Network Discovery and Link Provisioning in Cisco Crosswork Hierarchical Controller

This chapter describes Network Discovery in the Hierarchical Controller, Provisioning end-to-end OCH-NC and IP Links, and Troubleshooting OCH-NC and IP Links using the Hierarchical Controller and Cisco Optical Network Controller

Network Discovery in the Hierarchical Controller

Prerequisite:

Verify the following Crosswork Hierarchical Controller Applications are installed and enabled.

- Explorer
- Network Inventory
- Link Assurance
- Service Manager
- Device Manager

View Installed Crosswork Hierarchical Controller Applications

Use this procedure to view the installed Crosswork Hierarchical Controller Applications.

Step 1   To view the installed Crosswork Hierarchical Controller applications:

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.

Step 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 applications (for example, Device Manager) are disabled by default.

Add Cisco Optical Network Controller Adapter

Use this procedure to add Cisco ONC adapter.

Step 1 In the applications bar in Crosswork Hierarchical Controller, select **Services** > **Device Manager**.

A list of the adapters appears in the Adapters pane.

Step 2 Click **Add new adapter**.

Step 3 Enter the adapter details:

- **Adapter Type**: Select the adapter type from the list of available adapter types currently installed in Crosswork Hierarchical Controller. The Cisco Optical Network Controller adapter is `cisco-onc-adpt`.

- **Adapter Name**: Unique user defined name of this adapter type instance (there can be several instances of the same adapter type).

Step 4 Click **Add**.

Step 5 To configure the adapter, select the adapter in the **Adapters** pane.

- **Enabled**: Whether the adapter is enabled or disabled.

- **Logging Level**: The logging level (Info, Critical, Error, Warning, Debug). Info by default.

- **Polling Cycle (sec)**: The polling interval in seconds. The Polling cycle must be set to 300s or higher.

- **Number of concurrent routers collected**: The number of network elements that can be concurrently polled in a polling cycle.

- **Enable provisioning support**: Whether or not to enable provisioning support. For example, if provisioning is enabled, creating a new tunnel or service.

Step 6 Click the **General** tab.

Step 7 Configure the following options:

- **Enabled**: Whether the adapter is enabled or disabled.

- **Logging Level**: The logging level (Info, Critical, Error, Warning, Debug). Info by default.

- **Polling Cycle (sec)**: The polling interval in seconds.

- **Number of concurrent routers collected**: The number of network elements that can be concurrently polled in a polling cycle.

- **Enable provisioning support**: Whether or not to enable provisioning support. For example, if provisioning is enabled, creating a new tunnel or service.

Step 8   Configure Connection Properties.

- **Host**: This is the URL to access the Cisco Optical Network Controller TAPI interface. The format is `https://<ip>:<port>/crosswork/onc-tapi/`.

- **Timeout**

- **Credentials**: The TAPI credentials that you have added using the Credentials Manager.

Step 9   Configure the FILE BRINGER PARAMETERS:

- **Enable File Bringer**: This enables the module in the adapter to transfer the files from the remote file server to Crosswork Hierarchical Controller.

- **File Server Location**: The file server location. The format is `http/sftp://<ip>:port/<path>`.

- **File Type**: For example, CSV, JSON.

- **Authentication**

Step 10   Configure Notifications.

- **Enabled**: Whether notifications are enabled or disabled.

- **URL Sub-part**: Set CONC_NETCONF

Step 11   Configure Stats Collection.

- **Enabled**: Whether Stats Collection is enabled or disabled.

- **Stats Interval Polling (sec)**: The polling interval in seconds.

Step 12   Click **Save**.

Network Discovery for a New Network

Onboard Devices in Cisco Optical Network Controller

Follow the steps in Onboard Devices in Cisco Optical Network Controller, Import Planning Data in Cisco Optical Network Controller, and Import Planned Passives, Connections, Optical Attributes from Cisco Optical Network Controller workflows.

After onboarding is complete in Cisco Optical Network Controller, the devices are automatically populated in the Hierarchical Controller.

Create Sites for Network View

To add sites in Sites Manager:

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

Step 2   Select the **Sites** tab.

Step 3   Click **Add New Site**.

Step 4   Enter the site details. For example, ST/London.

Step 5   Click **Save Site**.

Map Devices to Geographical Location

To map devices to sites in Device Manager:

Step 1   In the applications bar in Crosswork Hierarchical Controller, select **Device Manager** > **Adapters** > **Devices**.

Step 2   Click a device.

Step 3   In the general tab, select the site for the device.

Step 4   Click **Save**.

Step 5   Repeat for all devices.

Network discovery in Crosswork Hierarchical Controller is complete. You can view devices and links in the Network Explorer app.

Network Discovery for an Existing Network

If a network has already been onboarded on to Cisco Optical Network Controller before adding the Optical Network Controller adapter to Crosswork Hierarchical Controller, the devices get automatically populated in the Hierarchical Controller after the adapter is added. After the devices are populated on the Hierarchical Controller, Create Sites for Network View and Map Devices to Geographical Location. You can view devices and links in the Network Explorer app.

Network Discovery after Update of an Existing Network

In case of a network update follow the same procedure as for a new network. Onboard Devices in Cisco Optical Network Controller, Create Sites for Network View, and Map Devices to Geographical Location. You can view the new devices and links in the Network Explorer app.

Delete Devices from the Network

To delete a device from Crosswork Hierarchical Controller:

Prerequisites

You must remove all the circuits passing through that device to delete a device from the Hierarchical Controller.

Delete Device from Cisco Optical Network Controller

Use this task to delete the devices onboarded to Cisco Optical Network Controller.

Restriction   Do not delete more than 10 devices in a 5 minute interval.

Step 1 Log into Cisco Optical Network Controller.

Step 2 Click **Devices** in the left panel.

Step 3 Select the target device and click **Delete**.

> **Note** You cannot delete a device if collection is in progress. The Cisco Optical Network Controller UI shows the device status. Verify the status is not collection in progress before deleting a device.
>
> You cannot delete devices if they have circuits provisioned. Remove the circuits before deleting the devices. If you try to delete a device that has circuits passing through it, the delete operation fails.

Remove Device from Crosswork Hierarchical Controller

You can delete a device and unassign it from its adapters. The device is deleted from the model.

To delete a device:

Step 1 In the applications bar in Crosswork Hierarchical Controller, select **Services** > **Device Manager**.

Step 2 Select the required adapter.

Step 3 Select the **Managed Devices** tab.

Step 4 Click on the required device row (not on the link in the Name column).

Step 5 Click **Delete device**.

A confirmation message appears.

Step 6 Click **Confirm** to delete the device, unassign it from all adapters and delete the device from the mode.

You can view the updated devices and links in the Network Explorer app.

Provision End-to-End OCH-NC Link

Before You Begin

- Network Discovery in the Hierarchical Controller
- Create IPC Using Cisco Optical Network Controller
- Import Alien Wavelength to the Hierarchical Controller

Create IPC Using Cisco Optical Network Controller

IPCs are created between the OCH ports of the OLT device and the OMS ports of the passive device. This is needed to expose the service end points to the Hierarchical Controller.

To create IPC in Cisco Optical Network Controller:

Step 1 Log into Cisco Optical Network Controller.

Step 2 Click **Sites** in the left panel.

Step 3 Click the site that you want to add the details of.

Step 4 Click **Optical Configurations**.

Step 5 Click **Add**.

Step 6 Select the source and destination devices and ports from the respective drop-down lists.

Step 7 Click **Add**.

Import Alien Wavelength to the Hierarchical Controller

Importing Alien wavelength to the Hierarchical Controller involves the following steps:

Step 1 Download the optical source from an Excel sheet in Cisco Optical Network Planner, customize the excel template based on the requirements, and import the customized excel template in Cisco Optical Network Planner. See Import Optical Sources.

Step 2 Download Optical Source in XML format in Cisco Optical Network Planner. See Download Optical Sources.

Step 3 Import the Alien wavelength in Cisco Optical Network Controller from Cisco Optical Network Planner. See Use Alien Import.

Step 4 Export the Alien wavelength from Cisco Optical Network Controller. See Use Alien Import.

Step 5 Import the Alien wavelength to the Hierarchical Controller.

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

  A list of the service settings appears.

- In OPTICAL TRANSCEIVERS APPLICATION CODES, click the **hamburger** icon to select an XML file with the application codes.

- Click **Import**.

Create End-to-End OCH-NC Link

Step 1 In the applications bar in Crosswork Hierarchical Controller, select **Services** >**Services Manager**.

Step 2 Select the **Point to Point** tab.

Step 3 Click **OCH-NC Link**.

  The **OCH-NC Link** wizard appears.

Step 4 In the **GENERAL** pane of the wizard, specify the following:

- **Name:** The unique user-defined name of this link.

- **Description:** A description of the link.

Step 5   Click **Next**.

Step 6   In the **SETTINGS** pane of the wizard, specify the following:

- **Optical Feasibility Threshold:** Indicates the optical feasibility of the OCH-NC link to ensure that the link is operational after provisioning. The optical feasibility is represented by the following colors: Choose **RED**, **GREEN**, **YELLOW** or **NONE**. For more information, see the Channel Validation Coloring section.

- **Admin State:** Choose **ENABLED** or **DISABLED**.

- **Central Frequency (THz):** (Optional) The frequency for this OCH-NC link. A number in range of nine digits, with a dot after the first 3 digits (xxx.xxxxxx). The range is between 000.000000 to 999.999999 in steps of 000.000001. If the value is blank, the first suitable wavelength is automatically assigned.

Step 7   Click **Next**.

Step 8   In the **APPLICATION CODE** pane of the wizard, specify the following:

- **Vendor Name:** The vendor name.

- **Product ID:** The product ID which is the Alien wavelength.

- **FEC:** The FEC depends on the product, for example, CFEC or OFEC.

- **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.

Application code is generated from the above parameters and is unique for each interface.

Step 9   Click **Next**.

Step 10   In the **ENDPOINTS** pane of the wizard, specify the following:

- Choose **Single Channel** or **Multiple Channel**. There will be multiple endpoints for Multiple Channel.

- **Endpoint A:** Click the **Search** icon and in the **Advanced** tab, select an NMC port, or click the **3D Explorer** tab and select an endpoint.

- **Endpoint B:** Click the **Search** icon and in the **Advanced** tab, select an NMC port, or click the **3D Explorer** tab and select an endpoint.

Step 11   Click **Next**.

Step 12   In the **PATH** pane of the wizard, specify the following:

- **Optimization Goal:** The optimization goal (**Number of Hops** or **Admin Cost**).

- **Disjoint From Link:** (Optional) Click the **Search** icon and in the **Advanced** tab, select an OCH-NC link, or click the **3D Explorer** tab to select an OCH-NC link. This means that the new OCH-NC link must not traverse this path.

- **Include Nodes or Links:** (Optional) Click the **Search** icon and in the **Advanced** tab, select a link, or click the **3D Explorer** tab to select a link.

• **Exclude Nodes or Links:** (Optional) Click the **Search** icon and in the **Advanced** tab, select a link, or click the **3D Explorer** tab to select a link.

Step 13   Click **Next**.

Step 14   In the **SUMMARY** pane of the wizard, review the details provided and click **Finish** to create an OCH-NC link.

Channel Validation Coloring

The optical power and OSNR of each channel are simulated over a specific optical path with average value (considering typical values) and variance (considering statistical propagation of variances). The simulation provides the statistical optical power and OSNR at the RX side of the optical interface. The statistical optical power and OSNR values delivered from the DWDM system are compared with the target optical power and OSNR values requested at the RX side of the optical interface for error-free post-FEC. This comparison provides channel validation coloring.
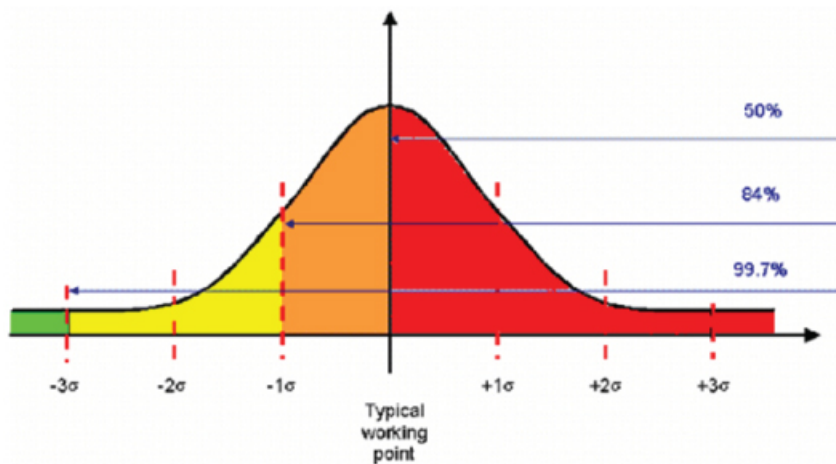
• Average-OSNR – $3x\sigma$ > target-OSNR ⇒ GREEN or working probability > 99%

• Average-OSNR – 1xs > target-OSNR ⇒ YELLOW or 99% > working probability > 84%

• Average-OSNR < target-OSNR ⇒ RED or working probability less than 50%

For each channel, optical power and OSNR margins are calculated considering the statistical worst case.

The following figure describes the (Typical_value -3σ) working point with respect to the optical interface working area (including penalties).
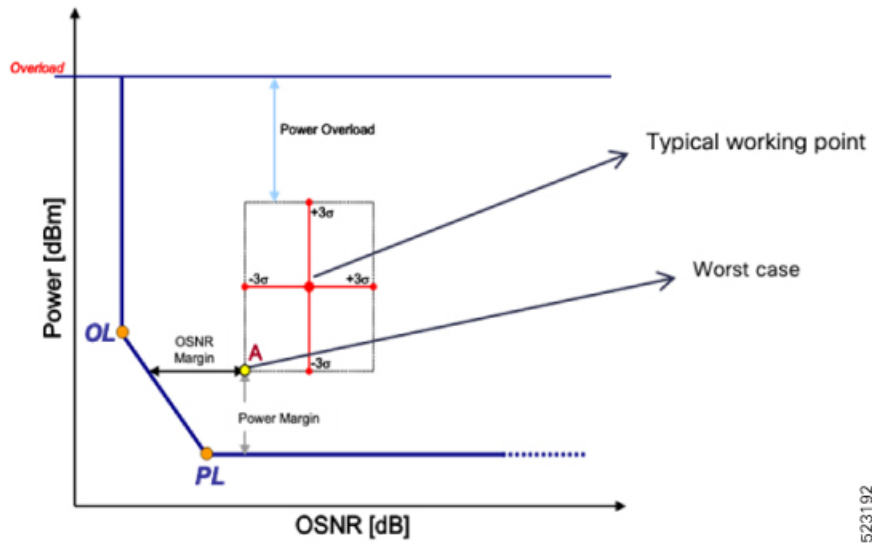
Provision the IP Link

See Provision Routed Optical Networking ML Service Using Crosswork Hierarchical Controller.

Troubleshoot IP Link and OCH-NC through the Hierarchical Controller and Cisco Optical Network Controller

Device Addition Failure

Reason	Description/Details	Troubleshooting	Workarounds/Remarks
Connection Failure	UI status – **Disconnected**	Check connectivity to the device by – Check if the user provided details like Device type, IP, Port, Protocol, and device credentials are correctly mentioned in Cisco Optical Network Controller UI.	Correct the details provided in the Cisco Optical Network Controller UI.
		Check if Ping to the device is working	Check if the device is properly configured and has proper network configuration.
		Check if the Netconf and gRPC (for NCS1010) connectivity to the device on the Netconf/gRPC port is working.	Check if the Netconf/gRPC and XR configuration is proper on the NCS1010 device
Collection Failure	UI status – **Failed/Errored**	Check the release on the NCS1010/SVO device.	NCS1010 should be running Release 7.7.1. SVO should be running one of the following releases – 12.2, 12.3, 12.3.1 If the issue occurs even when the required software versions are present call TAC.

Device Deletion Failure

Reason	Description/Details	Troubleshooting	Workarounds/Remarks
Device is part of a Circuit	UI status – **Circuit/Service spanning over the device - TBD**	This is expected Cisco Optical Network Controller behavior.	Delete the Circuit/Connectivity-service (via NBI) and then try Device deletion.

Reason	Description/Details	Troubleshooting	Workarounds/Remarks
Collection In Progress	UI Status – **Device cannot be deleted because Collection is in Progress**	This is expected Cisco Optical Network Controller behavior.	Wait for the collection to be completed and then try device deletion.
Resync in Progress	UI status –**Device cannot be deleted because Collection is in Progress**	This is expected Cisco Optical Network Controller behavior.	Wait for the Resync to be completed and then try device deletion.
Connectivity Check in Progress	UI status –**Device cannot be deleted because Waiting for Connection**	This is expected Cisco Optical Network Controller behavior.	Wait for the Resync/Recollection to be completed and then try device deletion.

IPC Creation Creation/Deletion Failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Invalid Port Selected	UI status – **Invalid port selected on OLT for a MPO passive type**	This is expected Cisco Optical Network Controller behavior.	Select the Correct Source and Destination ports.
UI not Refreshed/Updated	UI Status –**No IPC found between given source and destination ports** OR **Either or both the ports are already mapped!**	This could be expected Cisco Optical Network Controller behavior.	Click the Refresh button on the IPC tab and try IPC creation/deletion again.
Device Not Reachable	UI Status – **IPC Creation Failed**	This could be expected Cisco Optical Network Controller behavior.	Please verify Device Reachability.

Resync Operation failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Device not reachable	UI status – Device – **Disconnected** Status – **Blank/Resync pending/Resync Failed**	This is expected Cisco Optical Network Controller behavior.	Check if the device is properly configured and has proper network configuration. Check if the Netconf/gRPC and XR configuration is proper on the NCS1010 device. Try Resync again Check the release on the SVO/NCS1010 device for compatibility with Cisco Optical Network Controller release.
Device credentials changed on the device	UI status – Device – **Disconnected** Status –**Blank/Resync pending/Resync Failed**	This is expected Cisco Optical Network Controller behavior.	Edit the device credentials via Optical Network Controller UI and click OK. Resync will happen automatically.

Circuit Creation Failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
No Route Available	Cisco Optical Network Controller UI status – **NA**	No route can be found by the Path Computation Engine. Could be expected behavior.	Check the topology and the route for the currently created services.
Wrong SIP Selection	Cisco Optical Network Controller status – **NA**	SIP UUIDs are not proper	Check the list of available SIPs and supply only SIPs returned from the T-API topology-context fetched by the Hierarchical Controller from Optical Network Controller as part of the get call.
Device(s) not reachable	Cisco Optical Network Controller status – **NA**	Circuit will move to **Pending-Removal** lifecycle state.	Check the device reachability and fix it Delete the connectivity-service Recreate the connectivity-service.

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Routing constraint is Invalid	Cisco Optical Network Controller status – **NA**	Could be due to invalid UUIDs provided in the connectivity-service request constraints.	Check the list of available constraints and supply only valid constraints.
Routing Constraint Not Feasible	Cisco Optical Network Controller status – **NA**	Could be expected behavior since a route may not be available meeting the Constraint provided.	Check the topology and the constraint provided.

Circuit Deletion Failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Circuit Deletion attempted before circuit creation is completed	Connectivity-service lifecycle-state is **Planned** and same service deletion is attempted.	This is expected behavior.	Wait till the circuit lifecycle-state is either **Installed** or **Pending-removal**.
Invalid Circuit ID	Invalid connectivity-service UUID is provided	This is expected behavior.	Connectivity-service should be of an existing connectivity-service in the T-API connectivity-context.

Planning Data Import Failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Planning data file format is not proper	UI status – **Request Failed**	This is expected Cisco Optical Network Controller behavior.	Please check the file format. Cisco Optical Network Controller supports JSON file format from Cisco Optical Network Planner only.
Passive cards are already connected to OLT	UI status – **Error - Equipment Failed**	This is expected Cisco Optical Network Controller behavior.	Please physically remove and disconnect the Passive cards before pushing the data.
IPC already created in Optical Network Controller	UI status – **Error – Internal Patch cord Failed**	This is expected Cisco Optical Network Controller behavior.	Please remove the IPC from Cisco Optical Network Controller before pushing the data.

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Optical attributes are not compatible with the device	UI status – **Error – Optical attributes Failed**	This is expected Cisco Optical Network Controller behavior.	Please check and ensure that the actual hardware connected matches with the planned devices on Cisco Optical Network Planner. You can check this on the Cisco Optical Network Planner Planning data import screen using the actual device field.

Alien import failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Alien file format is not proper	UI status – **Request Failed**	This is expected Cisco Optical Network Controller behavior.	Please check the file format. Cisco Optical Network Controller supports XML file format from Cisco Optical Network Planner only.

CV failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks
Empty tone ID	UI status – **Empty Tone ID**	This is expected Cisco Optical Network Controller behavior.	Please remove the IPC and all related services and recreate it setting the tone ID to have CV working. This is a traffic affecting operation. Please see the connection verification workflow.
Degraded or broken IPC	UI status – **Failed**	This is expected Cisco Optical Network Controller behavior.	Please check the integrity of the IPC (physical fiber) and replace it if needed. To check the integrity, you need a reference power source and a power meter. Inject light on one end of the patch cord and measure the loss at other end of the patch cord.

PM failure

Reason	Description/Details	Troubleshooting	Workaround/Remarks

Device Reachability	Cisco Optical Network Controller UI status –
	
	 Device Status – **Disconnected**
		This is expected Cisco Optical Network Controller behavior if the device is not reachable or the gRPC interface is not UP/Working on the device.	Check the device connectivity to the NCS 1010 node using Ping.
			
			 Check the Telemetry Connection (gRPC for NCS1010 device) using
			
			 `show grpc`
			
			 and
			
			 `show grpc status`
			
			 on the NCS 1010 node.