



Cisco Optical Network Controller 3.1 Configuration Guide

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CHAPTER 1

Overview of Cisco Optical Network Controller

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Overview of Cisco Optical Network Controller

Cisco Optical Network Controller (Cisco ONC) is an SDN Domain Controller for Cisco optical networks. Cisco Optical Network Controller behaves as a Provisioning Network Controller (PNC) and performs the following functions.

- Collects information about the inventory and topology of the managed network.
- Monitors the physical or virtual topology of the network.
- Notifies of changes in topology and service changes.
- Supports optical path creation and deletion.

Cisco Optical Network Controller collects relevant data needed for optical applications. This data is also used to provide abstract network information to higher layer controllers, thus enabling a centralized control of optical network.

Some of the functions supported by Cisco Optical Network Controller are given below.

- Optical Domain Controller

Cisco Optical Network Controller behaves as a domain controller for Cisco optical products. The domain controller feeds data into hierarchical controllers. Optical Network Controller has a North Bound Interface (NBI) based on the TAPI standard which enables it to connect to any hierarchical controller which has a TAPI compliant South Bound Interface (SBI) and provide its functions to the controller.

- Path Compute Engine (PCE)

PCE service provides optical path computation to ensure optically valid paths are provisioned within the supplied constraints. PCE uses the latest network status.

- Model Based Network Abstraction

Cisco Optical Network Controller supports a standardized TAPI model which enables it to abstract the device level details from the hierarchical controller.



Note

- For more details on Cisco Optical Site Manager (COSM), see [COSM Configuration Guide](#).
 - For more details on Cisco Optical Network Planner (CONP), see [CONP Configuration Guide](#).
 - For further details about Cisco ONC, see the [data sheet](#) .
-

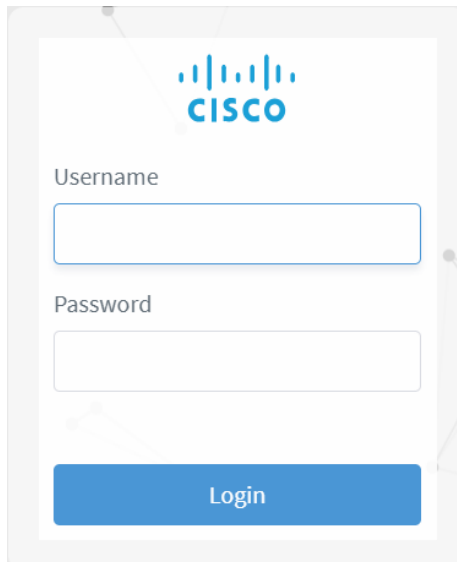
Log into Cisco Optical Network Controller

Before you begin

Use the following steps to log into Cisco Optical Network Controller:

-
- Step 1** In the browser URL field, enter **https://<virtual-ip:Port>/**
Login page is displayed.
 - Step 2** Enter the username and password.
 - Step 3** Click **Login**.

Figure 1: Log into Cisco Optical Network Controller



The screenshot shows the login interface for the Cisco Optical Network Controller. At the top center is the Cisco logo, consisting of a stylized signal icon above the word "CISCO". Below the logo are two input fields: the first is labeled "Username" and the second is labeled "Password". At the bottom of the form is a blue button with the text "Login".

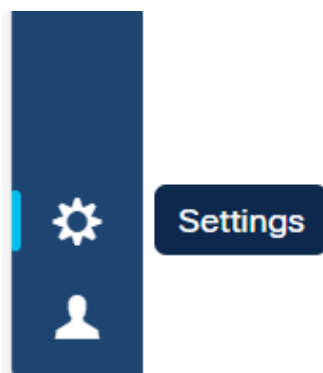
User Access in Cisco Optical Network Controller 3.1

You can manage the user access and permissions through Cisco ONC. It adds an additional layer of security and works as a Single Authentication Agent, thus sharing local, LDAP and SAML users.

Users, Roles, and Permissions

User can have have different permission levels. See *Set up Permission Mapping*. To allow access to Cisco ONC to a larger group of regular users, set the user authentication through LDAP or SAML SSO protocols. You can use both at the same time as well, depending on your environment.

Figure 2: Settings



Once you click **Settings** you will see the panel as given below.

Figure 3: Settings Options




Image Name	Version
docker.io/library/alpine	3.19.0
docker.io/library/registry	2.8.3
docker.io/rancher/local-path-provisioner	v0.0.26
dockerhub.cisco.com/cisco-onc-docker/dev/ciscotestautomation/pyats	23.7.1-pi
quay.io/coreos/etcd	v3.5.10
registry.k8s.io/coredns/coredns	v1.11.1
registry.k8s.io/kube-apiserver	v1.28.5
registrv.k8s.io/kube-controller-manager	v1.28.5

The **System Info** section has the information about the latest versions of Cisco ONC and the related microservices.

The **Security** section is for access management and consists of the following options.

- **Local Users:** Here you can display, create and edit local users through the UI.
- **LDAP:** Here you can set LDAP settings for user authentication.
- **SAML SSO:** Here you can set SAML Single-Sign-On settings for user authentication
- **Permission Mapping:** Here you can handle permission management through the Cisco Policy Management Tool.

Add Local Users to Cisco Optical Network Controller 3.1

Before you begin

You will need access to Cisco Optical Network Controller 3.1 with admin user privileges.

Use the following steps to add local user accounts to Cisco Optical Network Controller 3.1.

-
- Step 1** From the Cisco Optical Network Controller 3.1 home page click **Settings** .
 - Step 2** From the panel list, select **Local Users** tab and click **Add** .
 - Step 3** In the **Add User** screen, enter **Username*** .
 - Step 4** After entering the user name, enter **Password*** .
 - Step 5** Next confirm the password using **Confirm Password*** .

Step 6 Next enter the access permissions in the form of a comma separated list using **Access Permissions** and enter permission/admin as shown in the example below.

For example *permission/<admin>*

The **Description** and **Display Name** are optional fields.

Figure 4: Local Users

The screenshot shows the 'Local Users' configuration page in the Cisco Optical Network Controller. The left sidebar is dark blue with white icons and text. The main content area is white with a light blue header 'Local Users'. Below the header, there are four user entries, each in a white box with a light blue border. The first entry is 'internal (internal)' with ACCESS 'internal' and STATUS 'Active'. The second entry is 'NxF Admin (admin)' with ACCESS 'permission/admin', STATUS 'Active (Locked)', and DESC 'NextFusion Default Administrator'. The third entry is 'supervisor (supervisor)' with ACCESS 'supervisor' and STATUS 'Active'. The fourth entry is 'readonly (readonly)' with ACCESS 'readonly' and STATUS 'Active'. At the bottom right, there are two buttons: 'Reload' (white with blue border) and 'Add...' (blue with white text).

Display Name	Access Permissions	Status	Description
internal (internal)	internal	Active	
NxF Admin (admin)	permission/admin	Active (Locked)	NextFusion Default Administrator
supervisor (supervisor)	supervisor	Active	
readonly (readonly)	readonly	Active	

Figure 5: Add User

SYSTEM INFO

Versions

SECURITY

Local Users

LDAP

SAML SSO

Permission Mapping

← Add User

Username*

Password*

Confirm Password*

Access Permissions*

- permission/admin
- supervisor
- permission/supervisor
- internal
- permission/internal
- readonly
- permission/readonly
- admin
- permission/admin

Display Name

Active

Locked

Description

Save

Step 7 Use radio buttons to set the user status. You can make both radio buttons disabled or enabled at the same time

- **Active enabled:** Allows the user to log in to Cisco ONC.
- **Active disabled:** Forbids the user to log in Cisco ONC.
- **Locked enabled:** Prevents deleting the user.
- **Locked disabled:** Allows removal of the user

Step 8 Click **Save**.

Set up Authentication through LDAP

The Security Assertion Markup Language (SAML) SSO feature allows to gain single sign-on access based on the protocol SAML.

- Step 1** From the Cisco Optical Network Controller 3.1 home page click **Settings**.
- Step 2** Click **LDAP**.
- Step 3** Click the **Enabled** radio button.
- Step 4** Fill in the mandatory fields that are marked with an asterisk (*): **LDAP Server Address**, **Bind DN** and **Bind Credentials**. The **Search Filter**, **Search Base** and **Root CAs** are optional.
- Step 5** Click **Save**.

Figure 6: LDAP

LDAP

Enabled

LDAP Server Address*

Bind DN*

Bind Credentials*

Search Base

Search Filter

Attribute Value

Add

Root CAs

Reload **Save**

Set up Authentication through SAML SSO

The Security Assertion Markup Language (SAML) SSO feature allows you to gain single sign-on access based on the SAML protocol.

- Step 1** In the CWM, go to the outermost navigation menu on the left
- Step 2** From the Cisco Optical Network Controller 3.1 home page click **Settings** and navigate to **SAML SSO** tab.

Step 3 Click the **Enabled** radio button.

Step 4 Fill in the fields: **Login URL**, **Entity ID**, **Base URL**, **Signing Certificate** and **Groups Attribute Name**.

Step 5 Click **Save**.

Figure 7: SAML SSO

The screenshot displays the SAML SSO configuration interface. On the left, a vertical sidebar contains icons and labels for various system functions. The 'SAML SSO' option is highlighted. The main configuration area includes an 'Enabled' toggle switch, followed by input fields for 'Login URL', 'Entity ID', and 'Base URL'. A 'Use Current' button is positioned next to the 'Base URL' field. Below these is a large text area for the 'Signing Certificate'. At the bottom, there is an input field for 'Groups Attribute Name' with the value 'memberOf'. The 'Save' button is highlighted in blue.

Set up Permission Mapping

You can give specific permissions to a group of users using this option.

Step 1 From the Cisco Optical Network Controller 3.1 home page click **Settings**.

Step 2 Navigate to **Permission Mapping**.

- Step 3** Click **Add**.
- Step 4** In the **Add Permission Mapping** panel, choose one **Mapping Type** from the dropdown menu: **SAML User**, **SAML Group**, **LDAP User**, or **LDAP Group**.
- Step 5** Fill in the **Match** field.
- Step 6** Select the appropriate **Access Permission**.
- Step 7** Click **Save**.

Figure 8: Permission Mapping

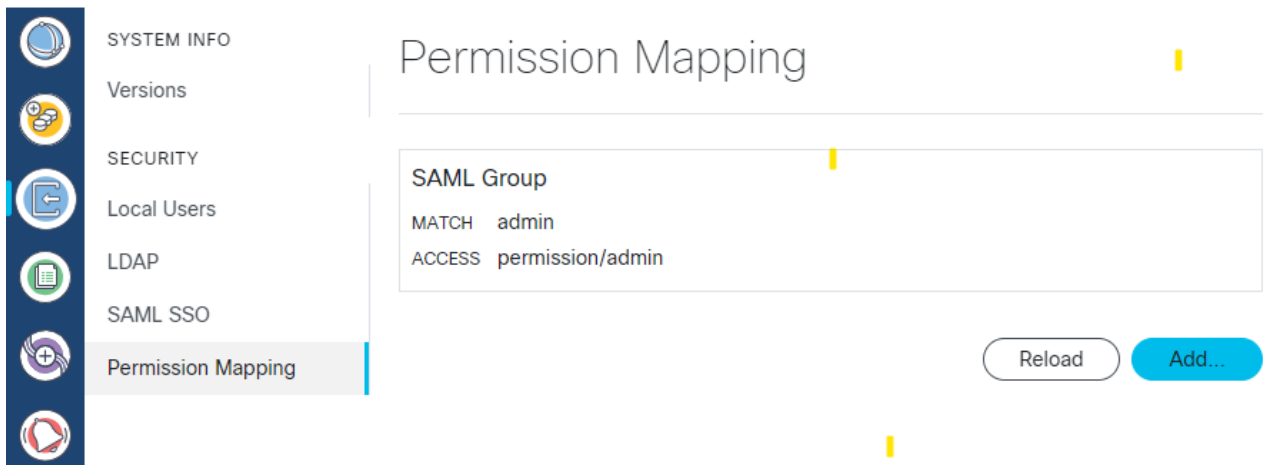


Figure 9: Add Permission Mapping

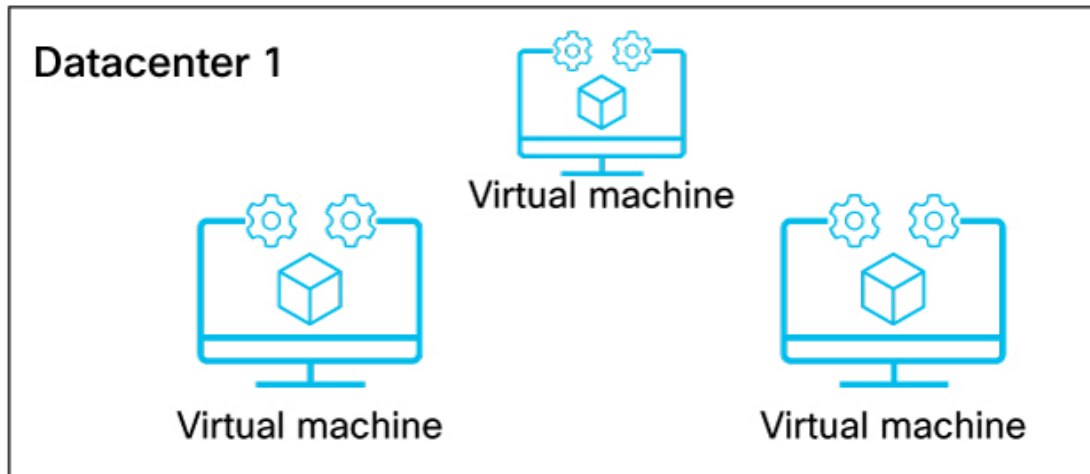
Note User can have different levels of permission mapping.

- **Admin:** No restrictions.
- **Supervisor:** Similar to admin but with restrictions on user management and log checks.
- **Readonly:** Can only check but provisioning is not allowed.
- **Internal:** To be used in case of any triage or troubleshooting to collect commands. It is recommended to use it only under supervision of Cisco Technical Assistance Center (TAC).

High Availability

Cisco ONC provides High Availability (HA) with distributed micro-service architecture. It provides an Active-Standby HA architecture. Cisco ONC HA cluster requires three VMs which are called primary, secondary and tertiary VMs. The primary and secondary VMs run the micro-service applications. The tertiary VM will be used for decision making on HA. One of the primary or secondary VMs is an active VM, while other is the standby one. Only the active VM's micro-services control the software. The standby VM's micro-services are activated only when the active VM fails, and this process is referred to as a switchover event.

Figure 10: Highly Available



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There are three types of switchover events.

- User triggered: You can trigger a switchover and assign any VM to be the active VM.
- Application failure: Cisco ONC detects any critical micro-services application failure and initiates the switchover to take place automatically.
- Node failure: This switchover happens when the active VM crashes or is switched off.

These are the commands related to HA.

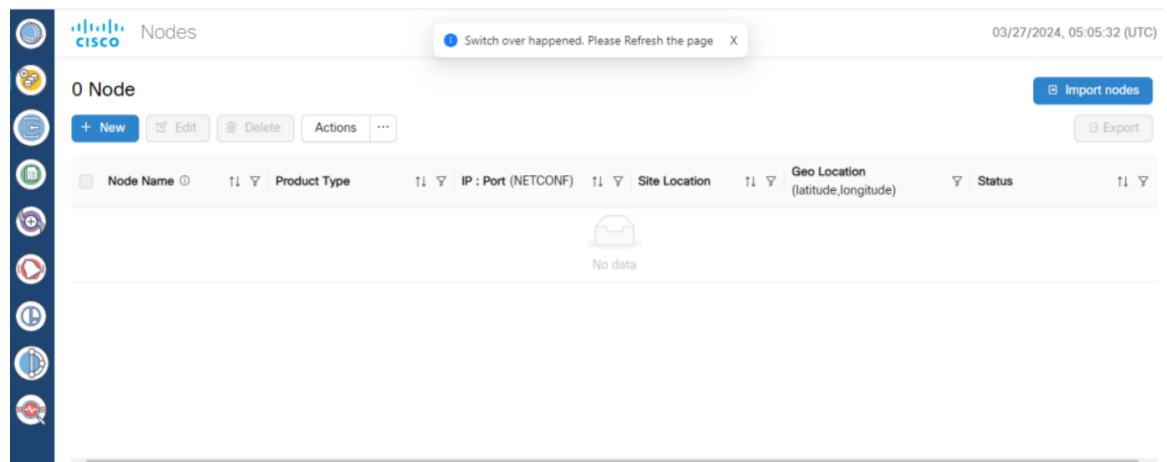
- `kubectl describe project onc | head`

This command refers to the VM which is active and running an instance.

- `'sedo ha switchover`

This command triggers the manual switchover in Cisco ONC.

Figure 11: HA Switchover





CHAPTER 2

Use Cisco Optical Network Controller

Before you begin

[Log into Cisco Optical Network Controller, on page 2](#)

Once you login, the **Topology** screen is displayed by default. The menu options are displayed on the left panel. You can click on the options and navigate to any specific screen. The options available are given below.

1. Topology
2. Nodes
3. Alien Import
4. Inventory
5. Service Manager
6. Alarms
7. Workspaces
8. Service Assurance
9. Monitoring



Note The following options can be used commonly across multiple application screens.

- The timestamp appears on the top right corner of the screen in all the screens. It follows the UTC time zone. The current date is displayed along with the time.
- Click **Refresh** button to refresh the status of the table content in each of the application screens anytime.
- Click **Show or hide columns** icon to select any columns to be displayed or hidden from the table view anytime.
- Click **Export** to export the details of any table from any application screen to a spreadsheet file.
- Use the **Sort** option to sort the table values and use the **Filter** option to filter the table content as per requirement in each application screen.

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Topology

Topology displays the network along with the nodes and the associated network links on a map. You can toggle between the **Light** and **Dark** modes to view this screen. You can zoom in zoom out the entire screen to view the network and its components. You can select the **OTS** or **OMS** layers as options in the display. The OTS option is used to display the ILA nodes belonging to the network and the OMS option is used to display only the ROADMs and the links between the ROADMs in the given network.

The **Topology** screen is an interactive screen which allows you to click on each node to fetch its information. The links between the nodes are the fiber links connecting each node. You can click on each fiber link to fetch its information when the OTS view is enabled. There can be multiple links connecting each node at any given point in time.

On the top of this screen, there is a panel for displaying the different alarm types and the count of each type of alarm that are part of the network. The alarm types are color coded based on the types of severity as seen in the table below.

Table 1: Alarm Severity

Alarm Type	Description
RED	Critical alarms are displayed in red color.
ORANGE	Major alarms are displayed in orange color.
YELLOW	Minor alarms are displayed in yellow color.



Note Alarm severity type for any warning will appear as **Warning** and for cleared alarms they severity is displayed as **Cleared**.



- Note**
- In the **Topology** screen, the alarms reported at the top left are related to only those nodes that have the geo location defined. Due to this there can be a discrepancy between the alarms reported in the **Topology** and the **Alarms** screen related to these nodes.
 - In the **Topology** screen only the critical, major and minor count alarms are reported, unlike the **Alarms** screen which reports the warnings or cleared alarms.

You can get the node name along with the COSM site name it belongs to and its current state by hovering over each node in the **Topology** map anytime. Right click on any node in the map to select **Resync**, **View in Node UI** and **View Alarms** options.

Table 2: Topology Node Options

Options	Description
Resync	Resync starts the resync of the selected node.
View in Node UI	This option takes you to the COSM site from where you can view the node details.
View Alarms	This option opens the Alarms application in a new tab, from where you can view all the alarms details.

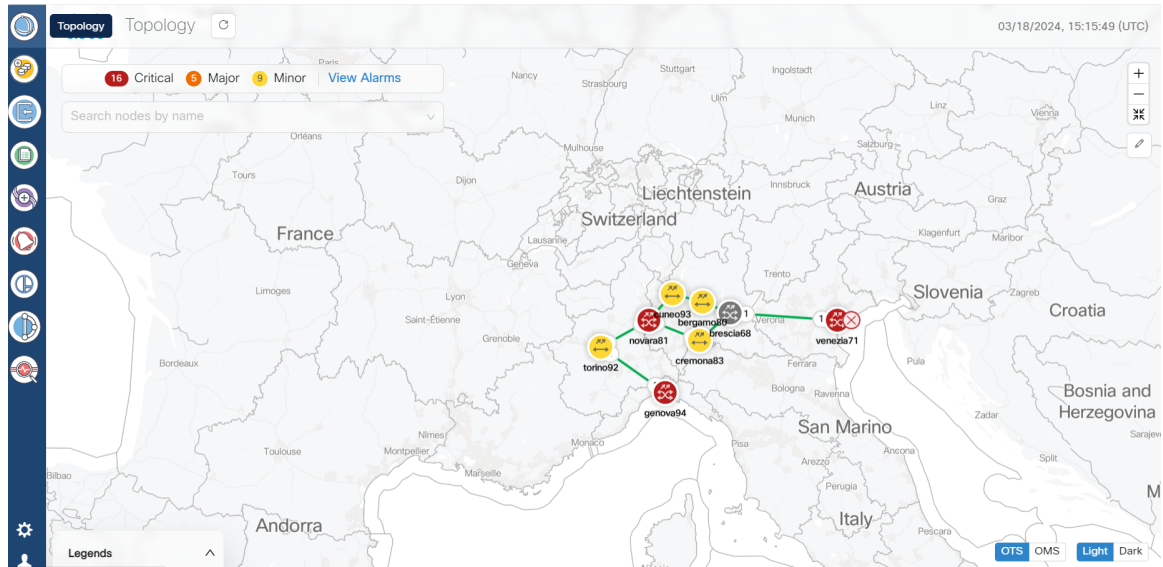
You can also view the information related to the different nodes, links, and the states of each node in the network at any point in time by clicking the **Legends** option. To select any node in the network, use the drop-down box to select the node.

The **EDIT** icon allows you to dynamically move any node to any geo location on the screen. You can click on the **RESET** or **SAVE** button to reset or save the network status that is being displayed in the Topology screen anytime. Use the **CENTER** icon to position the map in the center.

The disconnected nodes are displayed with a cross mark. To cross launch to other related pages use the options appearing when you right click from anywhere on the map. You can click on the **REFRESH** button to refresh the Topology screen with the current status anytime.

Use the **Search nodes by name** option to search for nodes in the topology network. This will fetch and locate the exact node in the map.

Figure 12: Topology Application

**Note**

- The links between each node in the network in the **Topology** map displays the degree numbers which can be right clicked to navigate to the particular **Node UI**. The 'R' in the link refers to Raman Amplified. This is not visible when you select the **OMS** layer option to view the map.
- Click **Legends** in the bottom of the **Topology** screen to view the various representations used in the map as shown below.
- **Nodes:** The different nodes that are part of the network at any given time.
 - **Links:** The different links between nodes along with the amplifier and degree labels.
 - **States:** The different states like operational, critical alarms, link down and minor alarms.
- In the **Topology** map if two nodes have the same geo location then they appear as a single node due to overlapping with each other which is a constraint.
 - If any node in the **Topology** screen does not have a geo location specified, the button in the upper right corner which is used to enter the geo location value displays an orange highlight or dot. This orange dot is used to represent that there is atleast one node which does not have any geo location specified. When you click this orange dot a pop-up menu appears displaying all such nodes that are lacking geo locations. Click the **Edit** icon and then select any node to move it to any desired location on the map. This will add the geo locations to the node. You can move the node and the **Topology** maps the geo location automatically for these node based on the location.
 - Once the geo location is selected, Cisco ONC displays a message to indicate that the **Topology** has been updated and to view the updated changes you must refresh the page by clicking the **Refresh** or **Reload** button.

Troubleshooting in Topology

The most common problems encountered while using the **Topology** application is given below.

- **A pop-up message:** Asking to reload the page appears in the following scenarios.
 - New node onboarded or deleted
 - Geo locations changed
- In case the node, link or icons of the nodes are missing and not displayed in the **Topology** screen then refresh the page.

Nodes

A node refers to a device in the network. You can add a single node or a set of nodes in the form of a batch at any given point in time.

Use the **Nodes** screen to view the details of each node that is part of a service at any given point in time. The **Nodes** table displays the following details for each node:

- **Node Name:** The name of the node. The node name provided by you must match the original node name used in the network. In case of any mismatch or discrepancy issues, the original node name in the network is used for outgoing payloads.
- **Product Type:** The type of product the node belongs to. For example: Cisco Optical Site Manager.
- **IP: Port (NETCONF):** The IP address of each node along with the part number.
- **Site Location:** The location of the site that each node belongs to. For example: COSMp2p83_Site1
- **Geo Location:** The geo location of each node in terms of the latitude and longitude values based on where exactly the node is situated in the world at any given time.

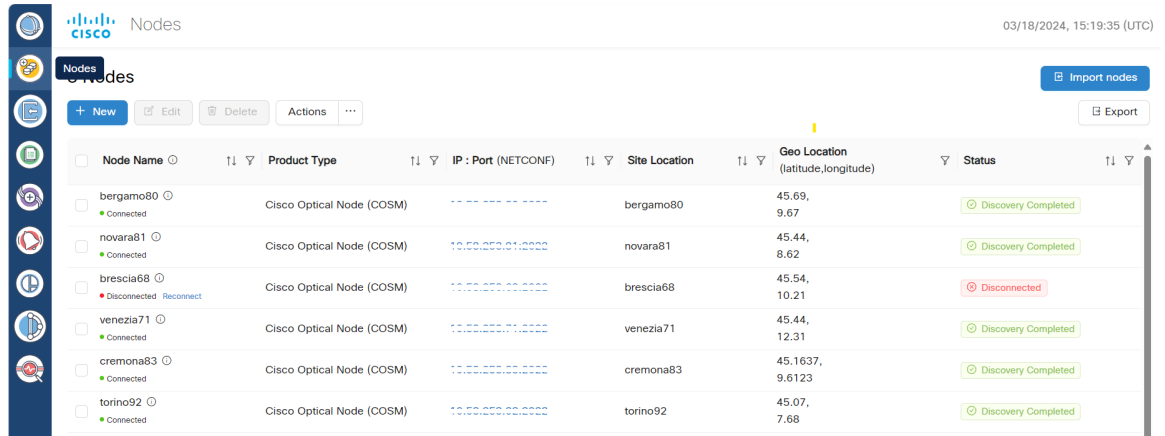


Note If the geo location values that are coming from Cisco Optical Site Manager in a pre-filled format has more than four digits, then the length of the geo location value is truncated to only four digits.

- **Status:** The status of each node within the network to know whether it is discovered or disconnected.

Use the information icon that appears along with each node in this table for viewing the additional details pertaining to each node.

Figure 13: Nodes



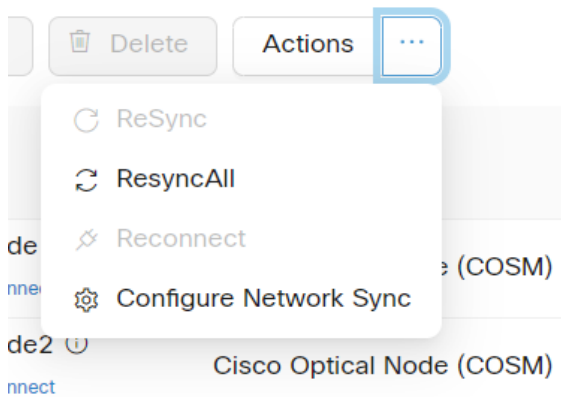
Node Name	Product Type	IP: Port (NETCONF)	Site Location	Geo Location (latitude,longitude)	Status
bergam080	Cisco Optical Node (COSM)	10.100.200.01:2000	bergam080	45.69, 9.67	Discovery Completed
novara81	Cisco Optical Node (COSM)	10.100.200.01:2000	novara81	45.44, 8.62	Discovery Completed
brescia68	Cisco Optical Node (COSM)	10.100.200.01:2000	brescia68	45.54, 10.21	Disconnected
venezia71	Cisco Optical Node (COSM)	10.100.200.01:2000	venezia71	45.44, 12.31	Discovery Completed
cremona83	Cisco Optical Node (COSM)	10.100.200.01:2000	cremona83	45.1637, 9.6123	Discovery Completed
torino92	Cisco Optical Node (COSM)	10.100.200.01:2000	torino92	45.07, 7.68	Discovery Completed

Use the sort or filter options to sort and filter values in the table. You can also cross launch to other supported pages using the links provided in this table.

Use the **Actions** button for synchronizing and configuring the network sync along with reconnecting the various nodes present in the network. There are four options available for this purpose.

- **ReSync**: Used for resyncing any selected node in the network.
- **ReSync All**: Used for resyncing all the nodes in the network.
- **Reconnect**: Used to reconnect any or all the nodes.
- **Configure Network Sync**: Used for **Periodic Network Full Sync**.

Figure 14: Actions



**Note**

- Latitude and longitude values can be set in both Cisco Optical Site Manager and Cisco Optical Network Controller. The following scenarios are possible:

- **Geo location is set in both Cisco Optical Site Manager and Cisco Optical Network Controller:** Cisco Optical Network Controller geo location is used.
- **Geo location is set only in Cisco Optical Site Manager:** Cisco Optical Site Manager geo location is used .
- **Geo location is set only in Cisco Optical Network Controller:** Cisco Optical Network Controller geo location is used.
- **Geo location is not set in either Cisco Optical Network Controller or Cisco Optical Site Manager:** You will be prompted to add the node in **Topology** with the edit button.

For all the cases mentioned above, Cisco Optical Network Controller latitude and longitude value has a higher priority over the Cisco Optical Site Manager latitude and longitude values during the onboarding process. In case the Cisco Optical Network Controller latitude and longitude values are not provided, only then the Cisco Optical Site Manager latitude and longitude values are used.

- Even if the user updates the geo location in Cisco Optical Network Controller, it does not get updated in the Cisco Optical Site Manager device.
- If the geo location values coming from Cisco Optical Site Manager have more than four digits, they are shortened to up to four digits only and displayed.

Troubleshooting in Nodes

The most common problems encountered while adding new nodes are given below.

- **Bulk import failure**

In this case you will get a text file describing the specific issues in the template.

**Note**

Cisco ONC does not allow deletion of a node which involved in the collection or resync process, or while it is a part of any circuit path

- **Nodes possible status**

Node Status	Description	User Action
In Progress	Cisco ONC is collecting information about the onboarded device.	No action is needed, wait for the status to change.
Resync Pending	Cisco ONC has gone out of sync with device and is scheduled for a resync.	Either wait for scheduled resync or start the resync manually.

Resync In-progress	Cisco ONC is re-collecting information about the onboarded devices.	No action is needed, wait for the status to change.
Disconnected	Cisco ONC was unable to establish a session with COSM.	Attempt re-connect or resync. If the problem still persists contact Cisco TAC.
Discovery Completed	All information has been collected from the device and it is ready for operations. Note It is recommended to wait for 60 secs once the device is turned to Discovery Completed state which ensures the device is ready for accepting requests.	

• **Nodes connection status**

Connection State	Description	User Action
Connected	Cisco ONC has successfully established the session with the COSM device provided user/password information.	No action is needed.
Disconnected	Cisco ONC was unable to establish session with COSM.	Attempt re-connect or resync. If the problem still persists contact Cisco TAC.
Waiting for connection	Cisco ONC is attempting to establish connection with COSM.	No action is needed.
Resync_needed	Cisco ONC has gone out of sync with device and is scheduled for a resync.	Either wait for scheduled resync or start the resync manually.

• **De-boarding of a node fails**

- Ensure no circuit is created involving this node.
- Retry deleting the node after sometime.
- In case the deletion fails even after you have retried it multiple times, contact Cisco TAC for further assistance.

Add Nodes on Cisco Optical Network Controller

You can add a single node or a set of nodes in the form of a batch use the procedure given below.

Figure 15: Add New Node

New Node ✕

Name*	Port*
<input type="text"/>	<input type="text"/>
IP*	Protocol*
<input type="text"/>	NETCONF ▼
Site Name*	Site Description
<input type="text"/>	<input type="text"/>
----- Credentials -----	
Username*	Password*
<input type="text"/>	<input type="text"/>
----- Geo Location -----	
Latitude	Longitude
<input type="text"/>	<input type="text"/>

Before you begin

To add NCS 1010 nodes to Cisco Optical Network Controller:

- The NCS 1010 nodes must run IOS XR Release 7.11.2.
- Cisco Optical Site Manager must be installed on the node.
- All NCS 1010 nodes must be added to Cisco Optical Network Controller with port number 2022.

- Step 1** Click **Nodes** in the left panel.
- Step 2** Click **New**.
- Step 3** Enter the device details necessary connect to the device as given in the table below.

Table 3: Add new node

Name	Description	Mandatory
Name	Name of the new node you are adding	Yes
IP	IP address of the new node which you are adding.	Yes
Port	The port number of the new node which you are adding.	Yes
Protocol	The protocol used for the new node which you are adding.	Yes
Site Name	The name of the site to which the new node belongs.	Yes
Username	The username you want to set for accessing the new node.	Yes
Password	The password you want to set for accessing the new node.	Yes
Site Description	The description of the site to which the new node belongs.	No
Latitude	The Latitude co-ordinate value you which you want to assign for the new node to set its location.	No
Longitude	The Longitude co-ordinate value you which you want to assign for the new node to set its location.	No

Note

- Ensure that you enter valid a username and password of the device to enable Cisco Optical Network Controller to connect to the device.

- Step 4** Click **Save**. The new node or device is onboarded successfully and added to the **Nodes** table. Cisco Optical Network Controller validates the connection with the onboarded device.

Import Nodes on Cisco Optical Network Controller

Before you begin

For importing the node details from any spreadsheet into the table, use the procedure given below.

- Step 1** Click **Nodes** in the left panel.
- Step 2** Click **Import** to import the table details from external files.
- Step 3** Select the spreadsheet which has all the node details and click **Open**. The new nodes are onboarded and added to the **Nodes** table.

To add the details of the nodes in a bulk format use the **Import nodes** option.

Note Click **Download** option to get the sample template of the bulk import file.

Figure 16: Import Nodes

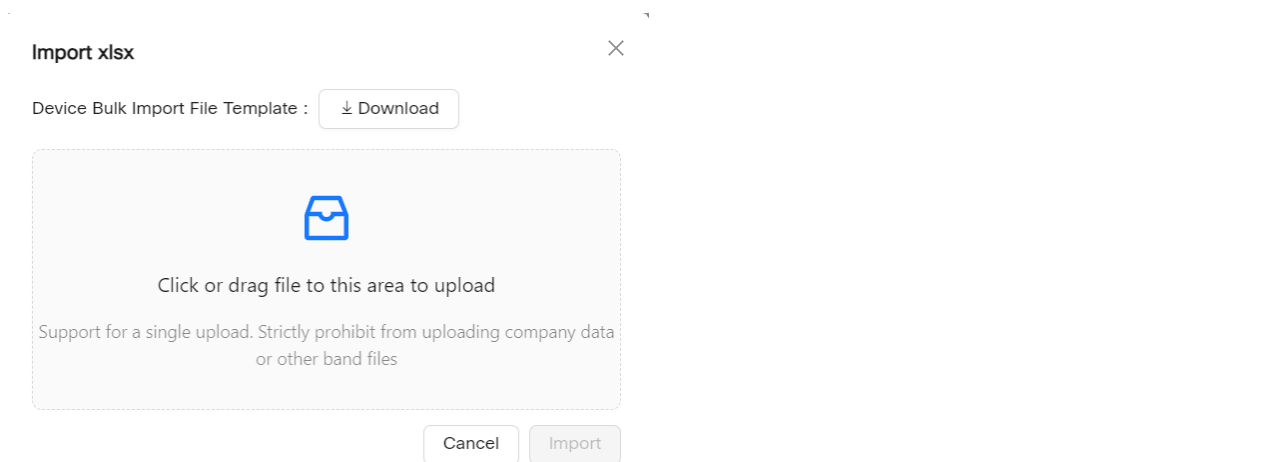


Figure 17: Sample Template of Bulk Import File

A	B	C	D	E	F	G	H	I	J	K
Host Name	Node IP	User Name	Password	Connectivity Type	Connectivity Port	Site Name	Site Description	Type	Latitude	Longitude
sampleDevice_1	10.00.00.99			NETCONF	830	sampleSite_1	sample site description	Cisco Optical Node		

The sample bulk import template has the following fields which need to be filled before importing node details.

Table 4: Bulk Import File Template

Name	Description
Host Name	Name of the host node.

Name	Description
Node IP	The IP address of the node you are adding.
User Name	The username you want to set for accessing the new node.
Password	The password you want to set for accessing the new node.
Connectivity Type	The type of the protocol used for connecting the node.
Connectivity Port	The port number of the node.
Site Name	The name of the site to which the new node belongs.
Site Description	The description of the site to which the new node belongs.
Type	Type of the node.
Latitude	The Latitude co-ordinate value you which you want to assign for the new node to set its location.
Longitude	The Longitude co-ordinate value you which you want to assign for the new node to set its location.

Export Nodes on Cisco Optical Network Controller

Before you begin

For exporting the node details from the table use the procedure given below.

Step 1 Click **Nodes** in the left panel.

Step 2 Click **Export** to export the details to a spreadsheet file.

Edit Nodes on Cisco Optical Network Controller

Before you begin

Use the **Edit** option for editing the node details, use the procedure given below.

Step 1 Click **Nodes** in the left panel.

Step 2 Click **EDIT** after selecting the node from the table.

In the edit mode the Cisco Optical Site Manager (COSM) geo location latitude and longitude values appear as separate values which can also be modified as required. Once the onboarding of the node or device is complete you can edit any selected node and modify its credentials using the **EDIT** option.

Delete Nodes on Cisco Optical Network Controller

Before you begin

Use the **Delete** option to delete one or more nodes at any given time. Follow the procedure given below.

- Step 1** Click **Nodes** in the left panel.
- Step 2** Select the node or nodes to be deleted.
- Step 3** Click **DELETE**.

This will delete the selected node from the table.

Note If the circuits are active and flowing over the nodes or if the resync is in progress, then deletion of the node fails. In this case you will receive an error message for the **Circuit Deletion Failure** when the circuit is spanning through the node.

For example: <Device A> cannot be deleted because circuit spanning across the device.

Alien Import

Before you begin

To import and export the alien device data use the procedure given below.



Note For more details on how to model an alien wavelength or transceiver, etc through Cisco Optical Network Planner (CONP) see [CONP Manage Alien](#).

Figure 18: Alien Import

03/18/2024, 15:38:53 (UTC)

7639 Equipments Last Updated on 03/18/2024 at 15:38:41

VID	PID	Data Rate	BR	FEC	Sub Mode
00B08E	NCS1K4-1.2T-K9	R500G	69.4351003125	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R600G	71.96	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	34.72	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	34.45	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	34.18	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	33.92	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	33.67	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	33.41	SD_FEC_27_DE_OFF	N/A
00B08E	NCS1K4-1.2T-K9	R50G	33.16	SD_FEC_27_DE_OFF	N/A

Step 1 Click the **Import** icon on the top of the table.

Cisco Optical Network Controller imports and displays the information of all the alien devices from the XML file. After successful import, the alien device information is available for applications that use the Cisco Optical Network Controller TAPI and REST API.

Step 2 To export the alien device information in JSON or XML formats, click Export and choose the target format from the drop-down list.

Note The XML file which is imported in Cisco ONC is generated by CONP and can have some third-party restrictions on it.

Step 3 Click the **Refresh** button to refresh the equipment status.

Step 4 Click on the **Show or hide columns** icon to select any columns to be displayed or hidden from the table view anytime.

Step 5 Use the page numbers and select the number of rows per page as required for the table display.

Step 6 Use the sort or filter options to sort and filter values in the table.

Network Inventory

Before you begin

This task describes how to view inventory details on Cisco Optical Network Controller. To view or export the inventory details, follow the procedure given below.

Figure 19: Network Inventory

Network Inventory 03/18/2024, 15:37:12 (UTC)

8 Nodes Last Updated on 03/18/2024 at 15:36:50 Refresh Export

Name	Admin State	Equipment Type	Equipment State	Actual Equipment Type	Serial No	Product ID
torino92		ola				
Shelf 1	UNLOCKED	NCS1010-SA	UNLOCKED	NCS1010-SA	FCB2628B0VM	NCS1010-SA
COMMON CARDS						
Slot PM0	UNLOCKED	NCS1K-PSU	UNLOCKED	NCS1010-AC-PSU	APS263000XK	NCS1010-AC-PSU
Slot FT0	UNLOCKED	NCS1K-FAN	UNLOCKED	NCS1010-FAN	FCB2625B1G2	NCS1010-FAN
Slot FT1	UNLOCKED	NCS1K-FAN	UNLOCKED	NCS1010-FAN	FCB2625B1DJ	NCS1010-FAN
Slot PM1	UNLOCKED	NCS1K-PSU	UNLOCKED	NCS1010-AC-PSU	APS263001NQ	NCS1010-AC-PSU
SLOT CARDS						
Slot 0	UNLOCKED	NCS1K-ILA-C	UNLOCKED	NCS1K-ILA-C	FCB2650B0QQ	NCS1K-ILA-C
Slot RP0	UNLOCKED	NCS1K-CNTRL-K9	UNLOCKED	NCS1010-CNTRL-K9	FCB2631B037	NCS1010-CNTRL-K9
cremona83		ola				
bergamo80		ola				
genova94		roadm				

Step 1 Click **Network Inventory** in the left panel.

Cisco Optical Network Controller displays the Inventory tab. This tab displays all the inventory at the selected site.

Step 2 Click the node that you want to view the details of.

There is an option for selecting cascading windows for each node to view the Common Cards and the Slot Cards.

Step 3 (Optional) To export inventory data into an excel file, click **Export**.

Step 4 Click the **Refresh** button to refresh the inventory status.

Step 5 Use the filter to search using **Custom Search** or **Quick Search** options.

Note Custom Search: Use this option to filter the search based on any particular field from the table. By selecting from the drop down list, the rows that are specific to the selected field appear in the search result. You can custom search using any of these options: **Admin State**, **Equipment Type**, **Software Revision**, **Equipment State**, **Actual Equipment Type**, **Serial No** or **Site Name**.

Quick Search: Use this option to search based on any value or field by typing it in the search box to fetch the related rows from the table.

Service Manager

Before you begin

Circuits are referred to as services. The **Service Manager** screen helps in viewing and creating services. **Service List** page displays the list of services which can be viewed and exported anytime. The **Provision Service** option allows to create a new service.

**Note**

- The recommended number of circuits that you can create or delete at once are up to a maximum of five circuits, even though it is possible to create or delete more than five circuits at any given point in time. In such cases, you can stop provisioning these additional circuits as required. Also, it is recommended that you wait until reaching the final status before you can work with other circuits.

There are circuits called brownfield circuits which can be already present on the devices before the onboarding proceeds. The configuration of these brownfield circuits happens outside Cisco ONC.

Brownfield circuits are circuits that are already existing on devices. The configuration of these circuits is done either outside of Cisco ONC like in COSM or through NCS 1010 CLI. It can be configured through a different instance of Cisco ONC as well which is managing the same network. The brownfield circuit's service names have the following format: `onc_<SourceNode Name>_<DestinationNode Name>_xx`.

To create a new service, follow the procedure given below.

Step 1

Click **Provision Service** in the left panel

Figure 20: Service Manager

The screenshot shows the Cisco Service Manager interface. The top navigation bar includes 'Service List' and 'Provision Service'. Below the navigation, there are buttons for 'Delete' and 'Edit'. The main area displays a table of services with columns for Name, Type, Source, Destination, Lifecycle State, and Operational status. The table shows 4 services out of 55 total, with filters cleared. The services listed are:

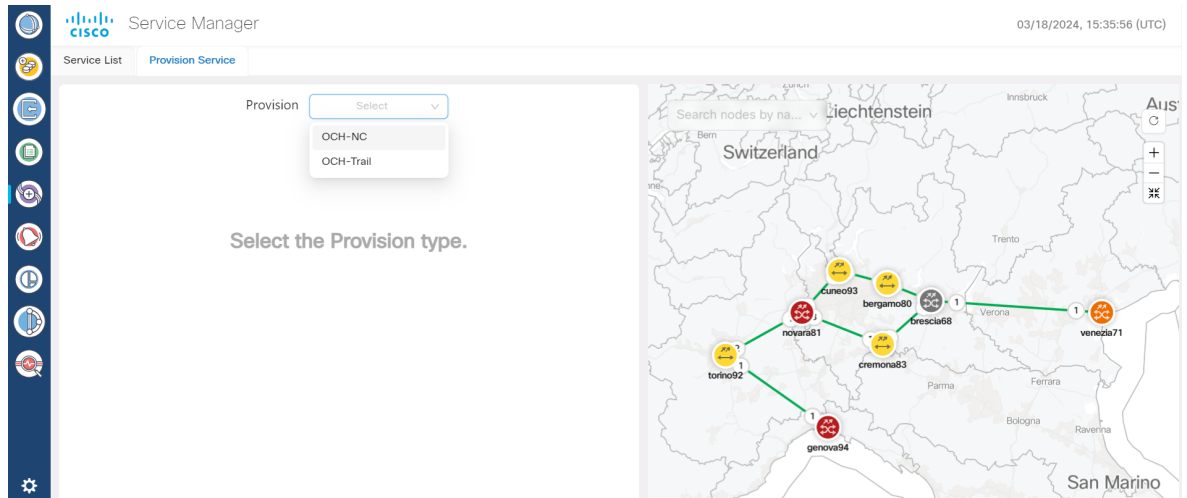
Name	Type	Source	Destination	Lifecycle State	Operational
service_genova94_venezia71	OCH-NC	GENOVA	VENEZIA	INSTALLED	DISAB
(Carrier)	OCH-NC	GENOVA 2/CH-15	VENEZIA 3/CH-15	INSTALLED	DISAB
ochnc_demo_genova_cremona_venezia	OCH-NC	GENOVA	VENEZIA	INSTALLED	DISAB
(Carrier)	OCH-NC	GENOVA 2/CH-11	VENEZIA 3/CH-11	INSTALLED	DISAB
service_genova94_cremona93_venezia71_3	OCH-NC	GENOVA	VENEZIA	INSTALLED	ENABI
service_genova94_cuneo93_venezia71	OCH-NC	GENOVA	VENEZIA	INSTALLED	DISAB

Step 2

Click **Provision** and select **OCH-NC** or **OCH-Trail**.

- Note**
- **OCH-NC:** The circuit is created between Add/Drop ports on the terminal OLTs or ROADMs.
 - **OCH-Trail:** The circuit is created between trunk ports of transponders or muxponders.

Figure 21: Provision Service



Step 3

Enter the details as per the sequential steps listed for the type of circuit and channel selected along with the other required preferences by clicking **Next** after each page. Fill each tab as per the details given below.

Figure 22: Provision Service Tabs

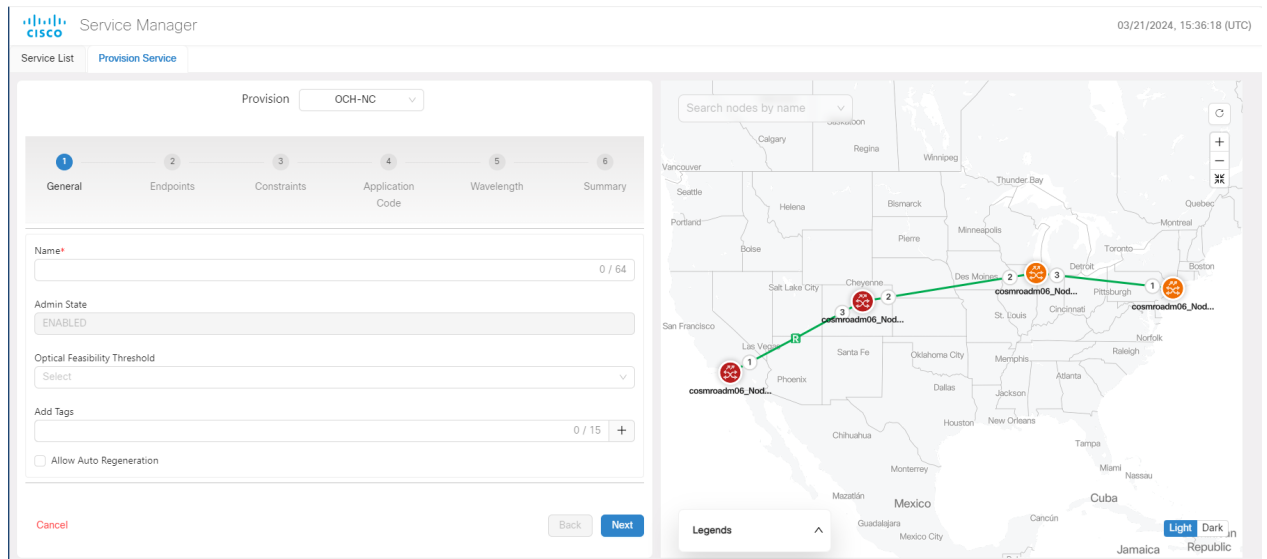


Table 5: Provision Service Tabs

Provision Service Tabs	Description
GENERAL	<p>Name: The unique user defined name of the OCH-NC link.</p> <p>(Allowed characters are a-z, A-Z, 0-9 and _ . <Space not allowed>).</p> <p>Admin State: only ENABLED is supported in 3.1.</p> <p>Optical Feasibility Threshold: Select RED, GREEN, YELLOW or ORANGE.</p> <p>GREEN = mean value YELLOW = +1 sigma ORANGE = +2 sigma RED = +3 sigma</p> <p>Add Tags:</p> <p>If user wants to add any tags to the service.</p> <p>Allow Auto Regeneration: Whether to allow auto regeneration (*not supported in 3.1).</p>
ENDPOINTS	<p>Single Channel/Multiple Channel</p> <p>In case of multi channel between the same Endpoints, the user can add multiple carriers, using the Add button, in a single OCH-NC service provisioning using different channel ports.</p> <p>Endpoint A/Endpoint B:</p> <p>Source and Destination Nodes.</p> <p>This can be selected either from the drop down menu or by clicking on the map icon and then selecting the node.</p> <p>Select port:</p> <p>Source port or Destination port from where you need to provision the service.</p>

Provision Service Tabs	Description
CONSTRAINTS	<p>Optimization goal (optional): The optimization goal (Length or Hops or OSNR).</p> <p>Disjoint from service (optional): The new OCH-NC line is not allowed to use the specified path.</p> <p>Include nodes or links (optional): Used to add Constraints for the new service by selecting from the drop down or by using the map.</p> <p>Exclude nodes or links (optional): Same as the above option but the Constraints here are used for excluding nodes or links.</p> <p>Click the re-cycle icon to remove any of the included or excluded items.</p>
Application Code	<ul style="list-style-type: none"> ◦ Customer Name: The Customer name. ◦ Product ID: The product ID. ◦ FEC: The FEC depending on the product, for example, CFEC or OFEC depending on the previous selection. ◦ Data Rate: The data rate supported by the selected product. ◦ Baud Rate: The baud rate supported by the selected product. ◦ Sub Mode: This may appear depending on the other settings. <p>Reload application code: Use this for a allenWL recently imported with Alien Import feature to reload the list of the Application code available for OCHNC provisioning.</p> <p>Reset can be used for resetting all the fields.</p>
Wavelength	<p>Central Frequency (THz): This can be filled in two ways.</p> <ul style="list-style-type: none"> • By filling the frequency value in the field. • By spectrum occupancy
Summary:	Summary of all the previous five steps given above.

Step 4 Click **Preview** to the preview the circuit before it is created.

Step 5 Click **Finish** to create the circuit.

Step 6 Click **OK** once the circuit is provisioned successfully.

The newly provisioned circuit appears in the **Service List** table once the provisioning is complete. The **Lifecycle State** for the new circuit appears as **PLANNED** initially and later changes to **INSTALLED**.

Step 7 Click **Edit** option to edit any selected service from the table.

Step 8 Click **Delete** option to delete a selected service from the table.

Step 9 Click + icon after selecting any node to expand the service and view its carriers.

Carriers can be of either single or multiple service types. Multiple carriers can have the same Endpoints over different channels.

Step 10 While provisioning a service you can also click and select any object from the map and that object's details gets added in the Endpoints tab automatically.

Troubleshooting in Service Manager

The most common problems encountered while using the **Service Manager** application is given below.

Some PCE error codes which you might encounter while provisioning the service are given below.

- [PCE-PR00003] - Failed for waves selector: [PCE-EXC00002] - Carrier 1 source wave (XXXXXXXX-XXXX (XXXX.XX)) and Destination one (XXXXXXXX-XXXX (XXXX.XX)) differs
- [PCE-WAL00048] - Requested central frequency XXX,XXX is out of supported range
- [PCE-WAL00026] - No free spectrum available to allocate MCH with central frequency XXX.XXX.
- [PCE-PR00001] - No routes available
- [PCE-WAL00026] - No free spectrum available to allocate MCH with central frequency XXX.XXX.x
- [PCE-PR00026] - Include constraint [Site uuid] not matched
- [PCE-PR00018] - Optical validation failed: ZONE_RED worse than ZONE_GREEN
- [PCE-PR00004] - Failed to evaluate optical path: [PCE-OV00016] - [Fiberspan UUID]: Invalid fiberType: [null value]

The probable scenarios in which the services can go to the **Pending Removal** State due to configuration failures and recovery steps are given below:

Failure Scenario	Cisco ONC Error	Recovery Step
COSM Node gets disconnected as soon as a service is provisioned in CONC	Config Failure	Delete the circuit and reprovision from the CONC.
COSM nodes are in sync state during CONC provisioning.	Config Failure	Check the COSM node and wait for synchronisation to complete.
NCS 1010 Devices under COSM Nodes are locked	Config Failure	<ul style="list-style-type: none"> • Check COSM and unlock the NCS 1010 device. • Verify COSM synchronisation status to be completed.

COSM node Restart during provisioning	Config Failure	Wait for CONC to re-establish the connection successfully after restart and its status moved to Discovery Completed in CONC.
Reload of the NCS 1010 device during provisioning from CONC	Config Failure	<ul style="list-style-type: none"> • Wait for the reload to complete on NCS 1010 device. • Verify the synchronisation is complete on COSM Node. • Wait for CONC to reestablish the connection successfully with COSM Node and its status moved to Discovery Completed.
Stale entries present in NCS 1010 while no cross connects present on COSM Nodes	Config Failure	<ul style="list-style-type: none"> • Clear the NCS1010 stale entries. • Wait for COSM node to complete the synchronisation.
Xcons Present in COSM Node along with NCS 1010	Config Failure	<ul style="list-style-type: none"> • Clear the XCONS on COSM and NCS 1010. • Wait for COSM node to complete the synchronisation and Discovery completed status.

Alarms

Before you begin

The **Alarms** screen displays all the alarm details for each node based on the severity level. You can view both the active alarms and the previously active alarms in this screen.

Figure 23: Alarms

Node Name	Severity	Alarm Type	Time Stamp	Object	Description	Service Affect
novara81	Critical	LOS-P	03/18/2024, 15:01:55	OTS: 1/0/[AD 4-11]-1-RX	Incoming Payload Signal Absent	SA
cuneo93	Warning	USER-LOGIN	03/18/2024, 15:01:05	SYSTEM	Login of User	NSA
brescia68	Major	NE-DISCONNECTED	03/18/2024, 14:21:21	DEVICE: 10.58.253.68	Connection To Managed NE Lost	NSA
brescia68	Warning	USER-LOGOUT	03/18/2024, 14:14:39	SYSTEM	Logout of User	NSA
brescia68	Warning	USER-LOGIN	03/18/2024, 13:52:57	SYSTEM	Login of User	NSA
torino92	Minor	LIC-SIA-OUT-OF-COMPL-GP-REM	03/17/2024, 14:09:57	MODULE: 1/RPO	SW Upgrade is still allowed as SIA Grace Period is remaining	NSA
genova94	Warning	T-UAS-SM	03/16/2024, 09:53:29	OTU: 5/0/7	PM TCA, NA, 15MIN, NA, threshold=500, current value=500	NSA

For viewing the active alarms using **Alarms** tab and the other for previous alarms using **History** tab.

Figure 24: Alarms History

Node Name	Severity	Service Affect	Alarm Type	Time Stamp	Object	Description
cosmp2p_s25_Node2	Cleared	SA	OPWR-LFAIL	03/28/2024, 09:10:44	OXC: onc_bhQLCM9RCznuiv4opl5i7X1F9 path1: OTS:1/0/LINE-2-TX	Optical
cosmp2p_s25_Node3	Cleared	SA	OPWR-LFAIL	03/28/2024, 09:10:44	OXC: onc_n3dJatSckNrBtKtUqVhP xHVEY path2: OTS:1/0/LINE-TX	Optical
cosmroadm_s4_Node6	Major	NSA	FPD-UPG-REQUIRED	03/25/2024, 10:02:54	MODULE: 3/0	Firmwa
cosmp2p_s25_Node2	Cleared	SA	OPWR-LFAIL	03/28/2024, 09:10:53	OXC: onc_NniG7nveY6TKX3n0Aqh JAgxkl path2: OTS:1/0/LINE-0-TX	Optical

- Step 1** Click **Alarms** in the left panel.
- Step 2** Select the **Alarms** tab to view the active alarms of each node.
- Step 3** Click **Annotation** to add user notes to any alarm, select the node and c. Add the user notes and click **Add**. This will send a notification to the user for the alarm. You can add multiple notes to multiple alarms in the form of a list.
- Step 4** Click **Change Status** to acknowledge or unacknowledged alarms.
- Step 5** Click **History** to view the inactive or previous alarms. The details of each alarm based on each node and alarm type are displayed in the form of a cascading list and tables. Use the **Custom Date Range** Custom Date Range drop down option to view the history alarms based on different dates or time periods.

Figure 25: Alarm History Expanded View

The screenshot displays the 'Alarms History' view in the Cisco Optical Network Controller. It shows a list of 399 alarms. A specific alarm is expanded, showing details such as 'RAVENNA', 'Cleared', 'SA', 'LOS-P', and the time '04/01/2024, 09:05:41'. Below the main alarm list, there is a '4 Alarms Status' summary table and a '0 User Notes' section.

Severity	Event Time
Critical	04/01/2024, 08:58:08
Cleared	04/01/2024, 08:58:29
Critical	04/01/2024, 09:05:40
Cleared	04/01/2024, 09:05:41

Step 6 Click any cross-launch icon for any node to cross launch to the linked COSM.

Step 7 Click **Export** to export the alarms details.

Note You can export the table content to an excel file using the **Table View** option which has only the visible portion of the table appearing in the file or export the entire table content at once.

Step 8 Click **Refresh** button to refresh the alarms status.

Note If you apply a filter and click the **Refresh** button, the status is refreshed as per the filter you have applied.

Step 9 Use the **Filter** option by clicking on the filter icon appearing in each column.

Note

- The filter option allows you to search the alarm details based on the selected filter.
- When you apply any filter in the **Alarms** screen, the **Critical**, **Major**, **Minor** and **Warning** counters they do not update their values as per the individual status of the alarms but only the count of each type of alarm.

Step 10 Use the **Sort** option by clicking on the sort icon appearing in each column.

Note The sort option allows you to sort the alarm details based on the order you have selected.

Step 11 Click on **Critical**, **Major**, **Minor** alarm types to filter and display the alarms belonging to each type. Click on **Warning** to display the list of warnings.

Step 12 Use the **Acknowledge** column in the table to view the acknowledged or unacknowledged alarms.














Note

- To acknowledge or unacknowledge any particular alarm, select the node from the table and then click on **Change Status**. From the drop down, select **Acknowledge** or **Unacknowledge** option to acknowledge or unacknowledge the alarm of the selected node.
- If an alarm is acknowledged, it appears with a green check mark in the table.
- Acknowledged alarms also display the date and time-stamp details.
- Multiple alarms can be acknowledged or unacknowledged at once.

Step 13 Use the **User Notes** column in the table to view the user notes added by any user.

- Note**
- To add a user note, select the node and click on **Annotation** option. Enter the user note details and click on **Add**. The newly added user note appears in the **User Notes** column in the table.
 - Multiple user notes can be added to the same node or alarm.
 - If you click on the user notes icon in the **User Notes** column, it will display all the user notes added for the selected node or alarm.

Figure 26: User Notes

↑↓ ▾	Direction	↑↓ ▾	User Notes	↑↓ ▾	Acknowledge	↑↓ ▾
	NA					
	NA					
	NA					
	NA					
	NA					
	NA					
	NA					
	NA					07/15/2024, 11:05:15
	NA					07/15/2024, 11:48:46
	NA					07/15/2024, 11:48:46

Workspaces

Before you begin

Workspaces option allows you to manage different workflows on a daily basis. The multiple standalone applications can interact with each other anytime and are displayed in multiple panels. The workflows available are **Network Monitoring** and **Circuit Monitoring**.

Figure 27: Workspaces

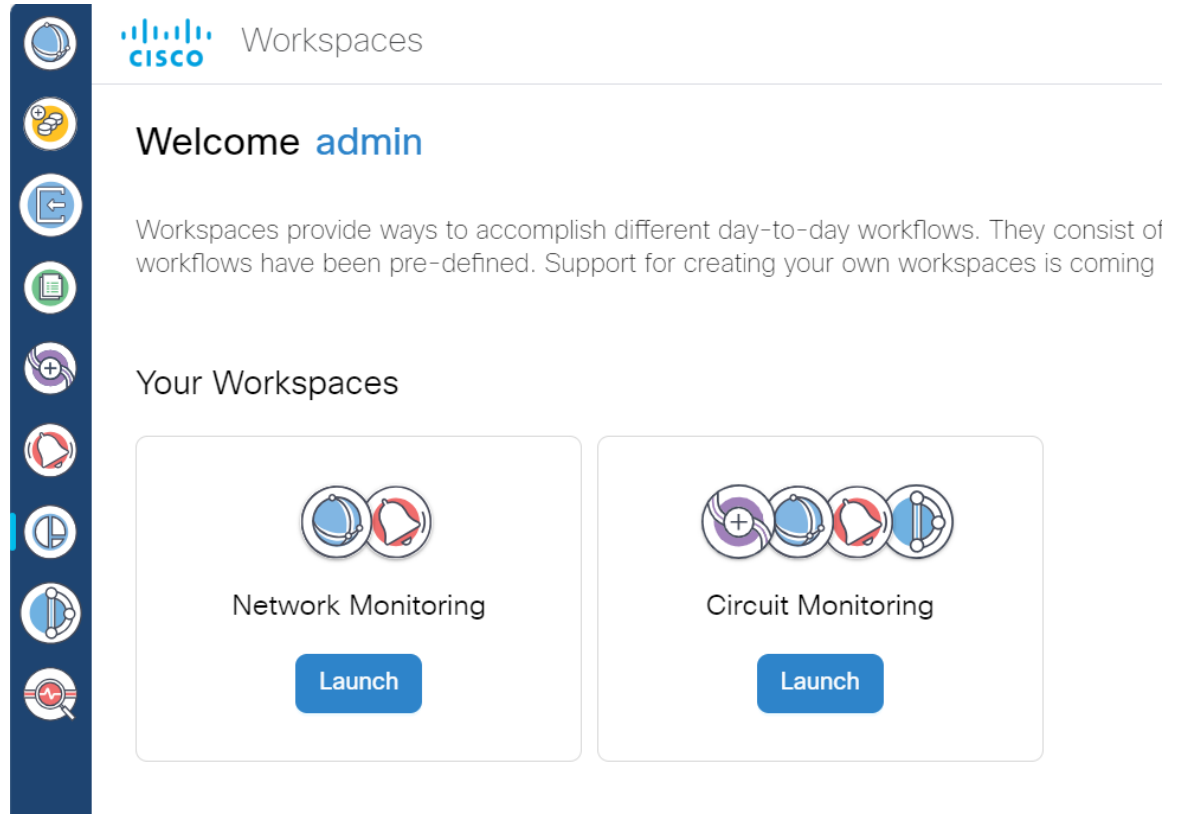
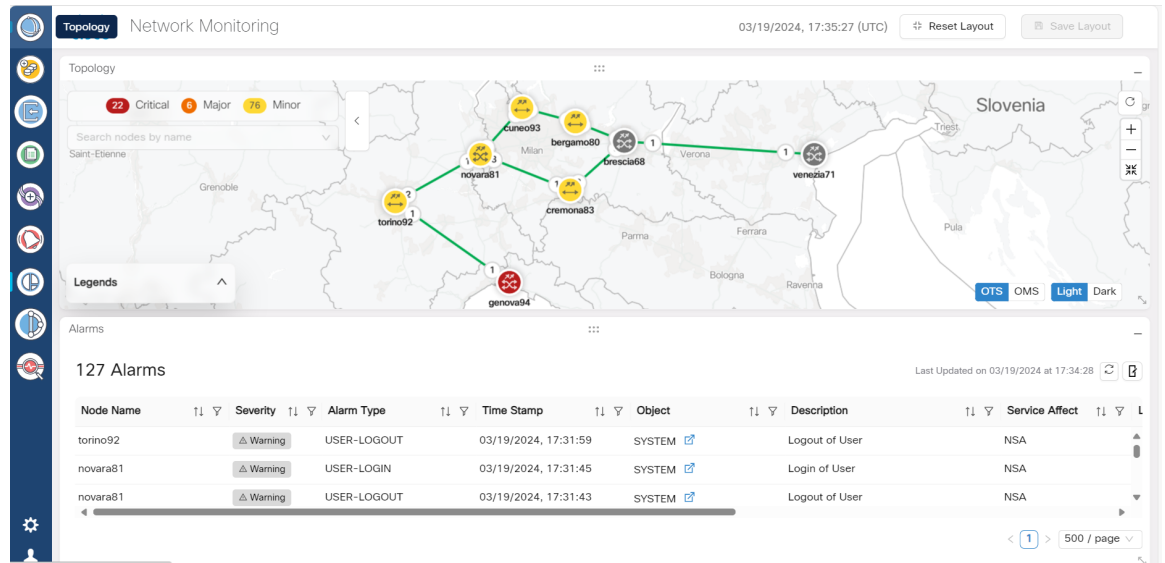


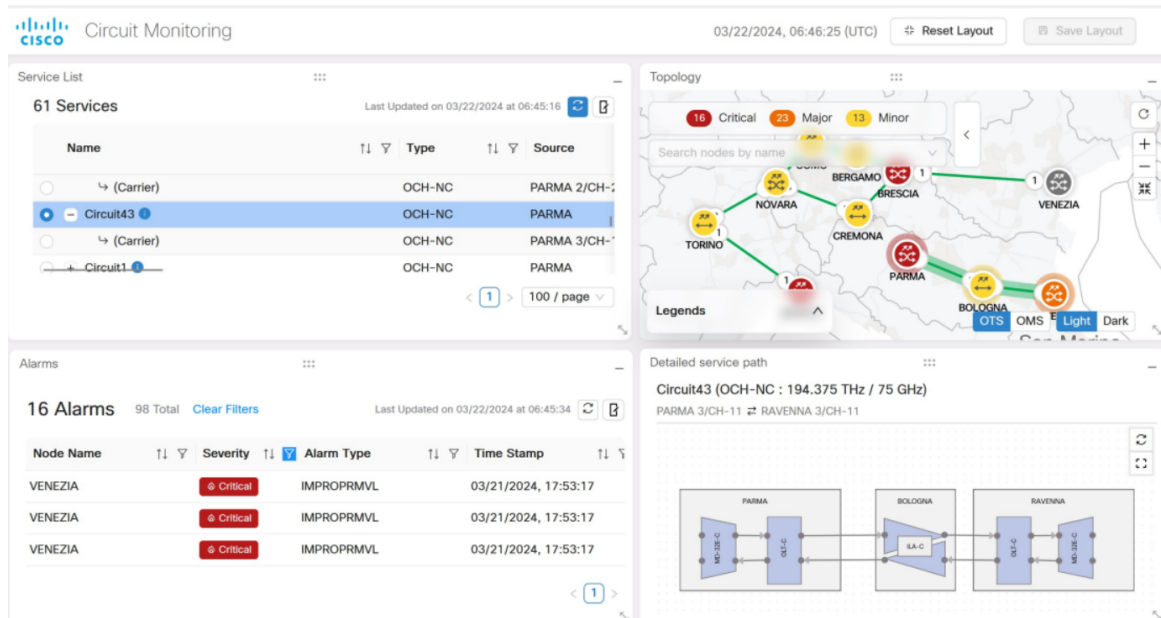
Figure 28: Workspaces Network Monitoring





Note In the network monitoring screen above, the alarm details are displayed based on the node or link which is selected from topology.

Figure 29: Workspaces Circuit Monitoring



Note

- In the **Topology** screen above, select any node or link and right click followed by **Show service(s)**. This will display all the services related to the selected node or link in the services layout.
- In the **Alarms** screen above, select any alarm and right click followed by **Show Affected service(s)**. This will display all the services related to the selected alarm in the services layout.

There can be many such workflows that can be added to the workspace anytime. Also, the workspace panels are dynamic and interactive. By default, we can see the **Alarms**, **Service List**, **Topology** and **Detailed Service Path** panels. These individual panels can be dragged and dropped anywhere on the monitoring screen. They can also be minimized and maximized as necessary anytime.



Note The alarms displayed here are applicable to the selected services only and not to the entire **Topology**. Also for multi carrier services, alarms are displayed for the selected carrier only.

- Step 1** Click **Workspaces** in the left panel.
- Step 2** Select the workspace and click **Launch**.
- Step 3** Click **Save Layout** to save the layout at any given point in time.
- Step 4** Click **Reset Layout** to revert to the default layout.

Step 5 Some of the other options that are available on these panels are mentioned below.

- Hovering on the nodes displays the node name and the alarm severity.
- Hovering on the equipment displays the equipment name, service state as enabled or disabled and the count of the severity of the alarms.
- Hovering on the port which is displayed as a round icon on the panel displays the port name, service state, and the alarms severity counts.
- Connectivity between each equipment is highlighted with arrows.
- If you right click at the node level it will cross launch to the Nodal UI to verify OXC's.
- If you right click at the equipment level it will cross launch to View Nodal UI: Equipment.
- If you right click on any port it will cross launch to View Nodal UI: Port.
- Connectivity between the nodes are represented with arrows.

Service Assurance

Before you begin

The **Service Assurance** option helps in visualizing the circuits and the related nodes, links, and the circuit paths.

Figure 30: Service Assurance

The screenshot displays the Cisco Service Assurance interface. At the top, it shows the date and time: 03/26/2024, 12:52:50 (UTC). Below this is a 'Service List' section with 897 services. A table lists services with columns for Name, Type, Source, Destination, Lifecycle State, Operational State, and Admin State. Two services are visible:

Name	Type	Source	Destination	Lifecycle State	Operational State	Admin State
Circuit320_6deg_N1_N10	OCH-NC	cosm12_10	cosm12_1_3_5_7_9_11	INSTALLED	DISABLED	UNLOCKED
Circuit16	OCH-NC	cosmp2p82_Node3	cosmp2p82_Node1-	INSTALLED	DISABLED	UNLOCKED

Below the table is a 'Detailed Service Path' section for the selected service 'Circuit320_6deg_N1_N10 (OCH-NC : 191.375 THz / 75 GHz)'. The diagram shows two nodes: 'cosm12_10' and 'cosm12_1_3_5_7_9_11'. Each node contains an 'OXC-C' component and an 'MP-3RF-C' component. Arrows indicate the flow of the service path between these components across the two nodes.

Step 1 Click **Service Assurance** in the left panel.

Step 2 Select the service from the **Service List**.

Step 3 In the **Detailed Service Path** layout, you can view the service details by hovering over the visual circuit for each node, ports, links, and paths of any service at any given time. These details are available when the **Lifecycle State** is either **INSTALLED** or **DELETION FAILED**.

Step 4 Click **Export** to export the details of the table from the screen to a spreadsheet file.

Monitoring

- **Audit Log:** You can view the audit logs related to the user login or logout, device enrollment, device re-sync service for circuit create, delete or edit options. Also the create, edit or delete user options.
- **Detailed Node Resources:** You can monitor the CPU, memory or disk consumption of the host.
- **Log Viewer:** Displays the internal logs of microservices.
- **Pod Monitoring:** You can monitor the CPU, memory or disk consumption of the microservices within the kubernetes cluster.

Before you begin

Use this option to view the log messages and other related details.

Click to view each option separately.

General Troubleshooting

These are some generic troubleshooting points to consider which are common across the different applications within Cisco ONC.

- **Switchover happens:** Refresh the page.
- **TAC case:** In order to raise a TAC case, collect the sedo diagnostic logs with the command:

```
sedo diagnostics archive-logs
```

Collect it along with the Grafana view.



CHAPTER 3

Alarm Troubleshooting

For information about alarms and clearing procedures, see the *Alarm Troubleshooting* chapter in the following guides:

- [Troubleshooting Guide for Cisco NCS 1014](#)
- [Troubleshooting Guide for Cisco NCS 1010](#)

