to the value to be removed. (#1970)
- Add support for SOCKS proxy support for outgoing connections from an Axon and Cortex, using the `'http:proxy` configuration option. This configuration value must be a valid string for the `aiohttp_socks.ProxyConnector.from_url()` API. The SOCKS proxy is used by the Axon when downloading files; and by the Cortex when making HTTP connections inside of Storm. (#1968)
- Add `aha:admin` to the Cell configuration to provide a common name that is used to create an admin user for remote access to the Cell via the Aha service. (#1969)
- Add `auth:ctor` and `auth:conf` config to the Cell in order to allow hooking the construction of the `HiveAuth` object. (#1969)

17.248 v2.11.0 - 2020-11-25

17.248.1 Features and Enhancements

- Optimize Storm lift and filter queries, so that more efficient lift operations may be performed in some cases. (#1966)
- Add a `Axon.wget()` API to allow the Axon to retrieve files directly from a URL. (#1965)
- Add a JsonStor Cell, which allows for hierarchical storage and retrieval of JSON documents. (#1954)
- Add a Cortex HTTP API, `/api/v1/storm/call`. This behaves like the `CoreApi.callStorm()` API. (#1967)
- Add `:client:host` and `:server:host` secondary properties to the `inet:http:request` form. (#1955)
- Add `:host` and `:acct` secondary properties to the `inet:search:query` form. (#1955)
- Add a Telepath service discovery implementation, the Aha cell. The Aha APIs are currently provisional and subject to change. (#1954)

17.249 v2.10.2 - 2020-11-20

17.249.1 Features and Enhancements

- The Storm `cron.at` command now supports a `--now` flag to create a cron job which immediately executes. (#1963)

17.249.2 Bugfixes

- Fix a cleanup race that caused occasional `test_lmdbslab_base` failures. (#1962)
- Fix an issue with `EDIT_NODEDATA_SET` nodeedits missing the `oldv` value. (#1961)
- Fix an issue where `cron.cleanup` could have prematurely deleted some cron jobs. (#1963)

17.250 v2.10.1 - 2020-11-17

17.250.1 Bugfixes

- Fix a CI issue which prevented the Python `sdist` package from being uploaded to PyPi. (#1960)

17.251 v2.10.0 - 2020-11-17

17.251.1 Announcements

The `v2.10.0` Synapse release contains support for Python 3.8. Docker images are now built using a Python 3.8 image by default. There are also Python 3.7 images available as `vertexproject/synapse:master-py37` and `vertexproject/synapse:v2.x.x-py37`.

17.251.2 Features and Enhancements

- Python 3.8 release support for Docker and PyPi. (#1921) (#1956)
- Add support for adding extended forms to the Cortex. This allows users to define their own forms using the existing types which are available in the Synapse data model. (#1944)
- The Storm `and` and `or` statements now short-circuit and will return when their logical condition is first met. This means that subsequent clauses in those statements may not be executed. (#1952)
- Add a mechanism for Storm Services to specify commands which may require privilege elevation to execute. An example of this may be to allow a command to create nodes; without managning individual permissions on what nodes a user may normally be allowed to create. Services using this mechanism wiill use the `storm.asroot.cmd.<<cmd name>>` hierarchy to grant this permission. (#1953) (#1958)
- Add `$lib.json` Stormtypes Library to convert between string data and primitives. (#1949)
- Add a `parallel` command to allow for executing a portion of a Storm query in parallel. Add a `background` command to execute a Storm query as a detached task from the current query, capturing variables in the process. (#1931) (#1957)
- Add a `$lib.exit()` function to StormTypes to allow for quickly exiting a Storm query. (#1931)
- Add `$lib.bytes.upload()` to Stormtypes for streaming bytes into the Axon that the Cortex is configured with. (#1945)
- Add Storm commands to manage locking and unlocking deprecated model properties. (#1909)
- Add `cron.cleanup` command to make it easy to clean up completed cron jobs. (#1942)
- Add date of death properties and consistently named photo secondary properties. (#1929)
- Add model additions for representing education and awards. (#1930)
- Add additional account linkages to the `inet` model for users and groups. (#1946)
- Add `inet:web:hashtag` as its own form, and add `:hashtags` to `inet:web:post`. (#1946)
- Add `lang:translation` to capture language translations of texts in a more comprehensive way than older `lang` model forms did. The `lang:idiom` and `lang:trans` forms have been marked as deprecated. (#1946)
- Update the `ou` model to add `ou:attendee` and `ou:contest` and `ou:contest:result` forms. Several secondary properties related to conference attendance have been marked deprecated. (#1946)
- The `ps:persona` and `ps:persona:has` forms have been marked as deprecated. (#1946)
- Add `ps:contactlist` to allow collecting multiple `ps:contact` nodes together. (#1935)
- Allow the Storm Service cmdargs to accept any valid model type in the `type` value. (#1923) (#1936)

- Add >, <, >= and <= comparators for `inet:ipv4` type. (#1938)
- Add configuration options to the Axon to limit the amount of data which can be stored in it. Add a configuration option the Cortex to limit the number of nodes which may be stored in a given Cortex. (#1950)

17.251.3 Bugfixes

- Fix a potential incorrect length for Spooled sets during fallback. (#1937)
- Fix an issue with the Telepath `Client` object caching their `Method` and `GenrMethod` attributes across reconnections of the underlying `Proxy` objects. (#1939) (#1941)
- Fix a bug where a temporary spool slab cleanup failed to remove all files from the filesystem that were created when the slab was made. (#1940)
- Move exceptions which do not subclass `SynErr` out of `synapse/exc.py`. (#1947) (#1951)

17.252 v2.9.2 - 2020-10-27

17.252.1 Bugfixes

- Fix an issue where a Cortex migrated from a *01x* release could overwrite entries in a Layer's historical nodeedit log. (#1934)
- Fix an issue with the layer definition schema. (#1927)

17.253 v2.9.1 - 2020-10-22

17.253.1 Features and Enhancements

- Reuse existing an existing `DateTime` object when making time strings. This gives a slight performance boost for the `synapse.lib.time.repr()` function. (#1919)
- Remove deprecated use of `loop` arguments when calling `asyncio` primitives. (#1920)
- Allow Storm Services to define a minimum required Synapse version by the Cortex. If the Cortex is not running the minimum version, the Cortex will not load (#1900)
- Only get the nxsindx in the `Layer.storeNodeEdits()` function if logging edits. (#1926)
- Include the Node iden value in the `CantDelNode` exception when attempting to delete a Node failes due to existing references to the node. (#1926)
- Take advantage of the LMDB append operation when possible. (#1912)

17.253.2 Bugfixes

- Fix an issues in the Telepath Client where an exception thrown by a onlink function could cause additional linkloop tasks to be spawned. (#1924)

17.254 v2.9.0 - 2020-10-19

17.254.1 Announcements

The `v2.9.0` Synapse release contains an automatic Cortex Layer data migration. The updated layer storage format reduces disk and memory requirements for a layer. It is recommended to test this process with a backup of a Cortex before updating a production Cortex.

In order to maximize the space savings from the new layer storage format, after the Cortex has been migrated to `v2.9.0`, one can take a cold backup of the Cortex and restore the Cortex from that backup. This compacts the LMDB databases which back the Layers and reclaims disk space as a result. This is an optional step; as LMDB will eventually re-use the existing space on disk.

If there are any questions about this, please reach out in the Synapse Slack channel so we can assist with any data migration questions.

17.254.2 Features and Enhancements

- Optimize the layer storage format for memory size and performance. (#1877) (#1885) (#1899) (#1917)
- Initial support Python 3.8 compatibility for the core Synapse library. Additional 3.8 support (such as wheels and Docker images) will be available in future releases. (#1907)
- Add a read only Storm option to the Storm runtime. This option prevents executing commands or Stormtypes functions which may modify data in the Cortex. (#1869) (#1916)
- Allow the Telepath Dmon to disconnect clients using a ready status. (#1881)
- Ensure that there is only one online backup of a Cell occurring at a time. (#1883)
- Added `.lower()`, `.strip()`, `.lstrip()` and `.rstrip()` methods to the Stormtypes Str object. These behave like the Python `str` methods. (#1886) (#1906)
- When scraping text, defanged indicators are now refanged by default. (#1888)
- Normalize read-only property declarations to use booleans in the data model. (#1887)
- Add `lift.byverb` command to allow lifting nodes using a light edge verb. (#1890)
- Add netblock and range lift helpers for `inet:ipv6` type, similar to the helpers for `inet:ipv4`. (#1869)
- Add a `edges.del` command to bulk remove light weight edges from nodes. (#1893)
- The `yield` keyword in Storm now supports iterating over Stormtypes List and Set objects. (#1898)
- Add `ou:contract`, `ou:industry` and `it:reveng:function:strings` forms to the data model. (#1894)
- Add some display type-hinting to the data model for some string fields which may be multi-line fields. (#1892)
- Add `getFormCounts()` API to the Stormtypes View and Layer objects. (#1903)
- Allow Cortex layers to report their total size on disk. This is exposed in the Stormtypes `Layer.pack()` method for a layer. (#1910)
- Expose the remote Storm Service name in the `$lib.service.get()` Stormtypes API. This allows getting a service object without knowing the name of the service as it was locally added to a Cortex. Also add a `$lib.service.has()` API which allows checking to see if a service is available on a Cortex. (#1908) (#1915)
- Add regular expression (~=) and prefix matching (^=) expression comparators that can be used with logical expressions inside of Storm. (#1906)
- Promote `CoreApi.addFeedData()` calls to tracked tasks which can be viewed and terminated. (#1918)

17.254.3 Bugfixes

- Fixed a Storm bug where attempting to access an undeclared variable silently fails. This will now raise a `NoSuchVar` exception. This is verified at runtime, not at syntax evaluation. (#1916)
- Ensure that Storm HTTP APIs tear down the runtime task if the remote disconnects before consuming all of the messages. (#1889)
- Fix an issue where the `model.edge.list` command could block the ioloop for large Cortex. (#1890)

- Fix a regex based lifting bug. (#1899)
- Fix a few possibly greedy points in the AST code which could have resulted in greedy CPU use. (#1902)
- When pivoting across light edges, if the destination form was not a valid form, nothing happened. Now a StormRuntimeError is raised if the destination form is not valid. (#1905)
- Fix an issue with spawn processes accessing lmdb databases after a slab resize event has occurred by the main process. (#1914)
- Fix a slab teardown race seen in testing Python 3.8 on MacOS. (#1914)

17.254.4 Deprecations

- The `0.1.x` to `2.x.x` Migration tool and associated Cortex sync service has been removed from Synapse in the `2.9.0` release.

17.254.5 Improved Documentation

- Clarify user documentation for pivot out and pivot in operations. (#1891)
- Add a deprecation policy for Synapse Data model elements. (#1895)
- Pretty print large data structures that may occur in the data model documentation. (#1897)
- Update Storm Lift documentation to add the ?= operator. (#1904)

17.255 v2.8.0 - 2020-09-22

17.255.1 Features and Enhancements

- Module updates to support generic organization identifiers, generic advertising identifiers, asnet6 and a few other secondary property additions. (#1879)
- Update the Cell backup APIs to perform a consistent backup across all slabs for a Cell. (#1873)
- Add support for a environment variable, `SYN_LOCKMEM_DISABLE` which will disable any memory locking of LMDB slabs. (#1882)

17.255.2 Deprecations

- The `0.1.x` to `2.x.x` Migration tool and and associated Cortex sync service will be removed from Synapse in the `2.9.0` release. In order to move forward to `2.9.0`, please make sure that any Cortexes which still need to be migrated will first be migrated to `2.8.x` prior to attempting to use `2.9.x`.

17.255.3 Improved Documentation

- Add Synapse README content to the Pypi page. This was a community contribution from https://github.com/wesinator. (#1872)

17.256 v2.7.3 - 2020-09-16

17.256.1 Deprecations

- The `0.1.x` to `2.x.x` Migration tool and and associated Cortex sync service will be removed from Synapse in the `2.9.0` release. In order to move forward to `2.9.0`, please make sure that any Cortexes which still need to be migrated will first be migrated to `2.8.x` prior to attempting to use `2.9.x`. (#1880)

17.256.2 Bugfixes

- Remove duplicate words in a comment. This was a community contribution from enadjoe. (#1874)
- Fix a nested Nexus log event in Storm Service deletion. The `del` event causing Storm code execution could lead to nested Nexus events, which is incongruent with how Nexus change handlers work. This now spins off the Storm code in a free-running coroutine. This does change the service `del` semantics since any support Storm packages a service had may be removed by the time the handler executes. (#1876)
- Fix an issue where the `cull` parameter was not being passed to the multiqueue properly when calling `.gets()` on a Storm Types Queue object. (#1876)
- Pin the `nbconvert` package to a known working version, as `v6.0.0` of that package broke the Synapse document generation by changing how templates work. (#1876)
- Correct `min` and `max` integer examples in tagprop documentation and tests. (#1878)

17.257 v2.7.2 - 2020-09-04

17.257.1 Features and Enhancements

- Update tests for additional test code coverage. This was a community contribution from blackout. (#1867)
- Add implicit links to documentation generated for Storm services, to allow for direct linking inside of documentation to specific Storm commands. (#1866)
- Add future support for deprecating model elements in the Synapse data model. This support will produce client and server side warnings when deprecated model elements are used or loaded by custom model extensions or CoreModules. (#1863)

17.257.2 Bugfixes

- Update `FixedCache.put()` to avoid a cache miss. This was a community contribution from blackout. (#1868)
- Fix the ioloop construction to be aware of `SYN_GREEDY_CORO` environment variable to put the ioloop into debug mode and log long-running coroutines. (#1870)
- Fix how service permissions are checked in `$lib.service.get()` and `$lib.service.wait()` Storm library calls. These APIs now first check `service.get.<service iden>` before checking `service.get.<service name>` permissions. A successful `service.get.<service name>` check will result in a warning to the client and the server. (#1871)

17.258 v2.7.1 - 2020-08-26

17.258.1 Features and Enhancements

- Refactor an Axon unit test to make it easier to test alternative Axon implementations. (#1862)

17.258.2 Bugfixes

- Fix an issue in `synapse.tools.cmdr` where it did not ensure that the users Synapse directory was created before trying to open files in the directory. (#1860) (#1861)

17.258.3 Improved Documentation

- Fix an incorrect statement in our documentation about the intrinsic Axon that a Cortex creates being remotely accessible. (#1862)

17.259 v2.7.0 - 2020-08-21

17.259.1 Features and Enhancements

- Add Telepath and HTTP API support to set and remove global Storm variables. (#1846)
- Add Cell level APIs for performing the backup of a Cell. These APIs are exposed inside of a Cortex via a Storm Library. (#1844)
- Add support for Cron name and doc fields to be editable. (#1848)
- Add support for Runtime-only (`runt`) nodes in the PivotOut operation (`-> *`). (#1851)
- Add `:nicks` and `:names` secondary properties to `ps:person` and `ps:persona` types. (#1852)
- Add a new `ou:position` form and a few associated secondary properties. (#1849)
- Add a step to the CI build process to smoke test the sdist and wheel packages before publishing them to PyPI. (#1853)
- Add support for representing `nodedata` in the command hinting for Storm command implementations and expose it on the `syn:cmd` runt nodes. (#1850)
- Add package level configuration data to Storm Packages in the `modconf` value of a package definition. This is added to the runtime variables when a Storm package is imported, and includes the `svciden` for packages which come from Storm Services. (#1855)
- Add support for passing HTTP params when using `$lib.inet.http.*` functions to make HTTP calls in Storm. (#1856)
- Log Storm queries made via the `callStorm()` and `count()` APIs. (#1857)

17.259.2 Bugfixes

- Fix an issue were some Storm filter operations were not yielding CPU time appropriately. (#1845)

17.259.3 Improved Documentation

- Remove a reference to deprecated `eval()` API from quickstart documentation. (#1858)

17.260 v2.6.0 - 2020-08-13

17.260.1 Features and Enhancements

- Support `+hh:mm` and `+hh:mm` timezone offset parsing when normalizing `time` values. (#1833)
- Enable making mirrors of Cortex mirrors work. (#1836)
- Remove read-only properties from `inet:flow` and `inet:http:request` forms. (#1840)
- Add support for setting nodedata and light edges in the `syn.nodes` ingest format. (#1839)
- Sync the LMDB Slab replay log if it gets too large instead of waiting for a force commit operation. (#1838)
- Make the Agenda unit tests an actual component test to reduce test complexity. (#1837)
- Support glob patterns when specifying files to upload to an Axon with `synapse.tools.pushfile`. (#1837)

- Use the node edit metadata to store and set the `.created` property on nodes, so that mirrors of Cortexes have consistent `.created` timestamps. (#1765)
- Support parent runtime variables being accessed during the execution of a `macro.exec` command. (#1841)
- Setting tags from variable values in Storm now calls `s_stormtypes.tostr()` on the variable value. (#1843)

17.260.2 Bugfixes

- The Storm `tree` command now catches the Synapse `RecursionLimitHit` error and raises a `StormRuntimeError` instead. The `RecursionLimitHit` being raised by that command was, in practice, confusing. (#1832)
- Resolve memory leak issues related to callStorm and Base object teardowns with exceptions. (#1842)

17.261 v2.5.1 - 2020-08-05

17.261.1 Features and Enhancements

- Add performance oriented counting APIs per layer, and expose them via Stormtypes. (#1813)
- Add the ability to clone a layer, primarily for benchmarking and testing purposes. (#1819)
- Update the benchmark script to run on remote Cortexes. (#1829)

17.261.2 Bugfixes

- Sanitize passwords from Telepath URLs during specific cases where the URL may be logged. (#1830)

17.261.3 Improved Documentation

- Fix a few typos in docstrings. (#1831)

17.262 v2.5.0 - 2020-07-30

17.262.1 Features and Enhancements

- Refactor the Nexus to remove leadership awareness. (#1785)
- Add support for client-side certificates in Telepath for SSL connections. (#1785)
- Add multi-dir support for CertDir. (#1785)
- Add a `--no-edges` option to the Storm `graph` command. (#1805)
- Add `:doc:url` to the `syn:tag` form to allow recording a URL which may document a tag. (#1805)
- Add `CoreApi.reqValidStorm()` and a `/api/v1/reqvalidstorm` Cortex HTTP API endpoint to validate that a given Storm query is valid Storm syntax. (#1806)
- Support Unicode white space in Storm. All Python *s* (Unicode white space + ASCII separators) is now treated as white space in Storm. (#1812)
- Refactor how StormLib and StormPrim objects access their object locals, and add them to a global registry to support runtime introspection of those classes. (#1804)
- Add smoke tests for the Docker containers built in CircleCI, as well as adding Docker healthchecks to the Cortex, Axon and Cryotank images. (#1815)
- Initialize the names of the default view and layer in a fresh Cortex to `default`. (#1814)

- Add HTTP API endpoints for the Axon to upload, download and check for the existend of files. (#1817) (#1822) (#1824) (#1825)
- Add a `$lib.bytes.has()` API to check if the Axon a Cortex is configured with knows about a given sha256 value. (#1822)
- Add initial model for prices, currences, securities and exchanges. (#1820)
- Add a `:author` field to the `it:app:yara:rule` form. (#1821)
- Add an experimental option to set the NexusLog as a `map_async` slab. (#1826)
- Add an initial transportation model. (#1816)
- Add the ability to dereference an item, from a list of items, in Storm via index. (#1827)
- Add a generic `$lib.inet.http.request()` Stormlib function make HTTP requests with arbitrary verbs. (#1828)

17.262.2 Bugfixes

- Fix an issue with the Docker builds for Synapse where the package was not being installed properly. (#1815)

17.262.3 Improved Documentation

- Update documentation for deploying Cortex mirrors. (#1811)
- Add automatically generated documentation for all the Storm `$lib...` functions and Storm Primitive types. (#1804)
- Add examples of creating a given Form to the automatically generated documentation for the automatically generated datamodel documentation. (#1818)
- Add additional documentation for Cortex automation. (#1797)
- Add Devops documentation for the list of user permissions relevant to a Cell, Cortex and Axon. (#1823)

17.263 v2.4.0 - 2020-07-15

17.263.1 Features and Enhancements

- Update the Storm `scrape` command to make `refs` light edges, instead of `edge:refs` nodes. (#1801) (#1803)
- Add `:headers` and `:response:headers` secondary properties to the `inet:http:request` form as Array types, so that requests can be directly linked to headers. (#1800)
- Add `:headers` secondary property to the `inet:email:messaage` form as Array types, so that messages can be directly linked to headers. (#1800)
- Add additional model elements to support recording additional data for binary reverse engineering. (#1802)

17.264 v2.3.1 - 2020-07-13

17.264.1 Bugfixes

- Prohibit invalid rules from being set on a User or Role object. (#1798)

17.265 v2.3.0 - 2020-07-09

17.265.1 Features and Enhancements

- Add `ps.list` and `ps.kill` commands to Storm, to allow introspecting the runtime tasks during (#1782)
- Add an `autoadd` mode to Storm, which will extract basic indicators and make nodes from them when executed. This is a superset of the behavior in the `lookup` mode. (#1795)
- Support skipping directories in the `synapse.tools.backup` tool. (#1792)
- Add prefix based lifting to the Hex type. (#1796)

17.265.2 Bugfixes

- Fix an issue for prop pivot out syntax where the source data is an array type. (#1794)

17.265.3 Improved Documentation

- Add Synapse data model background on light edges and update the Storm data modification and pivot references for light edges. (#1784)
- Add additional terms to the Synapse glossary. (#1784)
- Add documentation for additional Storm commands. (#1784)
- Update documentation for Array types. (#1791)

17.266 v2.2.2 - 2020-07-03

17.266.1 Features and Enhancements

- Add some small enhancements to the Cortex benchmarking script. (#1790)

17.266.2 Bugfixes

- Fix an error in the help for the `macro.del` command. (#1786)
- Fix rule indexing for the `synapse.tools.cellauth` tool to correctly print the rule offsets. (#1787)
- Remove extraneous output from the Storm Parser output. (#1789)
- Rewrite the language (and private APIs) for the Storm `model.edge` related commands to remove references to extended properties. That was confusing language which was unclear for users. (#1789)
- During 2.0.0 migrations, ensure that Cortex and Layer idens are unique; and make minimum 0.1.6 version requirement for migration. (#1788)

17.267 v2.2.1 - 2020-06-30

17.267.1 Bugfixes

- The Axon test suite was missing a test for calling `Axon.get()` on a file it did not have. This is now included in the test suite. (#1783)

17.267.2 Improved Documentation

- Improve Synapse devops documentation hierarchy. Add note about Cell directories being persistent. (#1781)

17.268 v2.2.0 - 2020-06-26

17.268.1 Features and Enhancements

- Add a `postAnit()` callback to the `synapse.lib.base.Base()` object which is called *after* the `__anit__()` call chain is completed, but before `Base.anit()` returns the object instance to the caller. This is used by the Cell to defer certain Nexus actions until the Cell has completed initializing all of its instance attributes. (#1768)
- Make `synapse.lib.msgpack.en()` raise a `SynErr.NotMsgpackSafe` exception instead of passing through the exception raised by msgpack. (#1768)

17.268.2 Bugfixes

- Add a missing `toprim()` call in `$lib.globals.set()`. (#1778)
- Fix an issue in the quickstart documentation related to permissions. Thank you `enadjoe` for your contribution. (#1779)
- Fix an Cell/Cortex startup issue which caused errors when starting up a Cortex when the last Nexus event was replayed. This has a secondary effect that Cell implementers cannot be making Nexus changes during the `__anit__` methods. (#1768)

17.268.3 Improved Documentation

- Add a minimal Storm Service example to the developer documentation. (#1776)
- Reorganize the Synapse User Guide into a more hierarchical format. (#1777)
- Fill out additional glossary items. (#1780)

17.269 v2.1.2 - 2020-06-18

17.269.1 Bugfixes

- Disallow command and bare string contensts from starting with `//` and `/*` in Storm syntax. (#1769)

17.270 v2.1.1 - 2020-06-16

17.270.1 Bugfixes

- Fix an issue in the autodoc tool which failed to account for Storm Service commands without cmdargs. (#1775)

17.271 v2.1.0 - 2020-06-16

17.271.1 Features and Enhancements

- Add information about light edges to graph carving output. (#1762)
- Add a `geo:json` type and `geo:place:geojson` property to the model. (#1759)
- Add the ability to record documentation for light edges. (#1760)
- Add the ability to delete and set items inside of a MultiQueue. (#1766)

17.271.2 Improved Documentation

- Refactor `v2.0.0` changelog documentation. (#1763)
- Add Vertex branding to the Synapse documentation. (#1767)
- Update Backups documentation in the Devops guide. (#1764)
- Update the autodoc tool to generate documentation for Cell confdefs and StormService information. (#1772)
- Update to separate the devops guides into distinct sections. (#1772)
- Add documentation for how to do boot-time configuration for a Synapse Cell. (#1772)
- Remove duplicate information about backups. (#1774)

17.272 v2.0.0 - 2020-06-08

Initial 2.0.0 release.

17.273 API Deprecation Notice - 2023-10-01

It's time to shed some long standing deprecations to reduce technical debt and prepare for some new features and subsystems! The following deprecated APIs and commands will be removed on 2023-10-01:

17.273.1 Storm Commands

- `sudo`
- `splice.list`
- `splice.undo`

17.273.2 Storm Options

- `editformat=splices`

17.273.3 Cortex Telepath APIs

- `stat()`
- `addCronJob()`
- `delCronJob()`
- `updateCronJob()`
- `enableCronJob()`
- `disableCronJob()`
- `listCronJobs()`
- `editCronJob()`
- `setStormCmd()`
- `delStormCmd()`
- `addNodeTag()`
- `delNodeTag()`

- setNodeProp()
- delNodeProp()
- eval()
- watch()
- splices()
- splicesBack()
- spliceHistory()
- addFeedData(syn.splice, ...)
- addFeedData(syn.nodeedits, ...)

17.273.4 Layer Telepath APIs

- splices()
- splicesBack()
- truncate()

17.273.5 Cmdr Commands

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