Cisco Crosswork Hierarchical Controller
(formerly Sedona NetFusion)

Admin Guide

October 2021

Contents

Introduction

This document is an administration guide for installation and configuration of the Cisco Crosswork Hierarchical Controller (formerly Sedona NetFusion) platform version 5.1.

The document explains:

- Crosswork Hierarchical Controller in Brief
- Crosswork Hierarchical Controller Installation Prerequisites
- Installing Crosswork Hierarchical Controller
- Security and Administration
- System Health
- Database Backup and Restore
- Model Settings (Regions, Tags, and Events)

Prerequisites

Hardware

Server Node

This spec is for active and standby or standalone instances of Crosswork Hierarchical Controller.

Hardware	Requirement
CPU	10 Cores
Memory	96 GB
Storage – for lab	400 GB SSD
Storage – for production (only for Crosswork Hierarchical Controller storage, not including OS needs)	3 TB disk. These partitions are recommended: OS partitions – 500 GB Data partition for Crosswork Hierarchical Controller – 2000 GB For expansion – 500 GB The data partitions (as a minimum) must use SSD. For more details on the calculated storage, see Solution Dimensions.
VMs	1

Hardware	Requirement

Witness Node

The witness node is the third node in the 'three-node-cluster' high availability solution of Crosswork Hierarchical Controller.

Hardware	Requirement
CPU	8 Cores
Memory	16 GB
Storage	256 GB SSD
VMs	1

Operating System

The Crosswork Hierarchical Controller application can be installed on the following supported Operating Systems:

- RedHat 7.6 EE
- CentOS 7.6

The OS can be installed on bare-metal or VM (Virtual Machine) servers.

Client

The client machine requirements are:

- PC or MAC
- GPU
- Web browser with GPU hardware acceleration support
- Recommended
    - Screen resolution 1920x1080
    - Google Chrome web browser

Note: GPU is mandatory to properly get all the benefits of the network 3D map

Solution Dimensions

Crosswork Hierarchical Controller is designed to model, analyze and perform provisioning operations in very large networks with hundreds of thousands of network elements, and millions of sub-NE and topology elements such as shelves, ports, links, tunnels, connections, and services. This document provides an analysis of the scale of the solution.

Before going into an in-depth analysis of the capabilities and limitations of Crosswork Hierarchical Controller, it is worth mentioning that the system has been successfully deployed for a few years over a network with about 12,000 optical NEs and 1,500 core and edge routers and growing to 19,000 NEs. This deployment uses direct access to the equipment, which is the most demanding case as explained below.

When designing a network controller like Crosswork Hierarchical Controller, one needs to consider the following potential scalability bottlenecks:

- Communicating with the NEs

- Storing the network model in the database

- Rendering the data in the UI

- Processing network data in applications

Crosswork Hierarchical Controller HCO model capacity is currently specified as following:

Components	Model Capacity
NEs	100,000
Links	500,000
Ports	1,000,000
LSPs	12,000
L3VPNs	500,000
Max response time for a node to be added/removed to a L3VPN service	10 s
SDN Controllers	12

Note the above model capacity is based on our deployment experience. However the actual number is larger as the footprint can be increased (scaled up) to handle larger network capacity. Further assessment is possible on demand.

Sedona Crosswork Hierarchical Controller GUI can manage the following number of concurrent users with a typical distribution of roles:

User	Role	Number of Users
Read-only	Access to Crosswork Hierarchical Controller Explorer UI.	100 (All)
Operational	Access to Crosswork Hierarchical Controller Explorer UI and all applications, some of which can change the network.	Less than 50
Administrator	Full control over configuration and all users. Access to Configuration UI, Crosswork Hierarchical Controller Explorer UI, and all applications.	Can be 100 (All)

Storage

The storage volume required for Crosswork Hierarchical Controller production depends on the amount of storage needed for performance counters and for daily DB backups.

The performance monitoring storage is calculated based on the number of client ports and the amount of time the counters are stored. The ballpark figure is 700 MB for 1000 ports.

The detailed formula to calculate the storage is:

<uncompressed data>=<number of ports>*<samples per day>*<number of days>*60

Storage = (<uncompressed data>*0.1)+<daily backup size>*<number of days>*<number of months>

Taking the following assumptions into account:

- **Samples** – samples per day

- **Sample size per port** – 60 bytes

- **Days** – number of days the PM data is stored

- **Compression ratio** – data is compressed in DB, at a ratio of ~10%

- **Daily backup** – ~60 MB per day

- **Number of backup day** – default is for last 7 days

- **Number of backup months** – default is 3 months

Installation Recommendations

- Use NTP to synchronize all clocks between the network elements.

- Ensure that the required ports are available and that the relevant ports are open to communicate with the network, managers and controllers (e.g. SNMP, CLI SSH, NETCONF). See the Ports section.

- Obtain the installation file (see the *Cisco Crosswork Hierarchical Controller Release Notes*) from your support representative. Download this file to a directory of your choice.

- Ensure that no firewalls prevent access between the Crosswork Hierarchical Controller platform and the remote hosts.

- Run a 'yum' update to make sure that any recent OS patches are installed (see recommendations here when no internet access is available: https://access.redhat.com/solutions/29269).

- Access the Crosswork Hierarchical Controller web client

Communications Matrix

The following are the default port requirements if the items listed in the Description column are used. You can configure these ports differently.

User	Role	Number of Users
Inbound	TCP 22	SSH remote management
	TCP 80	HTTP for UI access
	TCP 443	HTTPS for UI access
Outbound	TCP 22	NETCONF to routers
	UDP 161	SNMP to routers and/or ONEs
	TCP 389	LDAP if using Active Directory
	TCP 636	LDAPS if using Active Directory
	Customer Specific	HTTP for access to an SDN controller
	Customer Specific	HTTPS for access to an SDN controller
	TCP 3082, 3083, 2361, 6251	TL1 to optical devices

Installing Crosswork Hierarchical Controller

To install Crosswork Hierarchical Controller:
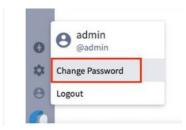
1. Go to the directory where the .sh installation file is downloaded.

2. Execute the installation command as root:

   ```
   sudo su –
   bash ./<file name>.sh
   ```

   The installation procedure requires no input from you during the installation. The installation procedure checks the HW resources and if there are insufficient resources, an error is raised, and you can either abort or resume the installation. In the event of other failures, contact your local Sedona support team.

   After the installation is complete, type sedo -h to enter the Crosswork Hierarchical Controller command line tool. Type the command version to check that the version was installed properly.

3. Log in to the Crosswork Hierarchical Controller user interface – https://server-name or IP with the user admin and password admin.

4. In the applications bar in Crosswork Hierarchical Controller, select **User Profile > Change Password**. The default admin password must be changed.

View Installed Crosswork Hierarchical Controller Applications

The relevant Crosswork Hierarchical Controller applications are integrated in the *.sh* installation file and are installed as part of the Crosswork Hierarchical Controller platform.

To view the installed Crosswork Hierarchical Controller applications:

1. After the installation is complete, ensure that you have **root** access to the OS where Crosswork Hierarchical Controller is installed, and type **sedo -h** to open the sedo utility by Sedona.

2. Run the following command to see which applications are installed:

   ```
   sedo apps list
   ```

   The output displays the installed applications with their ID, name and if they are enabled or not. All applications, except system apps (e.g. Device Manager) are disabled by default.

Enable or Disable Applications

Installed applications can be enabled and disabled using a sedo command.

To enable or disable applications:

1. To enable an application, run the command:

   ```
   sedo apps enable [application ID]
   ```

The application only appears in Crosswork Hierarchical Controller explorer after the application is enabled. If Crosswork Hierarchical Controller Explorer is already open, refresh the page. The application icon appears in the applications bar on the left.

2. To disable an active application, run the command:

```
sedo apps disable [application ID]
```

After disabling the application, the icon is no longer visible in the applications bar.

Install Crosswork Hierarchical Controller Applications

To install an application:

1. Obtain the **netfusion-apps.tar.gz** file which contains the application that needs to be installed or upgraded, and copy it to the Crosswork Hierarchical Controller server

2. Run the command:

```
sedo import apps [netfusion-apps.tar.gz file]
```

Upgrade Crosswork Hierarchical Controller Applications

It is possible to upgrade an application without re-installing the Crosswork Hierarchical Controller platform.

To upgrade an application:

1. Obtain the **netfusion-apps.tar.gz** file which contains the application that needs to be installed or upgraded, and copy it to the NetFusion server

2. Run the command:

```
sedo import apps [netfusion-apps.tar.gz file]
```

Note: If the upgraded application was enabled before upgrading the Crosswork Hierarchical Controller platform, the existing instance is automatically shut down and a new upgraded instance is started

Add Network Adapters and Discover Network Devices

For instructions on how to add network adapters and discover network devices, refer to the *Device Manager User Guide*.

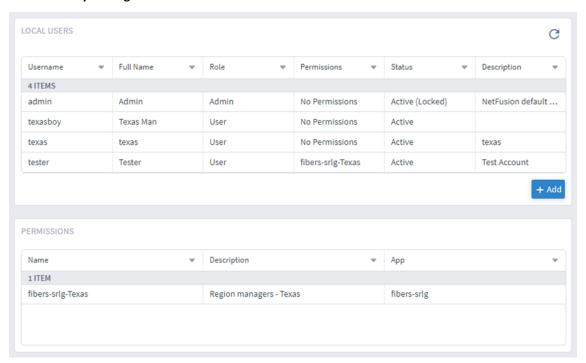# Security and Administration

User Administration

Crosswork Hierarchical Controller supports the creation and maintenance of local users, as well as integration with an Active Directory (LDAP) server. Local users can be created and assigned a role and permissions. The administrator can also select password complexity rules (OWASP) on passwords of local users. By selecting a scoring level, the length and character composition of the password is enforced.

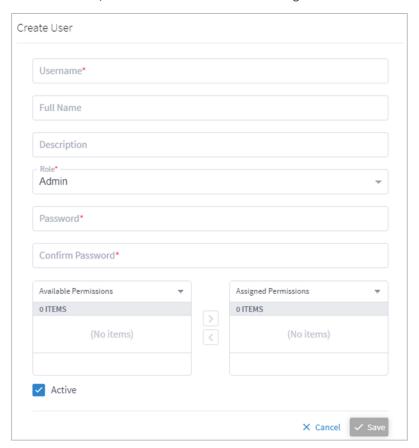| Crosswork Hierarchical Controller Role	Permissions
ReadOnly	Read-only access to Crosswork Hierarchical Controller Explorer UI.
User	Access to Crosswork Hierarchical Controller Explorer UI and all apps, some of which can change the network.
Admin	Full control over configuration and all users. Access to Configuration UI, Crosswork Hierarchical Controller Explorer UI, and all apps.

Crosswork Hierarchical Controller Role	Permissions
Support	Same permissions as the User role with the addition of access to Crosswork Hierarchical Controller diagnostic tools for the Sedona Support Team.

To add/edit a user:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. Click **Security Settings**.

LOCAL USERS

Username	Full Name	Role	Permissions	Status	Description
4 ITEMS					
admin	Admin	Admin	No Permissions	Active (Locked)	NetFusion default ...
texasboy	Texas Man	User	No Permissions	Active	
texas	texas	User	No Permissions	Active	texas
tester	Tester	User	fibers-srlg-Texas	Active	Test Account

+ Add

PERMISSIONS

Name	Description	App
1 ITEM		
fibers-srlg-Texas	Region managers - Texas	fibers-srlg

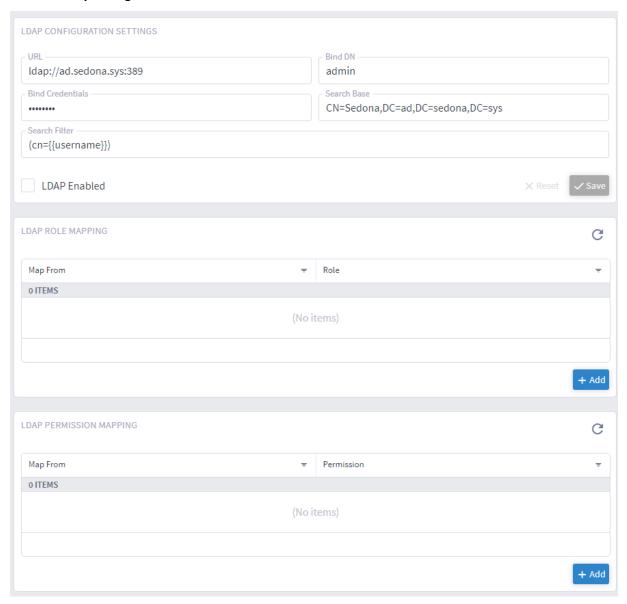3. In **LOCAL USERS**, click **Add** or click on an existing user.

4. Complete the fields and assign any required permissions.

5. Click **Save**.

Active Directory

Crosswork Hierarchical Controller allows for authenticating users via an LDAP server.

To configure an LDAP Server:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. Click **Security Settings**.

3. Configure the **ACTIVE DIRECTORY (LDAP)** settings. Full information on security in Crosswork Hierarchical Controller can be found in the *Crosswork Hierarchical Controller Security Architecture Guide*.

4. Click **Save**.

Login Limits

Number of logins attempts by users can be limited to avoid denial of service and brute force attacks.

To configure login limits:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. Click **Security Settings**.

LOGIN LIMITER

Max Attempts*
8

Delay After*
1

Delay Amount (ms)*
250

Limiter Window (ms)*
300000

Cancel   Save

3. Configure the **LOGIN LIMITER** settings.

4. Click **Save**.

SYSLOG Notifications

Crosswork Hierarchical Controller can send SYSLOG notification on security and monitoring events to multiple destinations.

The categories of these events are:
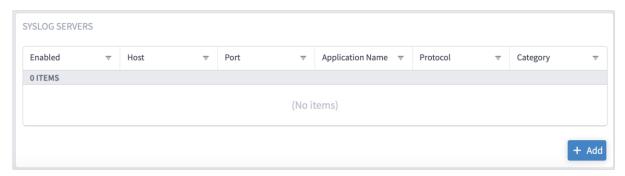
- **Security** – all login and logout events
- **Monitoring** – disk space thresholds, load average thresholds
- **SRLG** – get notifications on fiber SRLG app when new violations were detected
- **All** – security and monitoring

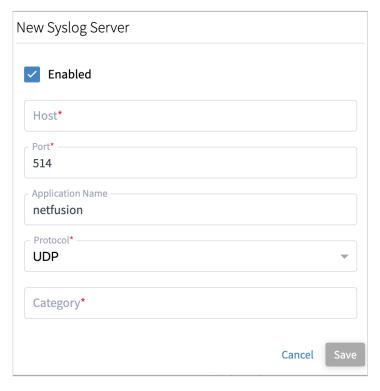Crosswork Hierarchical Controller sends three types of messages with the following facility codes:

- **AUTH (4)** – for /var/log/security messages.
- **LOGAUDIT (13)** – for Audit messages (login, logout, and so on).
- **USER (1)** – for all other messages.

To add a new server:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. Click **Security Settings**.

3. In **SYSLOG SERVERS**, click **Add**.

4. Complete the following:
   - **Host**
   - **Port:** 514 or 601
   - **Application Name:** free text
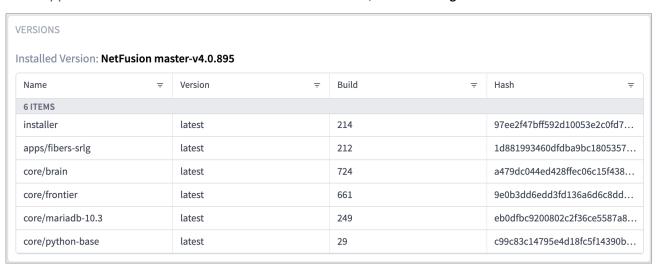   - **Protocol:** TCP or UDP
   - **Category:** security, monitoring, srlg, all

5. Click **Save**.

System Health

View System Info

To view system info:

- In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

VERSIONS

Installed Version: **NetFusion master-v4.0.895**

Name	Version	Build	Hash
6 ITEMS			
installer	latest	214	97ee2f47bff592d10053e2c0fd7…
apps/fibers-srlg	latest	212	1d881993460dfdba9bc1805357…
core/brain	latest	724	a479dc044ed428ffec06c15f438…
core/frontier	latest	661	9e0b3dd6edd3fd136a6d6c8dd…
core/mariadb-10.3	latest	249	eb0dfbc9200802c2f36ce5587a8…
core/python-base	latest	29	c99c83c14795e4d18fc5f14390b…

- In **System Info**, the **VERSIONS** table displays the installed packages and their build number.
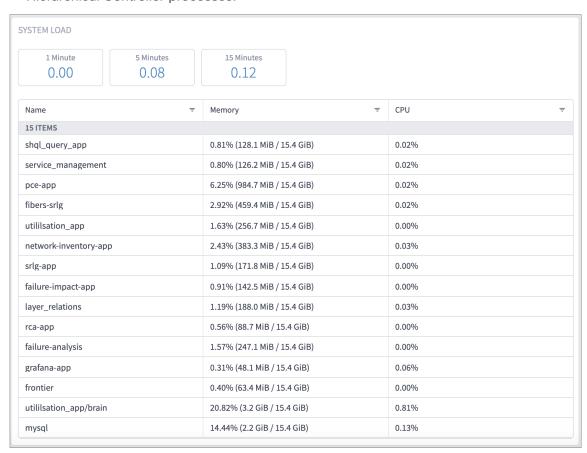
View System CPU Load

The Crosswork Hierarchical Controller platform performance can be tracked and you can view system CPU load and disk usage in the UI to isolate a specific service that may cause a reduction in performance or block specific functionality.

To view the system load:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. In **System Info**, the **SYSTEM LOAD** information is updated every two minutes by default.

   ◦ The values in the three rectangles displays the percentage of the CPU used by Crosswork Hierarchical Controller in the last minute, 5 minutes and 15 minutes (server load average).

- The columns display the percentage memory and CPU currently used by each of the Crosswork Hierarchical Controller processes.

SYSTEM LOAD

1 Minute	5 Minutes	15 Minutes
0.00	0.08	0.12

Name	Memory	CPU
15 ITEMS		
shql_query_app	0.81% (128.1 MiB / 15.4 GiB)	0.02%
service_management	0.80% (126.2 MiB / 15.4 GiB)	0.02%
pce-app	6.25% (984.7 MiB / 15.4 GiB)	0.02%
fibers-srlg	2.92% (459.4 MiB / 15.4 GiB)	0.02%
utililsation_app	1.63% (256.7 MiB / 15.4 GiB)	0.00%
network-inventory-app	2.43% (383.3 MiB / 15.4 GiB)	0.03%
srlg-app	1.09% (171.8 MiB / 15.4 GiB)	0.00%
failure-impact-app	0.91% (142.5 MiB / 15.4 GiB)	0.00%
layer_relations	1.19% (188.0 MiB / 15.4 GiB)	0.03%
rca-app	0.56% (88.7 MiB / 15.4 GiB)	0.00%
failure-analysis	1.57% (247.1 MiB / 15.4 GiB)	0.00%
grafana-app	0.31% (48.1 MiB / 15.4 GiB)	0.06%
frontier	0.40% (63.4 MiB / 15.4 GiB)	0.00%
utililsation_app/brain	20.82% (3.2 GiB / 15.4 GiB)	0.81%
mysql	14.44% (2.2 GiB / 15.4 GiB)	0.13%

3. To configure a different interval, run the command:

```
sedo config set monitor.load_average.rate.secs [VALUE]
```

4. Refresh the screen to see the change.

5. To set a load average threshold (a SYSLOG notification is generated when this is crossed), run the command:

```
sedo config set monitor.load_average.threshold [VALUE]
```
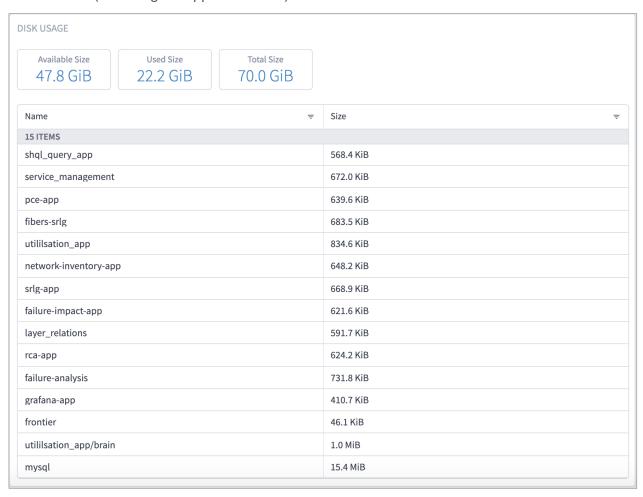
The recommended threshold is the number of cores multiplied by 0.8.

View Disk Usage

To view disk usage:

1. In the applications bar in Crosswork Hierarchical Controller, select **Settings**.

2. In **System Info**, the **DISK USAGE** information is updated every hour by default.

- The values in the three rectangles displays the available, used and total disk space on the current partition.

- The Size column displays the size of each of the Crosswork Hierarchical Controller application containers (excluding the application data).

DISK USAGE

Available Size	Used Size	Total Size
47.8 GiB	22.2 GiB	70.0 GiB

Name	Size
15 ITEMS	
shql_query_app	568.4 KiB
service_management	672.0 KiB
pce-app	639.6 KiB
fibers-srlg	683.5 KiB
utililsation_app	834.6 KiB
network-inventory-app	648.2 KiB
srlg-app	668.9 KiB
failure-impact-app	621.6 KiB
layer_relations	591.7 KiB
rca-app	624.2 KiB
failure-analysis	731.8 KiB
grafana-app	410.7 KiB
frontier	46.1 KiB
utililsation_app/brain	1.0 MiB
mysql	15.4 MiB

3. To configure a different interval, run the command:

   `sedo config set monitor.diskspace.rate.secs [VALUE]`

4. Refresh the screen to see the change.

5. To set a disk space threshold (a SYSLOG notification is generated when this is crossed), run the command:

   `sedo config set monitor.diskspace.threshold.secs [VALUE]`

   The recommended threshold is 80%.

Crosswork Hierarchical Controller Database Backup

Periodical Crosswork Hierarchical Controller DB Backup

- Backups are done every day automatically.
- Daily backups only include the gap from the previous day. These delta backups expire after a week.
- A full backup is done once a week automatically. The full backup expires after a year.

Manual Crosswork Hierarchical Controller DB Backup

You can manually back up the database, and you can use this complete backup file to restore the Crosswork Hierarchical Controller database or copy it to a new instance.

To back up the DB:

- To back up the database, use the command:

  ```
  sedo system backup
  ```

  The backup file name includes the version and date.

  `netfusion-backup-]5.0.1661-20210228100905.tar.gz`

Restore the Crosswork Hierarchical Controller DB

When you restore, Crosswork Hierarchical Controller uses the last full backup plus the delta backups to restore. This is done automatically for you when you use the restore command.

To restore the DB:

- To restore the database, use the command:

  ```
  sedo system restore [-h] (--backup-id BACKUP_ID | --filename FILENAME) [--no-verify] [-f]
  ```

  optional arguments:

  ```
  -h, --help              show this help message and exit
  --backup-id BACKUP_ID   restore backup by this ID
  --filename FILENAME     restore from this backup filename
  --no-verify             do not verify backup file integrity
  -f, --force             do not prompt for confirmation
  ```

List the Crosswork Hierarchical Controller DB Backups

Backups are created as follows:

- A full backup is created every Sunday (with an expiration of a year later).
- A delta backup is created daily, except for Sunday (with an expiration of seven days later).

  So typically you will see six delta backups between full backups.

In addition, full backups are created (with an expiration of seven days later):

- When the machine is first installed.
- If Crosswork Hierarchical Controller or the entire machine is rebooted (Monday to Saturday).
- To list the backups:
- To list the backups, use the command:

  ```
  sedo system list-backups
  ```

```
+----+--------+------------------------+--------+------------------------+----------+----------+
|    | ID     | Timestamp              | Type   | Expires                | Status   | Size     |
+====+========+========================+========+========================+==========+==========+
| 1  | QP80G0 | 2021-02-28 04:00:04+00 | FULL   | 2022-02-28 04:00:04+00 | OK       | 75.2 MiB |
+----+--------+------------------------+--------+------------------------+----------+----------+
| 2  | QP65S0 | 2021-02-27 04:00:01+00 | DELTA  | 2021-03-06 04:00:01+00 | OK       | 2.4 MiB  |
+----+--------+------------------------+--------+------------------------+----------+----------+
| 3  | QP4B40 | 2021-02-26 04:00:04+00 | DELTA  | 2021-03-05 04:00:04+00 | OK       | 45.9 MiB |
+----+--------+------------------------+--------+------------------------+----------+----------+
| 4  | QP2GG0 | 2021-02-25 04:00:03+00 | DELTA  | 2021-03-04 04:00:03+00 | OK       | 44.3 MiB |
+----+--------+------------------------+--------+------------------------+----------+----------+
| 5  | QP0LS0 | 2021-02-24 04:00:00+00 | DELTA  | 2021-03-03 04:00:00+00 | OK       | 1.5 MiB  |
+----+--------+------------------------+--------+------------------------+----------+----------+
| 6  | QOYR40 | 2021-02-23 04:00:03+00 | FULL   | 2021-03-02 04:00:03+00 | OK       | 39.7 MiB |
+----+--------+------------------------+--------+------------------------+----------+----------+
```

Regions

Regions are the geographical areas where network sites are located. The Model Settings application enables you to view and filter regions, delete regions, export regions, and import regions.

View a Region
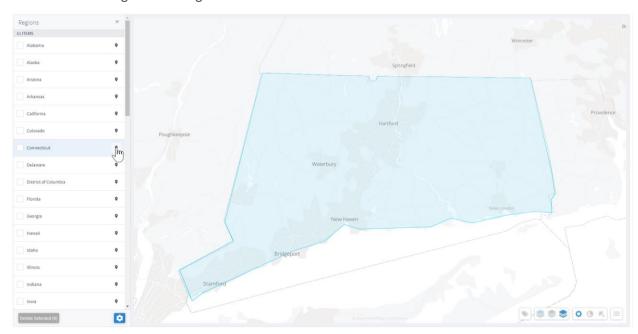
You can view a region in **Model Settings**.

To view a region in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Regions** tab.

3. To view a region, in **Regions**, click   next to the required region, for example, **Connecticut**. The map moves to the selected region. The region is outlined.
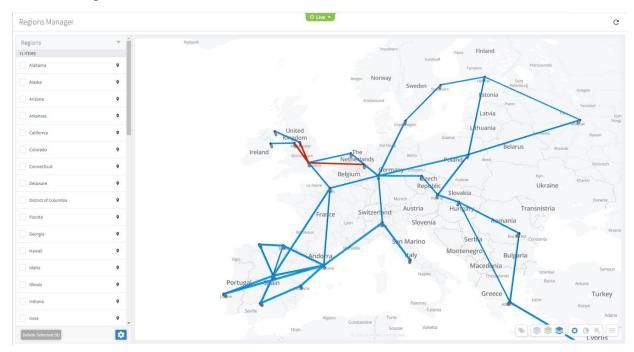
Filter the Regions
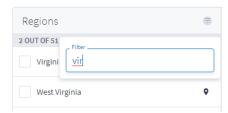
You can filter the regions.

To filter a region:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Regions** tab.

3. To filter the regions, click ⊤ and enter the filter criteria (case insensitive).

Delete Regions
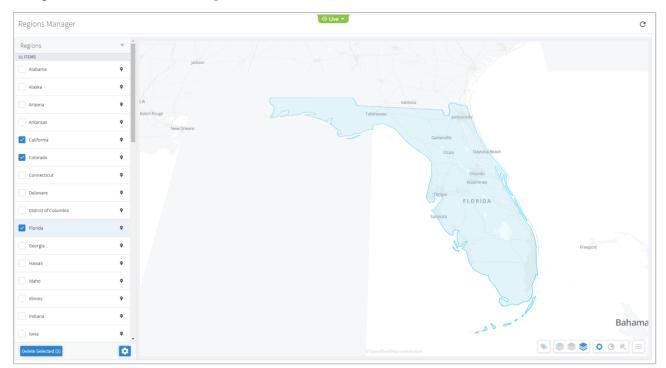
You can delete regions in Regions Manager.

To delete regions in Regions Manager:
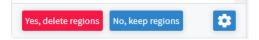
1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Regions** tab.

3. In **Regions**, select one or more regions.

4. Click **Delete Selected**.

5. To delete the regions, click **Yes, delete regions**.

Export and Import Regions
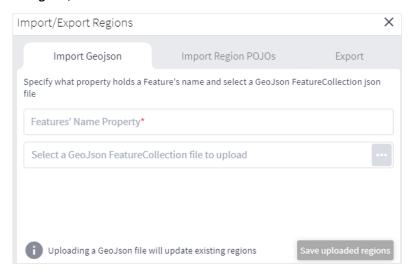
Sales Engineers will usually set up the regions in your model. The regions are set up according to the standards published by http://geojson.io/ and can be exported or imported in GeoJSON or Region POJOs.

You can import (and export) regions in the following formats:
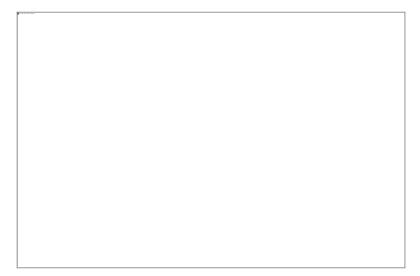
- GeoJSON
- Region POJOs
- Valid geometry types for regions are:
- Point
- LineString
- Polygon
- MultiPoint
- MultiLineString
- MultiPolygon

To export regions:

1. In the applications bar in Crosswork Hierarchical Controller, **select Services > Model Settings**.

2. Select the **Regions** tab.

3. In **Regions**, click ⚙ .

4. To export In **Regions**, select the **Export** tab.
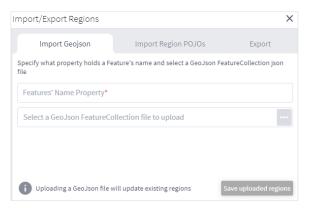
5. Select the required format, and then click **Export regions** ⚙. The JSON file is downloaded.

6. (Optional) Use a JSON formatter to review the content.

To import regions:

1. (Option 1) Prepare the import file in **GeoJSON** format:

   ◦ A quick way to create the file in the correct format is to export the current regions in the required format and then edit the file.

   ◦ The GeoJSON import file must be a **FeatureCollection** GeoJSON file and not a single **Feature** GeoJSON file.
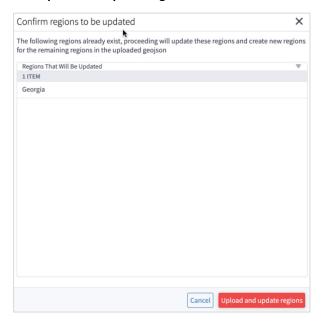
   ◦ The GeoJSON import file MUST have a region name property that will be specified when you import the file.

   ◦ The GeoJSON import file may include a GUID for each region. If a GUID is not provided, Regions Manager, generates a GUID for the GeoJSON feature. If a GUID is provided, Regions Manager uses it, and if a region with that GUID already exists it is updated.

   ◦ Each region name (and GUID if included) must only appear once.

   ◦ Region names are case insensitive.

   ◦ If a region already exists either by GUID or with an identical name, when you import the file, a message appears informing you that the region will be updated if you proceed.

2. (Option 2) Prepare the import file in Region POJOs format:

- A quick way to create the file in the correct format is to export the current regions in the required format and then edit the file.

- The RegionPOJO import file has a fixed format and the region name property is **name**. This property does not have to be specified when you import the file.

- The RegionPOJO import file must include the region GUID as a property.

- Each region name and GUID must only appear once.

- Region names are case insensitive.

- If a region already exists (by name or GUID), when you import the file, a message appears informing you that the region will be updated if you proceed.

3. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

4. Select the **Regions** tab.

5. In **Regions**, click ⚙ .

6. To import regions in GeoJSON format:

- Enter the property that includes the region name. Typically, this would be name.

- Select a file to upload.

7. To import regions in Region POJOs format:

- Select the Import Region POJOs tab.

- Select a file to upload.

8. Click **Save uploaded regions**. The JSON file is processed.

9. If there are updates to existing regions, a list of the regions that will be updated appears. To proceed, click **Upload and update regions**.

Regions API

Sedona Sales Engineers will usually set up the regions and overlays in your model. The regions are set up according to the standards published by http://geojson.io/. You can query the model to return the region definition. This returns the region GUID, name, coordinates, and geometry type. Valid geometry types for regions are: Point, LineString, Polygon, MultiPoint, MultiLineString, and MultiPolygon.

In Crosswork Hierarchical Controller, devices are attached to sites. Sites have geographical coordinates (latitude, longitude). A site may be in one or more regions.

Overlaps are used to group several regions, for example, the countries in Africa.

There are several APIs that can be used to:

- Get the region definition.

- Get the sites in one or more regions.

- Add regions to an overlay.

- Get the sites in an overlay.

Several samples are listed below:

- To return the RG/1 region definition, run the following GET command:

```
curl -skL -u admin:admin -H 'Content-Type: application/json'
https://$SERVER/api/v2/config/regions/RG/1 | jq
```

- To return the sites in the Estonia and Greece regions:

```
curl -skL -u admin:admin -H 'Content-Type: application/json'
https://$SERVER/api/v2/config/regions/RG/1 | jq
```

- To return the sites in the Estonia and Greece regions:

```
curl -skL -u admin:admin -H 'Content-Type: text/plain'  -d 'region[.name in ("Estonia",
"Greece")] | site' https://$server/api/v2/shql
```

- To add the Estonia and Greece regions to the overlay_europe overlap:

```
curl -X PUT -skL -u admin:admin -H 'Content-Type: application/json' -d '{"guid": "RG/116",
"overlay": "overlay_europe"}' https://$SERVER/api/v2/config/regions/RG/116

curl -X PUT -skL -u admin:admin -H 'Content-Type: application/json' -d '{"guid": "RG/154",
"overlay": "overlay_europe"}' https://$SERVER/api/v2/config/regions/RG/154
```

- To return the sites in the overlay_europe overlay:

https://$SERVER/api/v2/config/regions/RG/154

```
curl -skL -u admin:admin -H 'Content-Type: text/plain'  -d 'region[.overlay =
"overlay_europe"] | site' https://$SERVER/api/v2/shql | jq | grep -c name
```

The regions and overlays can be used in SHQL to query the model. You can transition down the model using link or site.

```
To return all the links in a specific region (using SHQL):

region[.name = "France"] | link
```

Sites

Sites are the logical groupings in the network . The Model Settings application enables you to view and filter sites, delete sites, export sites, and import sites.
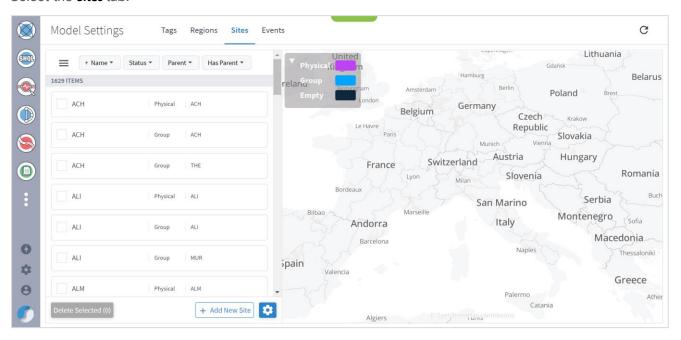
The physical objects in the site can be grouped by parent object, which in turn can be grouped by the next level of parent object, and so on. The only limitation is that all sites must have the same number of levels.

View a Site
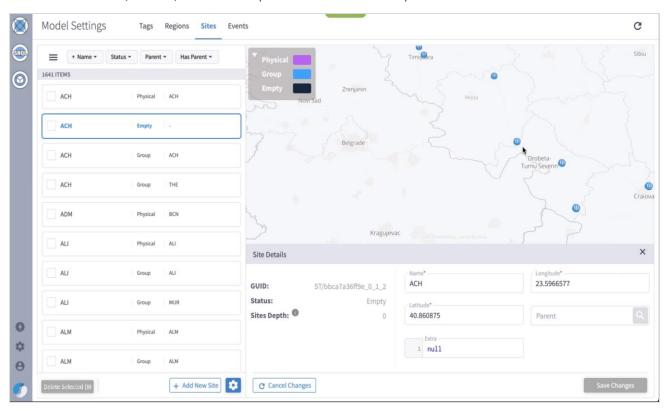
You can view a site in **Model Settings**.

To view a site in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Sites** tab.

3. To view a site item, in **Sites**, click the required site item. The map moves to the selected site item.
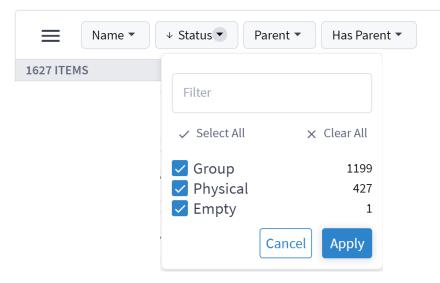
Filter the Sites

You can filter the sites, by name, status, parent or has parent.

To filter a site:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Sites** tab.

3. To filter the sites, click and select or enter the filter criteria (case insensitive).

Delete Sites

You can delete sites in Sites Manager.

To delete sites in Sites Manager:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Sites** tab.

3. In **Sites**, select one or more sites.

4. Click **Delete selected**. A confirmation appears.

5. To delete, click **Delete selected**.
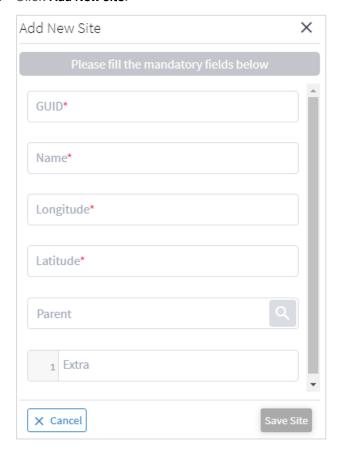
Add Sites

You can add sites in Sites Manager.

To add sites in Sites Manager:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Sites** tab.

3. Click **Add New Site**.

4. Enter the site details.

5. Click **Save Site**.

Export and Import Sites
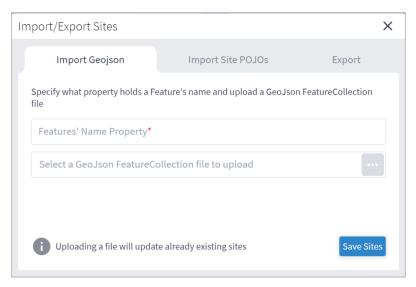
Sales Engineers will usually set up the sites in your model. The sites are set up according to the standards published by http://geojson.io/ and can be exported or imported in GeoJSON or Site POJOs.

You can import (and export) sites in the following formats:
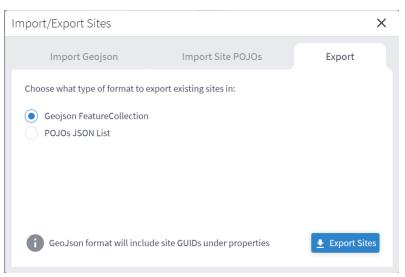
- GeoJSON
- Site POJOs

To export sites:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Sites** tab.

3. In **Sites**, click ⚙ .

4. To export In **Sites**, select the **Export** tab.
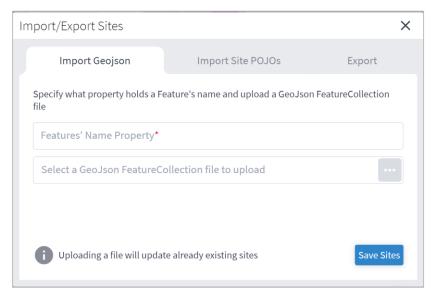
5. Select the required format, and then click **Export sites** ⚙. The **netfusion-sites-geojson.json** file is downloaded.

6. (Optional) Use a JSON formatter to review the content.

```
 1   {
 2     "site": [
 3       {
 4         "guid": "ST/001ca9f0dc37",
 5         "latitude": 51.5105384,
 6         "longitude": -0.5950406,
 7         "name": "SLO",
 8         "parent": {
 9           "guid": "ST/001ca9f0dc37_0"
10         },
11         "extra": null
12       },
13       {
14         "guid": "ST/001ca9f0dc37_0",
15         "latitude": 51.5105384,
16         "longitude": -0.5950406,
17         "name": "SLO",
18         "parent": {
19           "guid": "ST/2971737bd3ba_0_1"
20         },
21         "extra": null
22       },
23       {
24         "guid": "ST/002d237f16fb8c65",
25         "latitude": 37.9020842,
26         "longitude": -6.5648524,
27         "name": "ILA-SD1EVO01-SD1SEV01-1",
28         "parent": {
29           "guid": "ST/002d237f16fb8c65_0"
30         },
31         "extra": null
32       },
33       {
34         "guid": "ST/002d237f16fb8c65_0",
35         "latitude": 37.9020842,
36         "longitude": -6.5648524,
37         "name": "ILA-SD1EVO01-SD1SEV01-1",
```
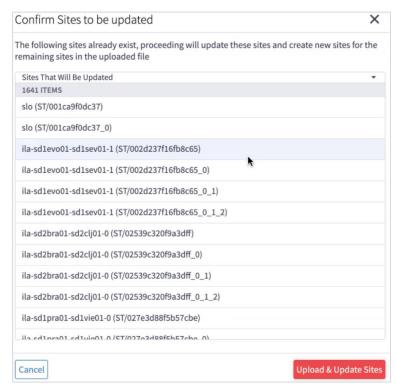
To import sites:

1. (Option 1) Prepare the import file in **GeoJSON** format:

   ◦ A quick way to create the file in the correct format is to export the current sites in the required format and then edit the file.

   ◦ The GeoJSON import file must be a **FeatureCollection** GeoJSON file and not a single **Feature** GeoJSON file.

   ◦ The GeoJSON import file MUST have a site name property that will be specified when you import the file.

   ◦ The GeoJSON import file may include a GUID for each site. If a GUID is not provided, Sites Manager, generates a GUID for the GeoJSON feature. If a GUID is provided, Sites Manager uses it, and if a site with that GUID already exists it is updated.

- Each site name (and GUID if included) must only appear once.

- Site names are case insensitive.

- If a site already exists either by GUID or with an identical name, when you import the file, a message appears informing you that the site will be updated if you proceed.

2. (Option 2) Prepare the import file in Site POJOs format:

- A quick way to create the file in the correct format is to export the current sites in the required format and then edit the file.

- The SitePOJO import file has a fixed format and the site name property is **name**. This property does not have to be specified when you import the file.

- The SitePOJO import file must include the site GUID as a property.

- Each site name and GUID must only appear once.

- Site names are case insensitive.

- If a site already exists (by name or GUID), when you import the file, a message appears informing you that the site will be updated if you proceed.

3. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

4. Select the **Sites** tab.

5. In **Sites**, click 🔧 .

Import/Export Sites ✕

| Import Geojson | Import Site POJOs | Export |

Specify what property holds a Feature's name and upload a GeoJson FeatureCollection file

Features' Name Property*

Select a GeoJson FeatureCollection file to upload   ...

ⓘ Uploading a file will update already existing sites   Save Sites

6. To import sites in GeoJSON format:

- Enter the property that includes the site name. Typically, this would be name.

- Select a file to upload.

7. To import sites in Site POJOs format:

- Select the **Import Site POJOs** tab.

- Select a file to upload.

8. Click **Save uploaded sites**. The JSON file is processed.

9. If there are updates to existing sites, a list of the sites that will be updated appears. To proceed, click **Upload and Update Sites**.
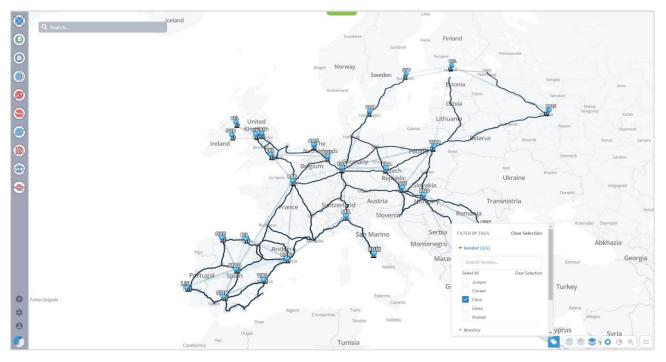
Tags

Resources can be tagged with a text label (using key:value pair). You can view, add or delete tags in the Model Settings application (or using the Tags API).
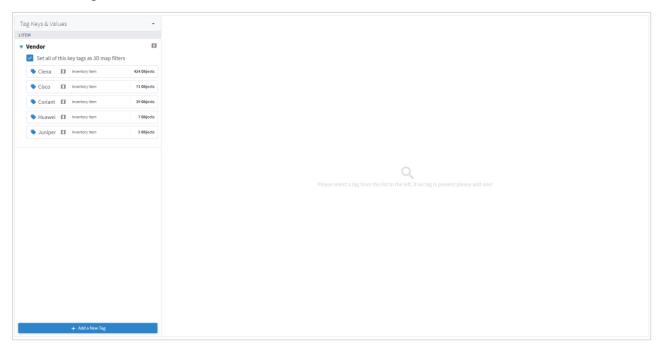
Tags can be used as follows:

- In Explorer, for example, you can filter the 3D map by links tags – this applies to the links that are visible in the map (logical, OMS), and you can select which tags to use as a map filter.

- In the Network Inventory application, you can show tags as columns.

- In the Path Optimization application, you can run a test on tagged links, and exclude tagged links from the path.

- In the Network Vulnerability application, you can run a test on tagged routers.

- In the Root Cause Analysis application, you can filter results by tag.
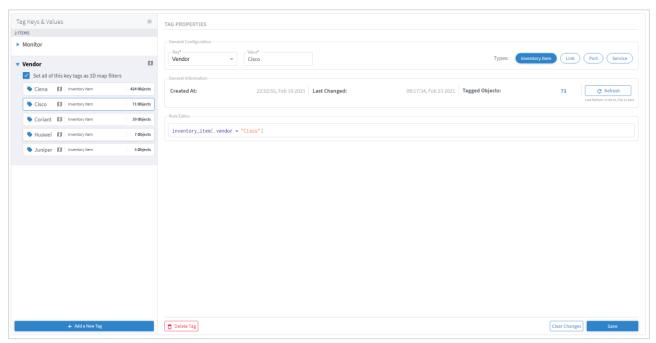
View the Tags

To view the tags in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.
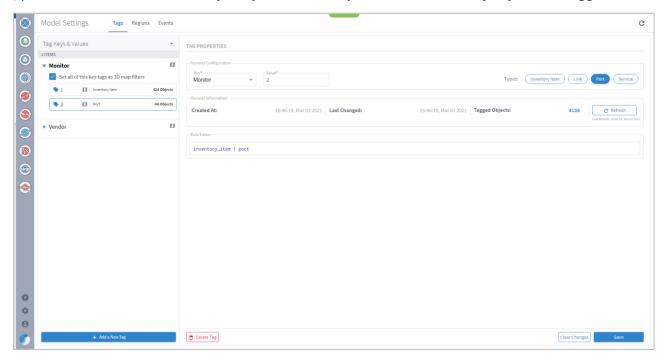
2. Select the **Tags** tab.

3. To view the tags, expand the tag key and select the value, for example, expand **Vendor**.
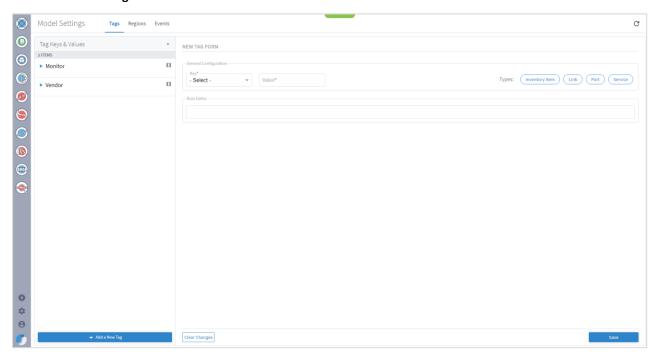
Add Tags
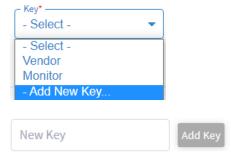
You can add a new value to an existing tag, or add a new tag.

To add tags in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, **select Services > Model Settings**.

2. Select the **Tags** tab.

3. Click **Add a New Tag**.

4. To add a new key, from the **Key** dropdown, select **Add New Key**.

5. Enter a key name and click **Add Key**.

6. To add a new value to an existing key, from the **Key** dropdown select an existing key, and then enter a new **Value**.
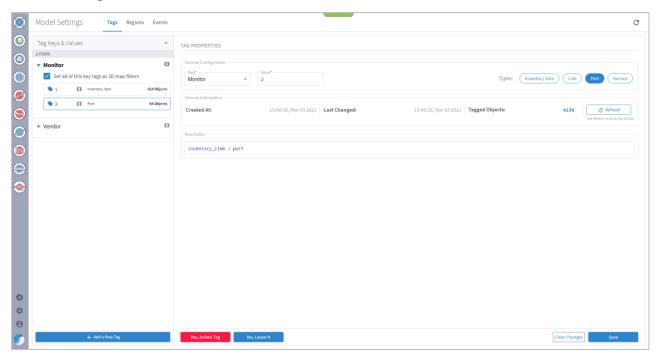
7. In the **Rule Editor**, select the required resources to apply the key and value to, for example, **inventory_item** | port and then click **Save**. The key entry is added and you can see how many objects are tagged.

Delete Tags

To delete tags in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Tags** tab.

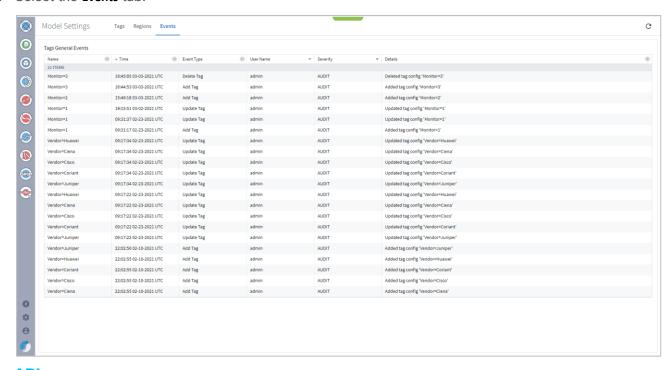3. Expand the required tag key and select a tag value.

4. Click **Delete Tag**.

5. Click **Yes, Delete Tag**.

View Tag Events

You can view a list add, update and delete tag events.

To view tag events in Model Settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Model Settings**.

2. Select the **Events** tab.

Tags API

Tags can also be added or changed by API or SHQL.

Get Devices by Tags

You can get devices by tags using the SHQL app.

- To return all devices that are tagged with the Vendor tag set to Ciena (using SHQL):

  ```
  inventory[.tags.Vendor has ("Ciena")]
  ```

Add Tag to Device

You can create a tag and assign the tag with a value to a device (or several devices) using the tags API. This API uses an SHQL rule as a parameter. All devices returned by the SHQL rule are tagged with the specified value. For example, this creates a Vendor tag and assigns the value Ciena to all the inventory items with vendor equal to Ciena.

```
POST "https://$SERVER/api/v2/config/tags" -H 'Content-Type: application/json' -d "{
    \"category\": \"Vendor\",
    \"value\": \"Ciena\",
    \"rules\": [
        \"inventory_item[.vendor = \\\"Ciena\\\"]\"
```

```
    }"
```

Parameter	Description
category	The tag category, for example, **Vendor**.
value	The value to tag the device with, for example, **Ciena**.
rules	The SHQL rule to apply. The rule MUST return items. Use the following in the rules: regions, tags, site, inventory.

For example, you can add tags to devices by using a query that returns all devices in a specific region:

```
POST  "https://$SERVER/api/v2/config/tags" -H 'Content-Type: application/json' -d "{
    \"category\": \"Region\",
    \"value\": \"RG_2\",
    \"rules\": [
        \"region[.guid = \\\"RG/2\\\"] | site | inventory\"
    ]
}"
```

Delete Tag

You can delete a tag.

```
DELETE "https://$SERVER/api/v2/config/tags/Vendor=Ciena"
```