# Sample end-to-end configuration

### Network sizing requirements

This section details the sizing requirements for a network. For a small lab installation, you need three servers with 256 GB of RAM to run Crosswork, Crosswork Network Controller, Cisco Optical Network Controller, NSO, Crosswork Hierarchical Controller, and EPNM without high availability (HA). For a production setup, calculate the total resources required using information provided in the tables.

For Cisco Crosswork, see Plan Your Deployment.

For Cisco Optical Network Controller, see Cisco Optical Network Controller 25.1.x Installation Guide.

### Network profiles

Network profiles are defined according to network size, available services, and application features.

| Network entity or feature | Lab (20%) | Production (100%) |
|---|---|---|
| Devices | 2000 | 10000 |
| Total number of interfaces | 100000 | 650000 |
| IGP interfaces | 20000 | 100000 |
| VPN Services (Layer2 and Layer3) | 40000 | 200000 |
| Endpoints for each VPN service | 2–10 | 50 |
| Total LSPs (SR policies and RSVP tunnels) | 12000 | 60000 |
| Number of PCEP sessions | 2000 | 10000 |

**Note** Each SR-PCE pair can only support 2000 PCEP sessions which means only 2000 headends for lab networks and 10000 headends for production networks. While counting headends, LCM nodes must be included.

### Deployment size for each network profile

This table provides recommended deployment sizing requirements based on the defined network profiles for solutions that use Cisco Crosswork Network Controller.

| Package | Contents | Crosswork Data Gateway deployment | Recommended number of cluster VMs |
|---|---|---|---|
| Cisco Crosswork Network Controller Essentials | Cisco Crosswork Optimization Engine | **On-Premise Standard** (default): Collectors only. | When Essentials package is installed without element management functions:<br>• **three hybrid nodes**<br>When Essentials package is installed with element management functions:<br>• **three hybrid nodes and one worker node** |
| | Cisco Crosswork Active Topology | **On-Premise Standard** (default): Collectors only. | |
| | Element Management Functions | **On-Premise Standard** (default): Collectors only. | |
| Cisco Crosswork Network Controller Advantage | Cisco Crosswork Service Health | **On-Premise Extended**: Collectors and offload services. | **three hybrid nodes and two worker nodes** |
| Add-on Package | Cisco Crosswork Change Automation | **On-Premise Extended**: Collectors and offload services. | **three hybrid nodes and two worker nodes** |
| | Cisco Crosswork Health Insights | **On-Premise Extended**: Collectors and offload services. | |
| | Cisco Crosswork Zero Touch Provisioning | **On-Premise Standard** (default): Collectors only. | |

**Note** For non-production lab installations without HA, you can use one hybrid node.

### VM resources

This table provides details about CPU, memory, and disk requirements for each Crosswork VM and other VMs in the deployment.

| Crosswork VM | Crosswork Data Gateway | NSO | SR-PCE | Crosswork Hierarchical Controller | EPNM |
|---|---|---|---|---|---|
| • CPU: 12 vCPU<br>• RAM: 96 GB<br>• DISK: 1 TB (SSD) | • CPU: 20 vCPU<br>• RAM: 112 GB<br>• DISK: 0.5 TB | • Small Network Profile<br>  • CPU: 8 vCPU<br>  • RAM: 64 GB<br>  • DISK: 250 GB<br>• Large Network Profile<br>  • CPU: 24 vCPU<br>  • RAM: 132 GB<br>  • DISK: 1 TB | • CPU: 8 vCPU<br>• RAM: 24 GB<br>• DISK: 45 GB | • CPU: 10 cores<br>• RAM: 96 GB<br>• DISK: 400 GB SSD for lab use, 3 TB SSD for production use | • Professional (Small)<br>  • CPU: 16 vCPU<br>  • RAM: 64 GB<br>  • DISK: 2.8 TB<br>• Extended (medium or large)<br>  • CPU: 24 vCPU<br>  • RAM: 128 GB<br>  • DISK: 4 TB |

**Note** In Routed Optical Networking 2.1, Cisco Optical Network Controller and Crosswork Network Controller require different Crosswork Infrastructure versions.

The Crosswork Infrastructure Cluster for Cisco Optical Network Controller must have:

- three VMs
- 12 vCPU
- 96 GB RAM
- DISK: 1TB SSD

### Cisco Optical Network Controller scale support

Cisco Optical Network Controller supports up to 500 nodes and 600 services. It can run on the same cluster and adds resources incrementally at the maximum supported scale. These requirements are included in the Crosswork VM resources table.


- Sample configuration, on page 4
- Planning and design phase, on page 4
- Implement phase, on page 5
- Operate phase, on page 74
- Optimization phase, on page 88

# Sample configuration

This section details the step-by-step approach to build a new Routed Optical Networking based, 75 km fiber span to replace an existing legacy span in a two node DCI topology.



# Planning and design phase

The planning and design phase consists of these activities:

1. Network planning and design

   Inputs needed: packet layer traffic demands, optical fiber topology, resiliency criteria, and other network constraints.

   a. WAE can be used to determine a new network build or augmentations to an existing network.

   b. After the IP network circuits have been determined, Cisco ONP evaluates the optical layer feasibility and identifies the components required to support the network.

   The output for a sample configuration includes these components:

   This topology uses two Cisco 8201 routers, two NCS 2006 terminal nodes equipped with NCS1K-MD-64 add/drop multiplexers, and EDFA-35 bidirectional amplifiers. The span length is 75 km. Additional ILA nodes may be required for amplification if the spans are longer.

2. Automation software resource planning

   Identify the servers required for the full solution. See Sample end-to-end configuration, on page 1 and Installation requirements for Routed Optical Networking components, on page 4.

   a. For a lab or EFT setup, it is recommended to use three servers each with 384 GB of RAM, 32 cores, and two TB SSDs.

   b. The solution requires the use of VMware ESX 6.7 or higher.

## Installation requirements for Routed Optical Networking components

The installation requirements for different Routed Optical Networking components are:

- Cisco Optical Network Planner 5.2
- Cisco WAN Automation Engine 7.6.x
- Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications

- Cisco Optical Network Controller 3.1
- Cisco Evolved Programmable Network Manager 7.1.2
- Cisco Network Services Orchestrator 6.1.9
  - Cisco NSO Routed Optical Networking Core Function Pack 3.0.0
  - Cisco NSO Transport-SDN Function Pack Bundle 6.0
  - Cisco Network Services Orchestrator DLM Service Pack 6.0
- Cisco Crosswork Hierarchical Controller 8.0
- Cisco Crosswork Network Controller 6.0

# Implement phase

The implement phase involves:

1. **Installation of hardware components**
   a. Hardware staging or installation and initial base configuration required for management connectivity.
   b. All onboard software updates must be completed to the required revision.
   c. All associated base wiring must be completed to support the network. This includes connections between the optical elements and connections between routers and optical add/drop end-points to support Routed Optical Networking circuits using ZR and ZR+ optics. See Deployment Topologies.
   d. Install Cisco Optical Site Manager to support NCS 1010 nodes. See Install Cisco Optical Site Manager
2. **Installation of automation software somponents**
   a. Complete all server hardware installation and base configuration to support the solution, including VMWare ESX if not already installed.
   b. Install the following software components to support the Routed Optical Networking solution.
      - Cisco Optical Network Planner 5.2 (for optical planning)
      - Cisco WAN Automation Engine 7.6.x (for IP planning)
      - Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications (for supporting Crosswork Network Controller)
      - Cisco Optical Network Controller 3.1 (for supporting optical network)
      - Cisco Evolved Programmable Network Manager 7.1.4 (for managing the physical router and the optical network nodes)
      - Cisco Network Services Orchestrator 6.1.9 (base installation to support RON FP)
        - Cisco NSO Routed Optical Networking Core Function Pack 3.0 (for RON ML provisioning)
        - Cisco NSO Transport-SDN Function Pack Bundle 6.0 (for Crosswork Network Controller SR and xVPN provisioning)

- Cisco Network Services Orchestrator DLM Service Pack 6.0 (for device synchronization between Crosswork Network Controller and NSO)

- Cisco Crosswork Hierarchical Controller 8.0 (for provisioning the Routed Optical Networking ML service using the Crosswork Hierarchical Controller)

**Note** This is required only if the Routed Optical Networking ML service is provisioned via the Crosswork Hierarchical Controller GUI.

3. **Onboarding of devices**
   a. Add devices to Cisco Optical Network Controller. See Onboard Devices to Cisco Optical Network Controller.
   b. Add NSO, SR-PCE, and devices to Crosswork Network Controller. See Add SR-PCE providers, NSO providers, and routers to Crosswork Network Controller, on page 7.
   c. Add routers to NSO using the IOS-XR CLI NED. See Step 3 in Provision an ML service using NSO Routed Optical Networking CFP, on page 31.
   d. Add and configure the following Crosswork Hierarchical Controller adapters. See Configure adapters for Routed Optical Networking in Crosswork Hierarchical Controller, on page 14.

**Note** This step is required only if the Routed Optical Networking ML service is provisioned via the Crosswork Hierarchical Controller GUI.

- Add and configure the Crosswork Network Controller adapter.
- Create or import sites in Crosswork Hierarchical Controller. See the sections, "Add Sites" and "Export and Import Sites" in the Cisco Crosswork Hierarchical Controller Administration Guide 8.0.
- Add and configure the IOS-XR adapter. Create router devices in Crosswork Hierarchical Controller using the IOS-XR adapter type. After the routers are created, add the Crosswork Network Controller adapter to the router device.
- Add and configure the Cisco Optical Network Controller adapter.

4. **Provisioning of services**
   a. Ensure all device interconnections are complete.
   b. To provision the Routed Optical Networking ML service, use either one of the procedures:
      1. **Using the NSO GUI:**
         a. Utilize the Routed Optical Networking FP ML services to provision and end-to-end service. See Provision an ML service using NSO Routed Optical Networking CFP, on page 31.
         b. Verify that the end-to-end service has been deployed by checking the NSO service deployment status using the check-sync status.

c. Verify the router optics controller state using the CLI or in EPNM. See Troubleshoot provisioning issues on ZR or ZR+ optics.

2. **Using the Crosswork Hierarchical Controller GUI:**

   a. Utilize the Crosswork Hierarchical Controller GUI to provision and end-to-end Routed Optical Networking ML service. See *Provision a Routed Optical Networking ML service using Crosswork Hierarchical Controller*.

   b. Verify the router optics controller state using the Link Assurance tool in Crosswork Hierarchical Controller. See Step 4 in *Provision a Routed Optical Networking ML service using Crosswork Hierarchical Controller*.

# Add SR-PCE providers, NSO providers, and routers to Crosswork Network Controller

Follow these steps to add SR-PCE providers, NSO providers, and routers to Crosswork Network Controller.

**Note** When you add or import devices, or create providers, you need to specify the credential profile.

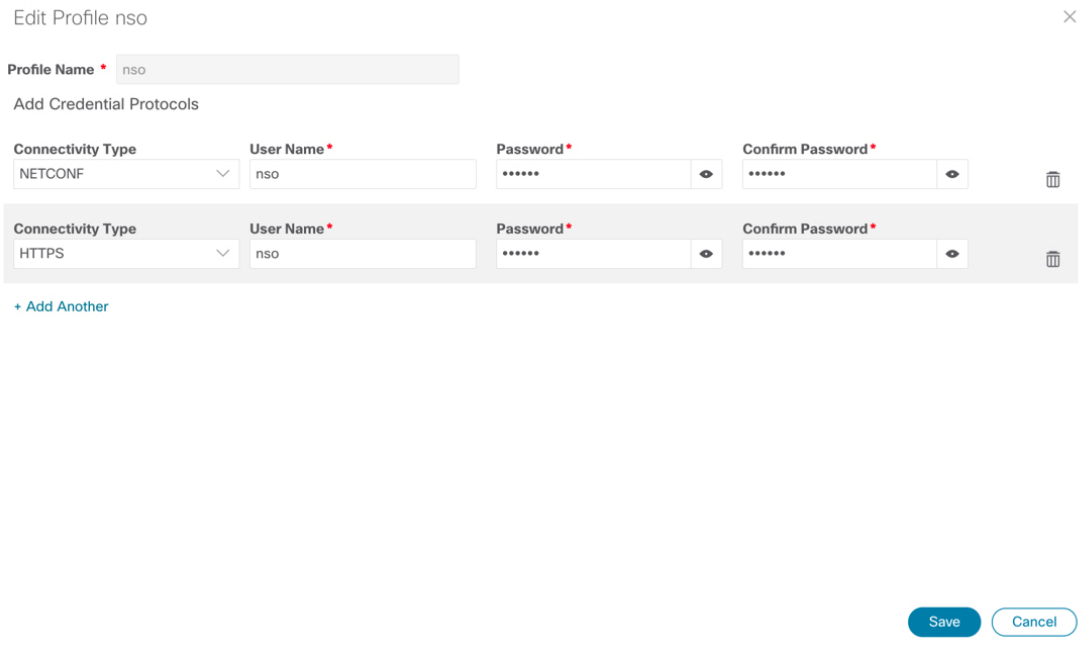
### Procedure

**Step 1** Log in to the Crosswork user interface.

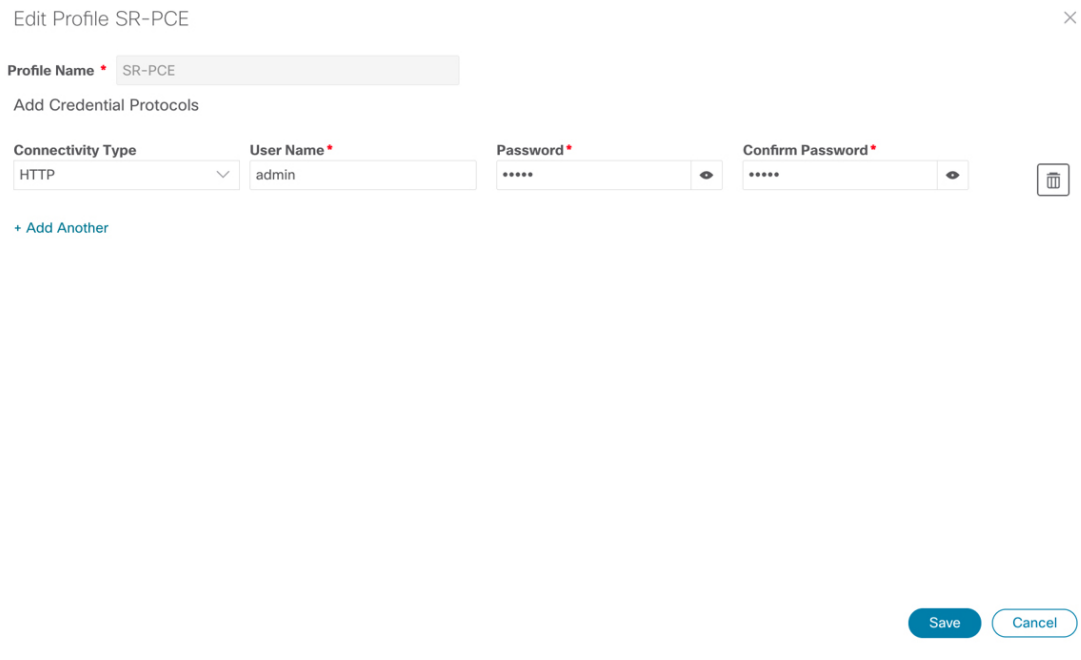
**Step 2** Choose **Device Management** > **Credential Profiles** from the main menu to create a credential profile. See Manage Credential Profiles.

a) For the NSO credential profile, the connectivity type must be set to NETCONF and HTTPS. Optionally, HTTP can also be defined if HTTPS is not used in NSO.

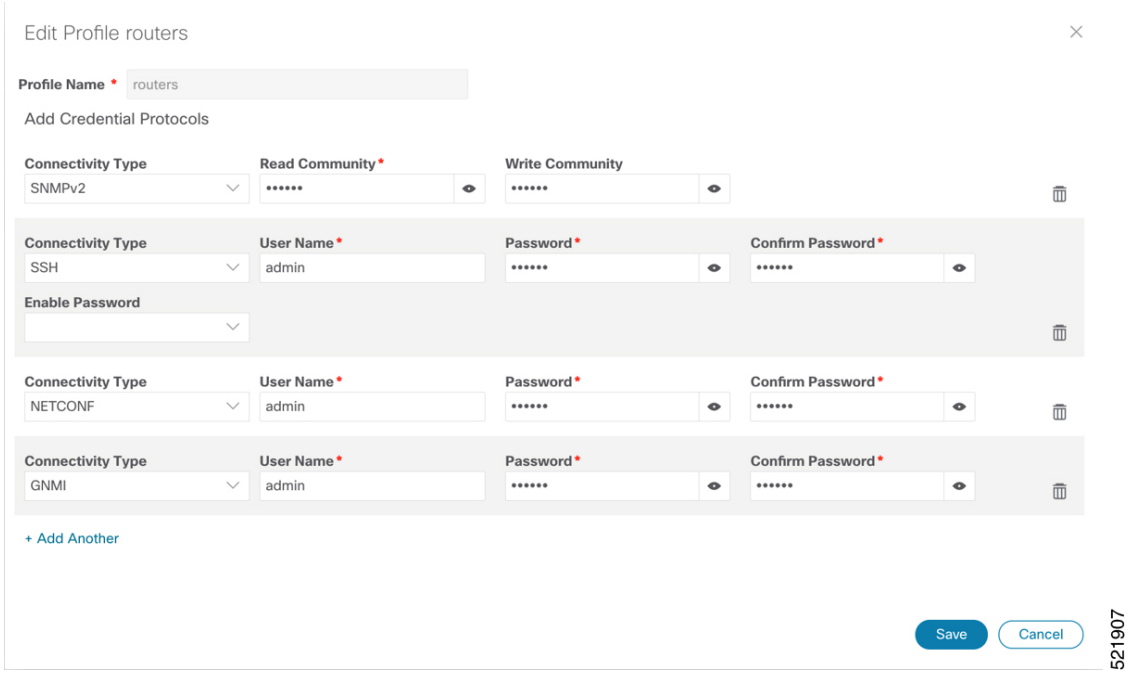
Sample end-to-end configuration




b) The SR-PCE credential profile requires HTTP credentials to communicate with the SR-PCE Northbound API.




c) The router credential profile requires SNMPv2 or SNMPv3 and SSH connectivity types. NETCONF is optional. Use gNMI when you configure streaming telemetry sensors on the node.




**Step 3** Add the providers. See About Adding Providers.

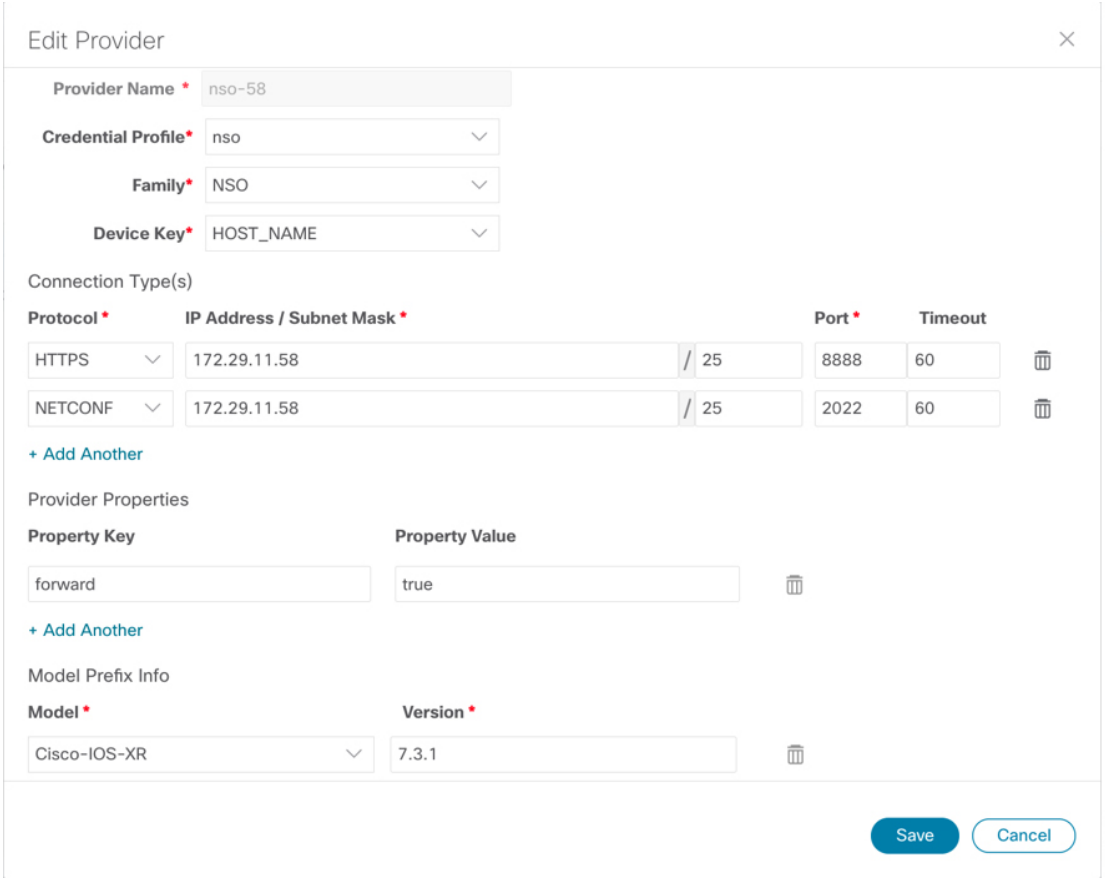
a) Choose **Administration** > **Manage Provider Access** from the main menu to add the SR-PCE or NSO provider. See Manage Providers.

b) Add the NSO provider. See Add Cisco NSO Providers.

Select the credential profile created for NSO. Select the family as NSO. The Device Key may be set to either HOST_NAME or INVENTORY_ID, depending on the specific deployment.

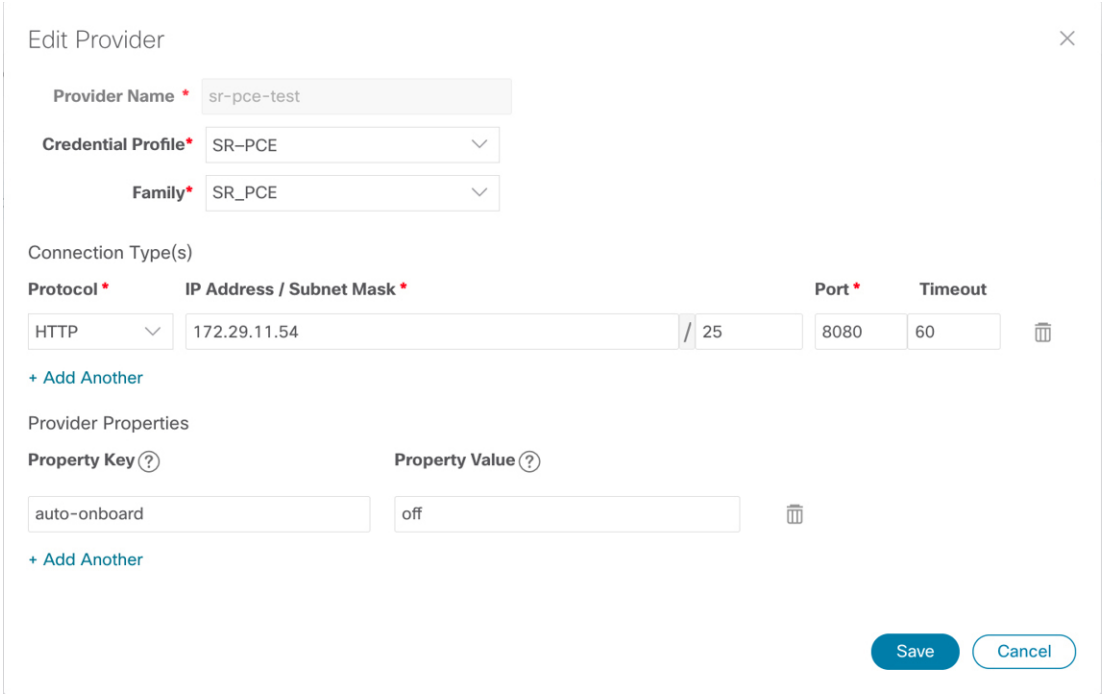
This image shows the connectivity to the RESTCONF API for NSO over SSL using port 8888 and NETCONF using the default port number 2022. Since the Routed Optical Networking NSO CFP utilizes the XR CLI NED, the Cisco-IOS-XR model is not applicable and may be set to any version.

Sample end-to-end configuration




c) Add the SR-PCE provider. See Add Cisco SR-PCE Providers..

Select the credential profile created for SR-PCE. Select the family type as SR_PCE. The connectivity type for SR-PCE must be HTTP. In this image, the default API port of 8080 is specified. When the Property Key, "auto-onboard" is set to a Property value, "off", Crosswork Network Controller does not automatically add nodes that are discovered via the SR-PCE IGP topology to the device inventory. Devices must be added through the Crosswork Network Controller UI or inventory API.

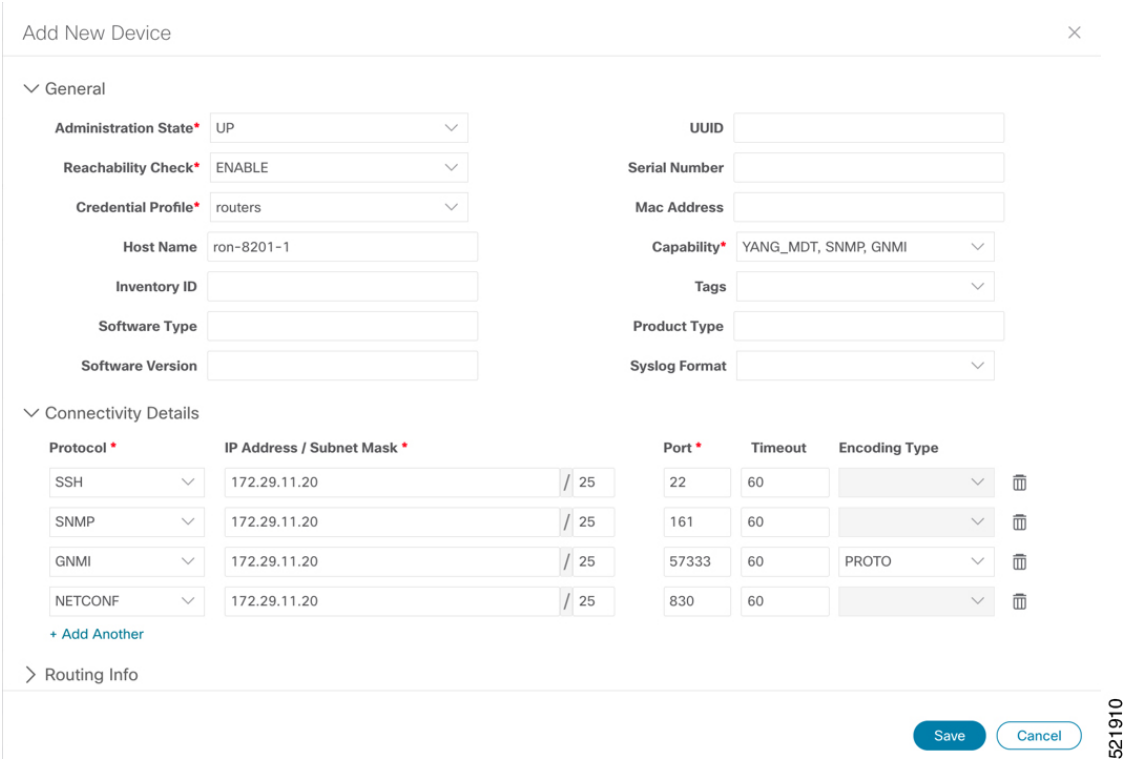



**Step 4** Validate communications with one or more providers. Check the reachability of the provider using Get Provider Details.

**Step 5** Onboard devices. See Add Devices Through the UI.

a) The Administration State, Reachability Check, and Credential Profile are mandatory elements. The Host Name must be used if the NSO provider device key is set to the Host Name value. If the NSO provider device key is set to Inventory ID that field must be populated. The Software Type, Software Version, UUID, Serial Number, MAC address, and Product Type are filled by device discovery. Optionally, tags can be applied to the device. The GNMI encoding type can be set to JSON or PROTO.

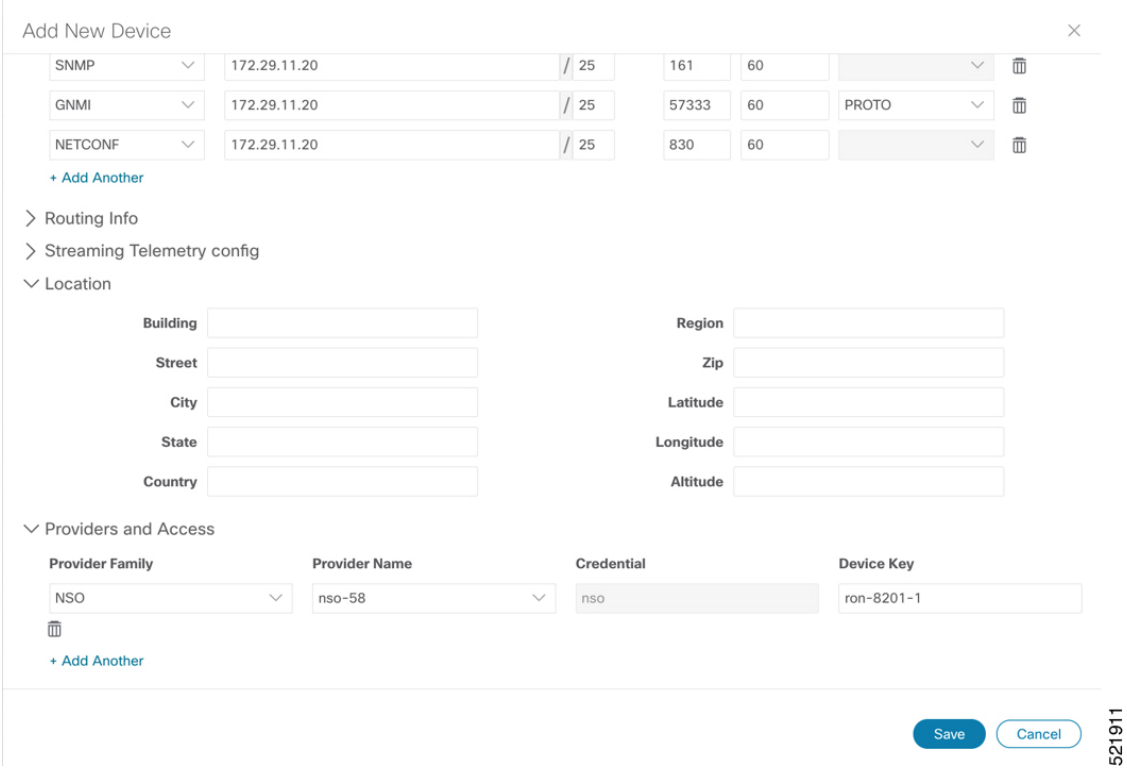
Sample end-to-end configuration




Optionally, you can enter location information. Latitude and longitude information is used to specify the node's geographic location.

Add the previously configured NSO provider as a provider for the device.

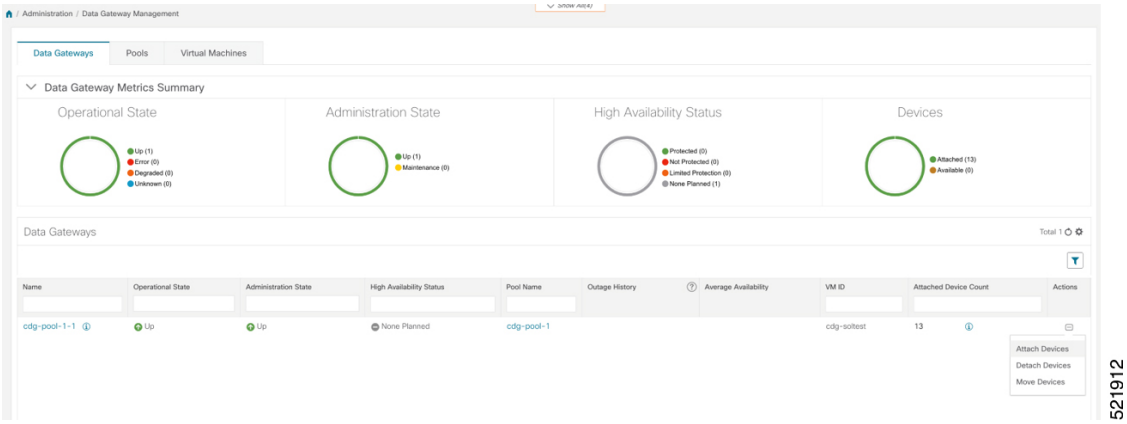
Sample end-to-end configuration




b) Attach the devices to an active Cisco Crosswork Data Gateway pool to manage them (device discovery).

Review the Data Gateways pane (see Overview of Cisco Crosswork Data Gateway). The operational state of the Cisco Crosswork Data Gateway pool to which you want to attach devices must be **Up**.

See Attach Devices to Cisco Crosswork Data Gateway.




SR-PCE providers, NSO providers, and routers appear in Crosswork Network Controller and are ready for management and monitoring.

# Configure adapters for Routed Optical Networking in Crosswork Hierarchical Controller

These adapters are needed for the Routed Optical Networking solution.

***Table 1: Routed Optical Networking adapters***

| Adapter | Credential type |
|---|---|
| Crosswork Network Controller | HTTP (username and password) |
| Crosswork Network Controller Crosswork Data Gateway | HTTP (username and password) |
| Cisco Optical Network Controller | HTTP (username and password) |
| IOS-XR | SSH (username and password) |

**Note** If Cisco Optical Network Controller and Crosswork Network Controller are on the same Crosswork cluster, use the same credential profile for both.

**Before you begin**

To use Crosswork Hierarchical Controller adapters, you are required to use credentials. These credentials are used for authentication when a device is assigned to an adapter. You can use the same credentials for multiple adapters.

The credentials are added under the **Services** > **Device Manager** > **Credentials** tab in the Crosswork Hierarchical Controller GUI.

Follow these steps to add the adapters:

**Procedure**

**Step 1** Choose **Services** > **Device Manager** > **Adapters** in the applications bar in Crosswork Hierarchical Controller.

**Step 2** Click **Add new adapter** to add a new adapter.

**Step 3** Enter the adapter details:

- **Adapter Type**: Select an adapter type from those available and currently installed in Crosswork Hierarchical Controller.
- **Adapter Name**: Enter a unique name for this adapter type instance. Multiple instances of the same adapter type are allowed.

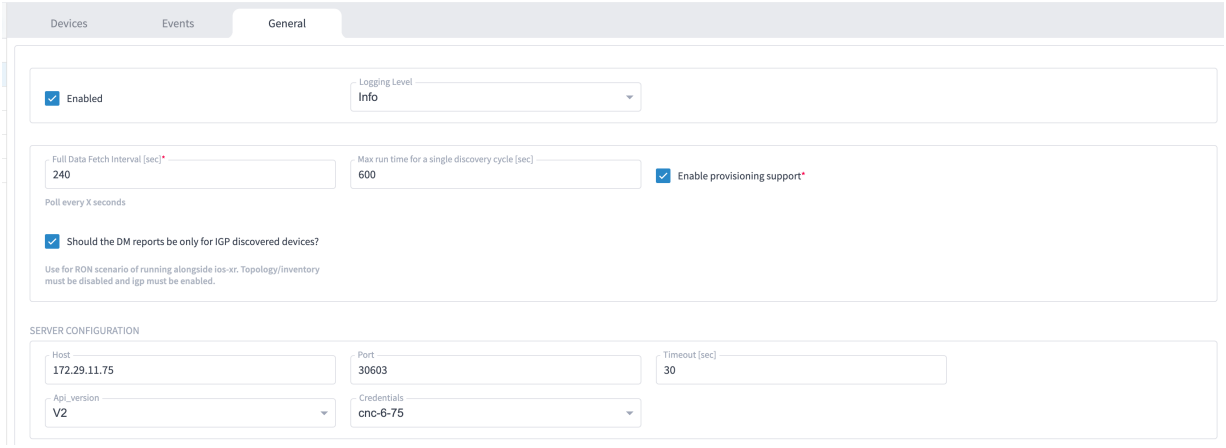
**Step 4** Select the adapter in the **Adapters** pane to configure the adapter. Configure the parameters as shown in these images.

- **Crosswork Network Controller adapter**:

  **Note**
  API version for Crosswork Network Controller must be version 2.

Sample end-to-end configuration

*Figure 1: Crosswork Network Controller adapter configuration—General tab*




**Note**
The Full Data Fetch Interval must be set to 300 seconds or higher in a production network.

These parameters must be configured for Crosswork Network Controller notifications and collection.

*Figure 2: Crosswork Network Controller notifications*

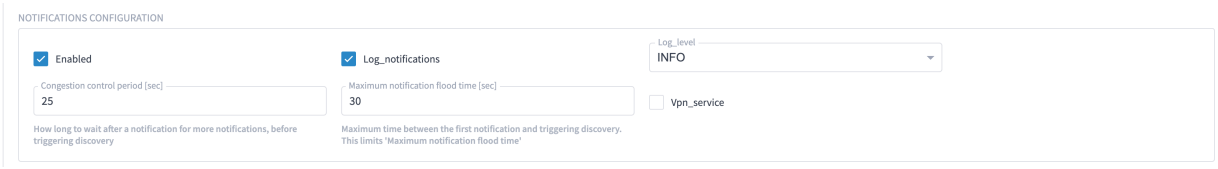
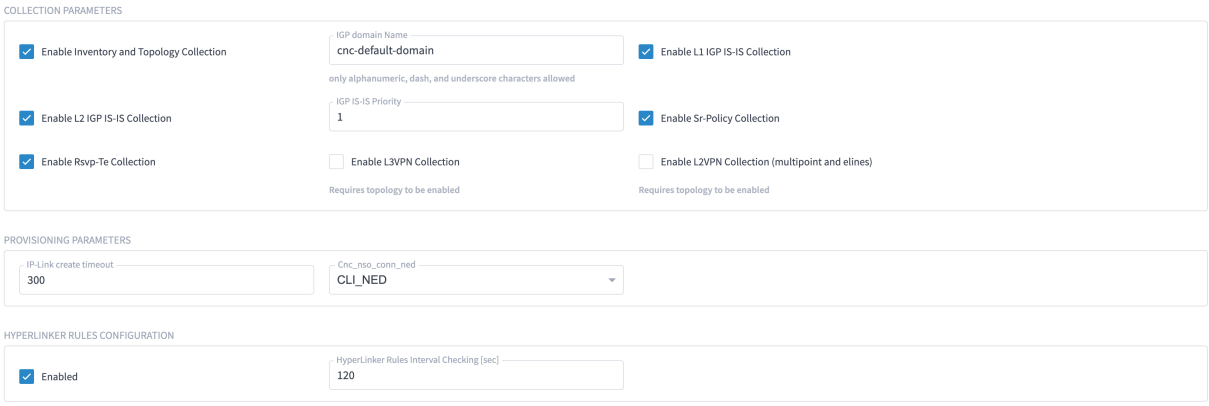


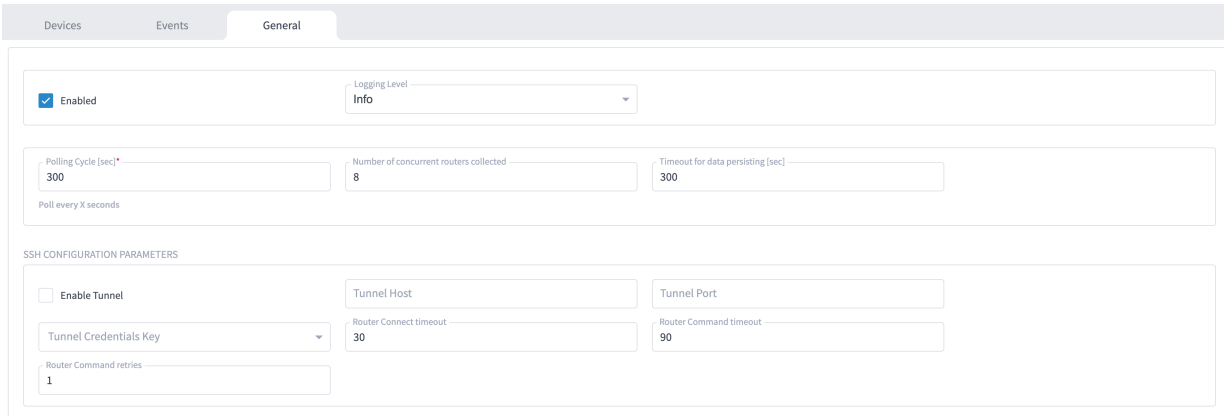

*Figure 3: Crosswork Network Controller collection and provisioning*




- **IOS-XR adapter**

Sample end-to-end configuration

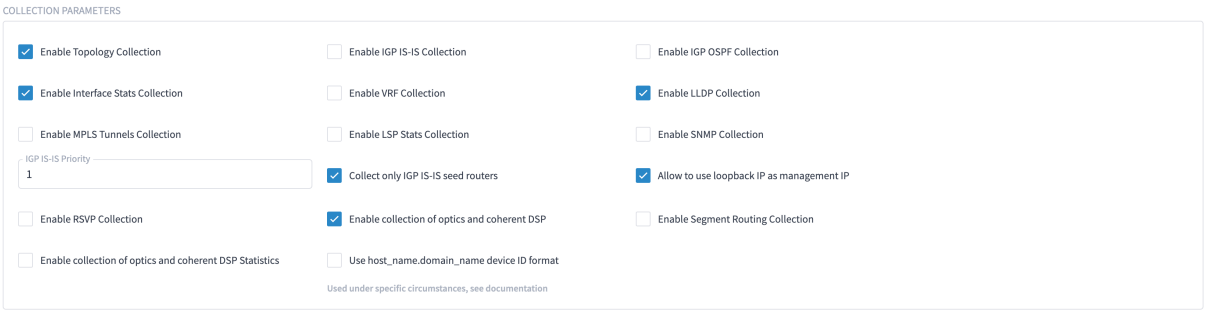
*Figure 4: IOS-XR adapter —General tab*




**Note**
The Polling Cycle must be 300 seconds or higher in a production network. Concurrency can be increased. Set the Logging Level to Info when everything is working correctly.

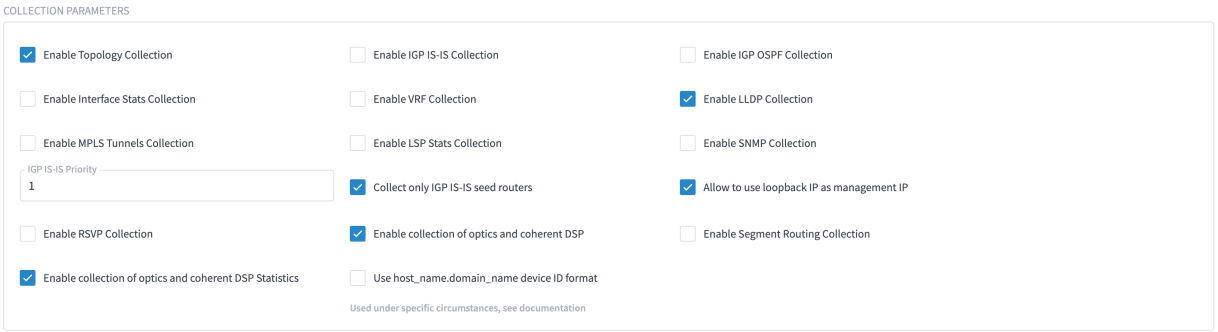
These collection parameters must be configured. These parameters collect optical power values for the link assurance application.

*Figure 5: IOS-XR adapter —General tab*




**Note**
Check the **Enable collection of optics and coherent DSP Statistics** parameter only when using Automation Starter Solution.

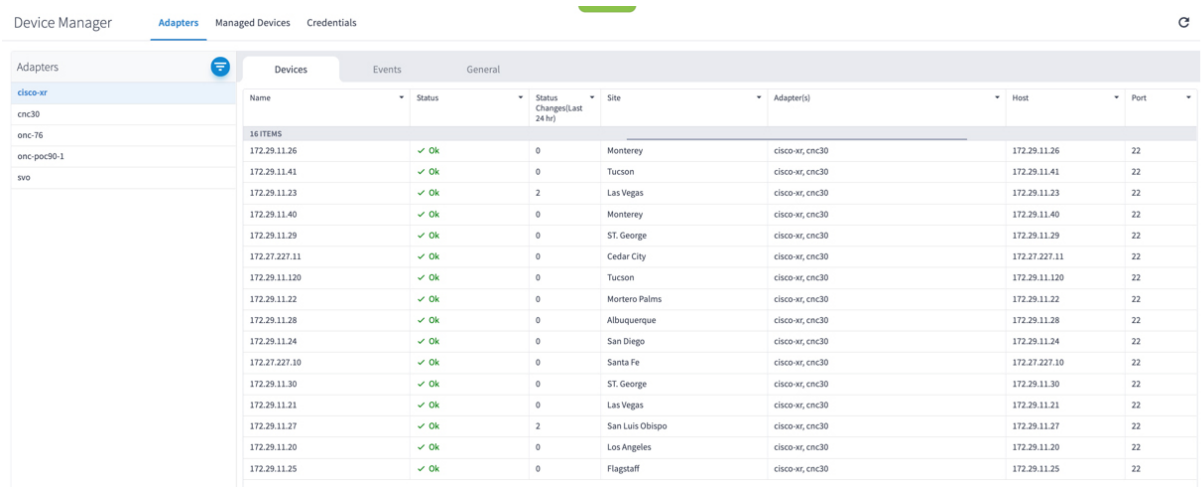
*Figure 6: IOS-XR adapter —General tab*



Sample end-to-end configuration

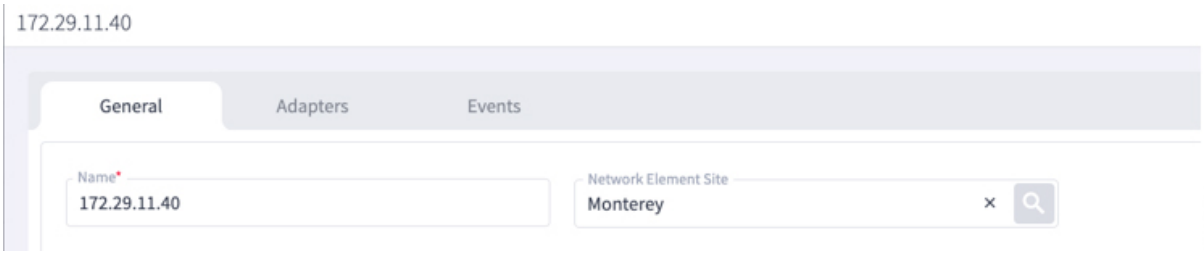
The status of the devices must be **ok** in the **Devices** tab after the addition and completion of a successful collection cycle.

***Figure 7: IOS-XR adapter - Devices tab***




To add routers to Crosswork Hierarchical Controller, click the **Managed Devices** tab and then **+ Add Device**.

***Figure 8: IOS-XR adapter —add new device— General tab***

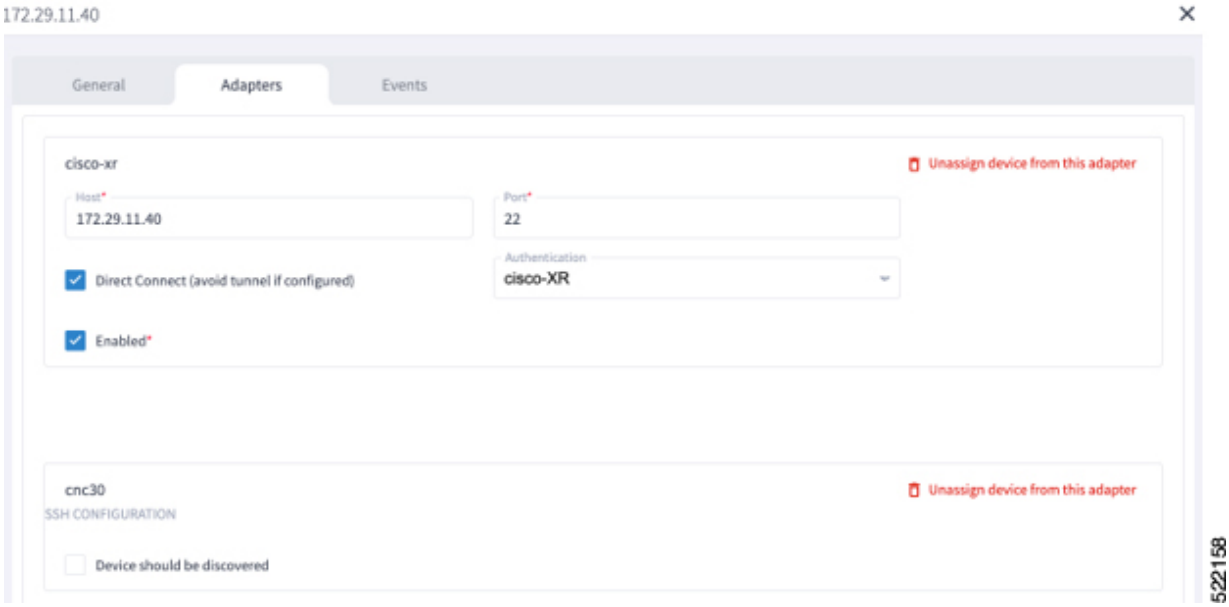



Use the hostname+hco (ron-8201-1-hco) or the device IP address. Assign the device to a site for display in Explorer UI.

Assign both the IOS-XR adapter type and the Crosswork Network Controller adapter type to the device. Do not enable discovery for the Crosswork Network Controller adapter.

Sample end-to-end configuration

*Figure 9: IOS-XR Adapter—add new device— Adapters tab*

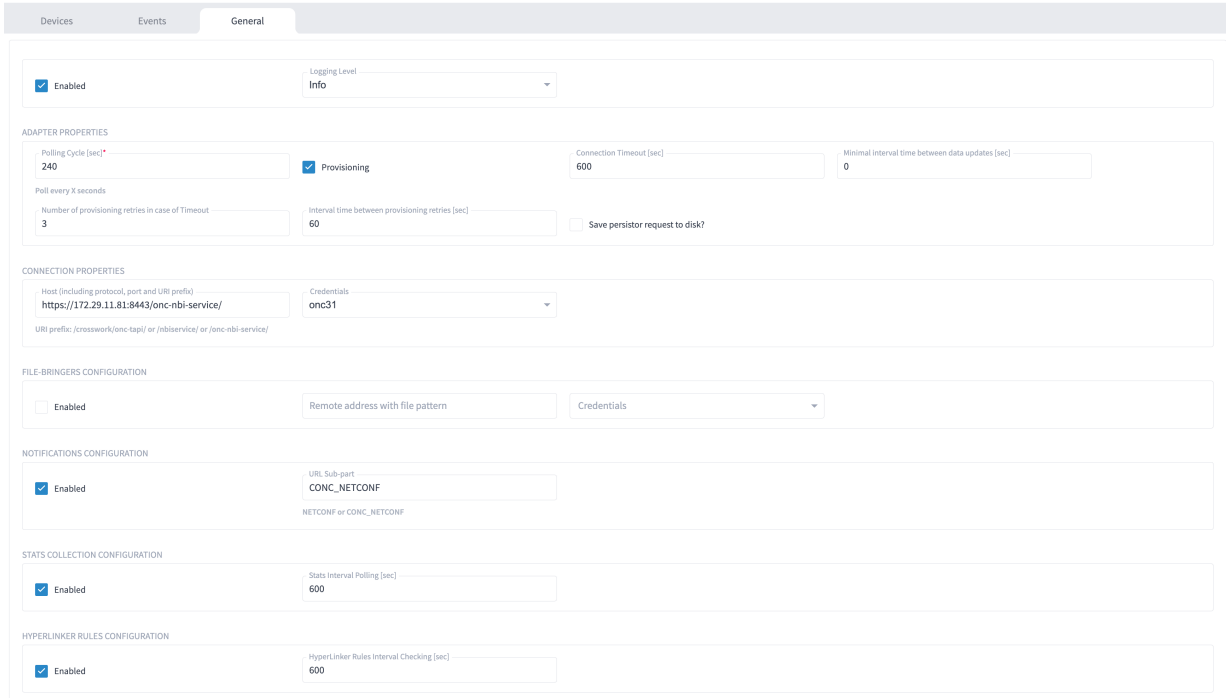



- **Cisco Optical Network Controller adapter**

*Figure 10: Cisco Optical Network Controller adapter — General tab*

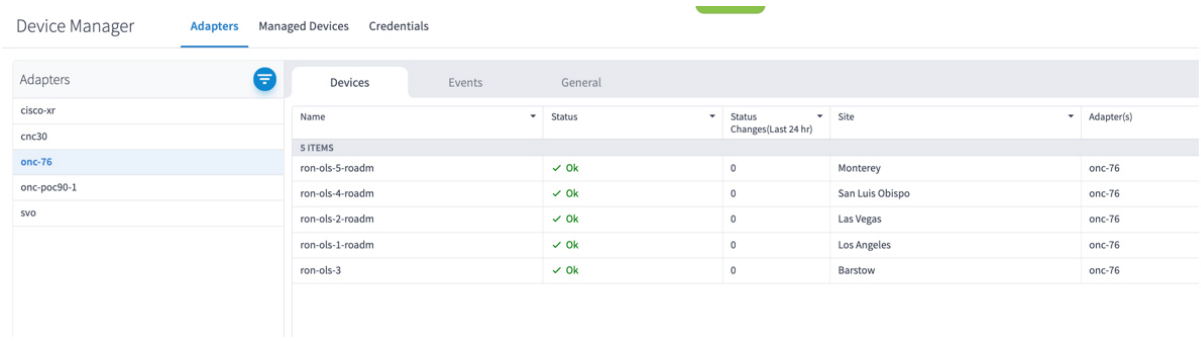
The Polling cycle must be set to 300s or higher in a production network. Polling retrieves TAPI SIPs, topology, and connectivity services.

The URL in this figure is for the Cisco Optical Network Controller 3.1.



Cisco Optical Network Controller automatically discovers optical nodes. Assign a site to the nodes to display them in the Explorer UI.

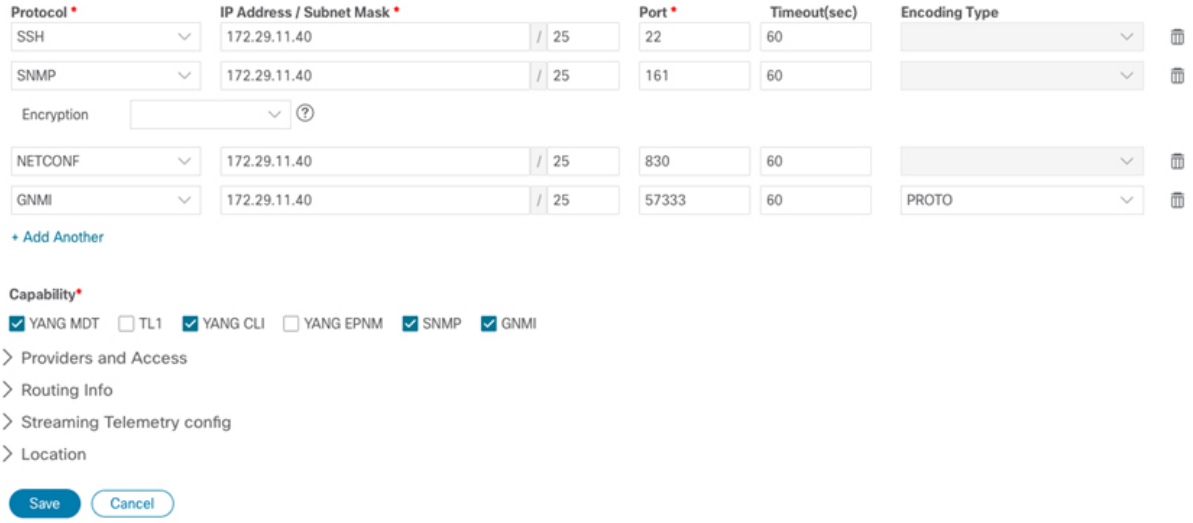
***Figure 11: Cisco Optical Network Controller adapter - Devices tab***




- **Crosswork Network Controller Crosswork Data Gateway adapter**

Crosswork Network Controller Crosswork Data Gateway adapter is used to collect telemetry data through gNMI (gRPC Network Management Interface) to the router. In Crosswork Network Controller, the routers must be configured with the gNMI protocol with the encoding type set to “PROTO” and the gNMI capability enabled. In IOS XR, the routers must be configured for gRPC so that Crosswork Data Gateway can create gNMI telemetry subscriptions.

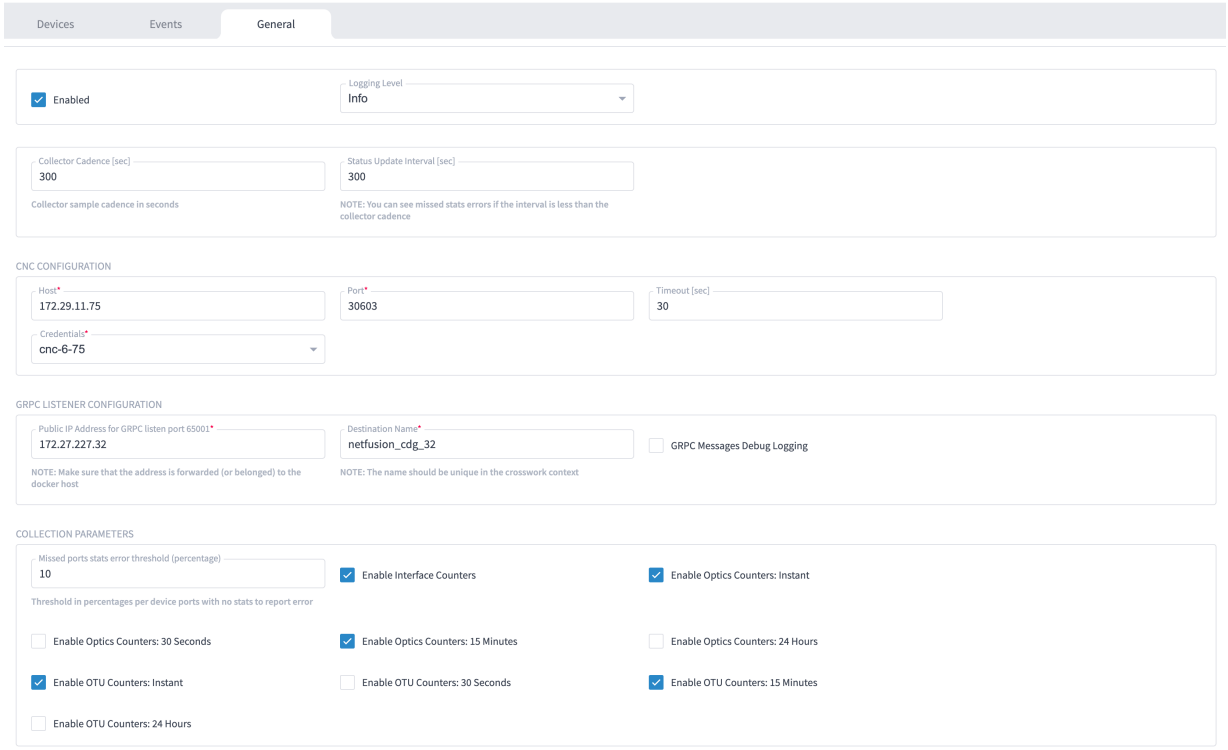
***Figure 12: Crosswork Network Controller Crosswork Data Gateway adapter***




The Crosswork Data Gateway adapter is configured to connect to Crosswork Network Controller controlling Crosswork Data Gateway instance. It can be the same as the Crosswork Network Controller used for the topology or a different Crosswork Network Controller. The collection parameters describe the supported telemetry collection jobs. The statistics show up in the physical interface statistics and in the Link Assurance application.

Sample end-to-end configuration

*Figure 13: Crosswork Network Controller Crosswork Data Gateway adapter—General tab*




- The device name in Cisco Crosswork Hierarchical Controller must match the device name in Crosswork Network Controller for successful deployment. If successful, you will see Cisco Crosswork Hierarchical Controller as a new destination in Crosswork Network Controller. This is automatically set up by Cisco Crosswork Hierarchical Controller. As Crosswork Data Gateway is enabled on devices, new collection jobs are populated. A single collection job is available for each router collecting multiple KPIs.

*Figure 14: Crosswork Network Controller Crosswork Data Gateway adapter - data destinations*

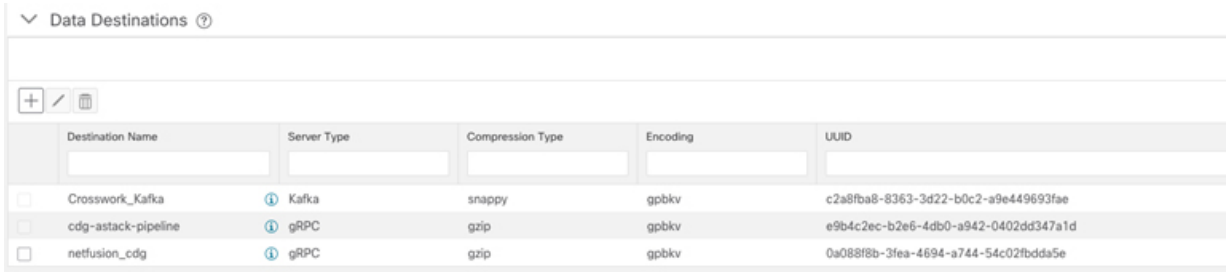
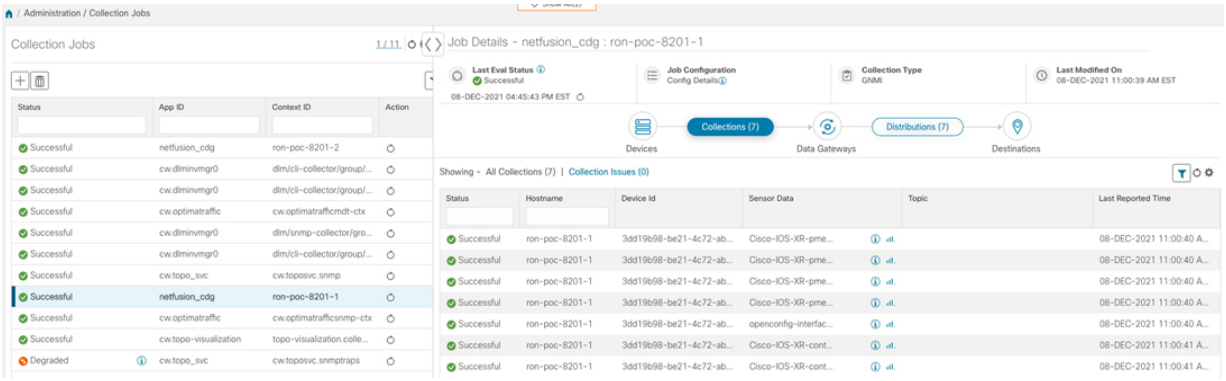


*Figure 15: Crosswork Network Controller Crosswork Data Gateway adapter - collection jobs*




- **NSO adapter In Hierarchical Controller**

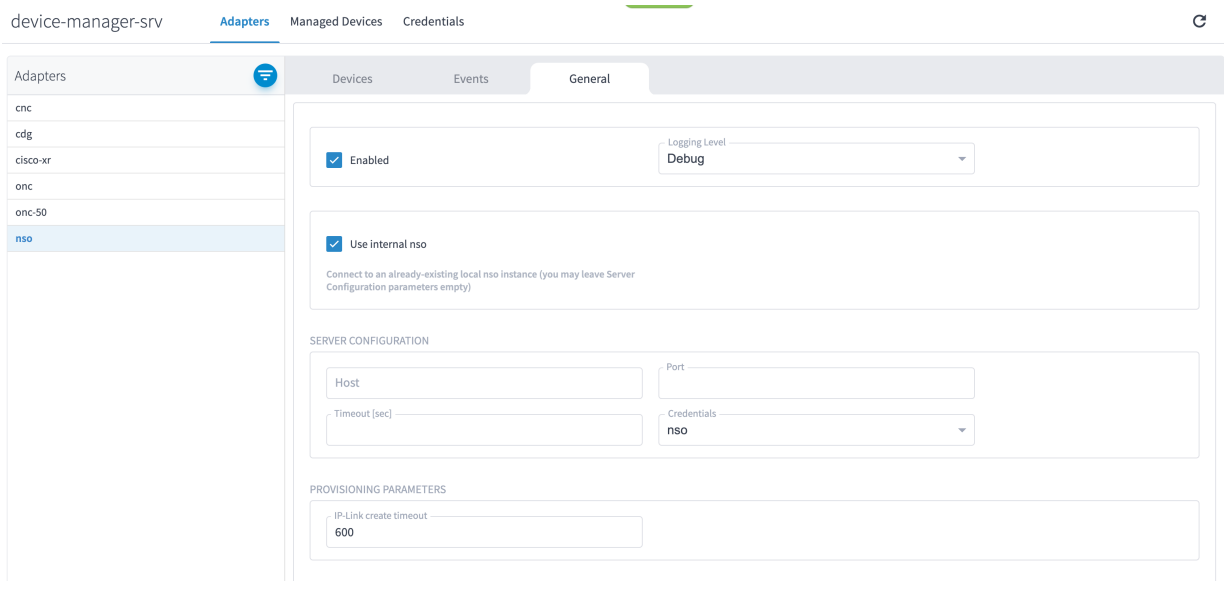
  In Hierarchical Controller 8.0 there is an embedded NSO installed when Hierarchical Controller 8.0 is installed. The NSO adapter can use the internal NSO or an external NSO instance. To provision devices using the NSO adapter, add the NSO adapter to the devices.

  Use the NSO adapter when you use the Automation starter solution and full solution.

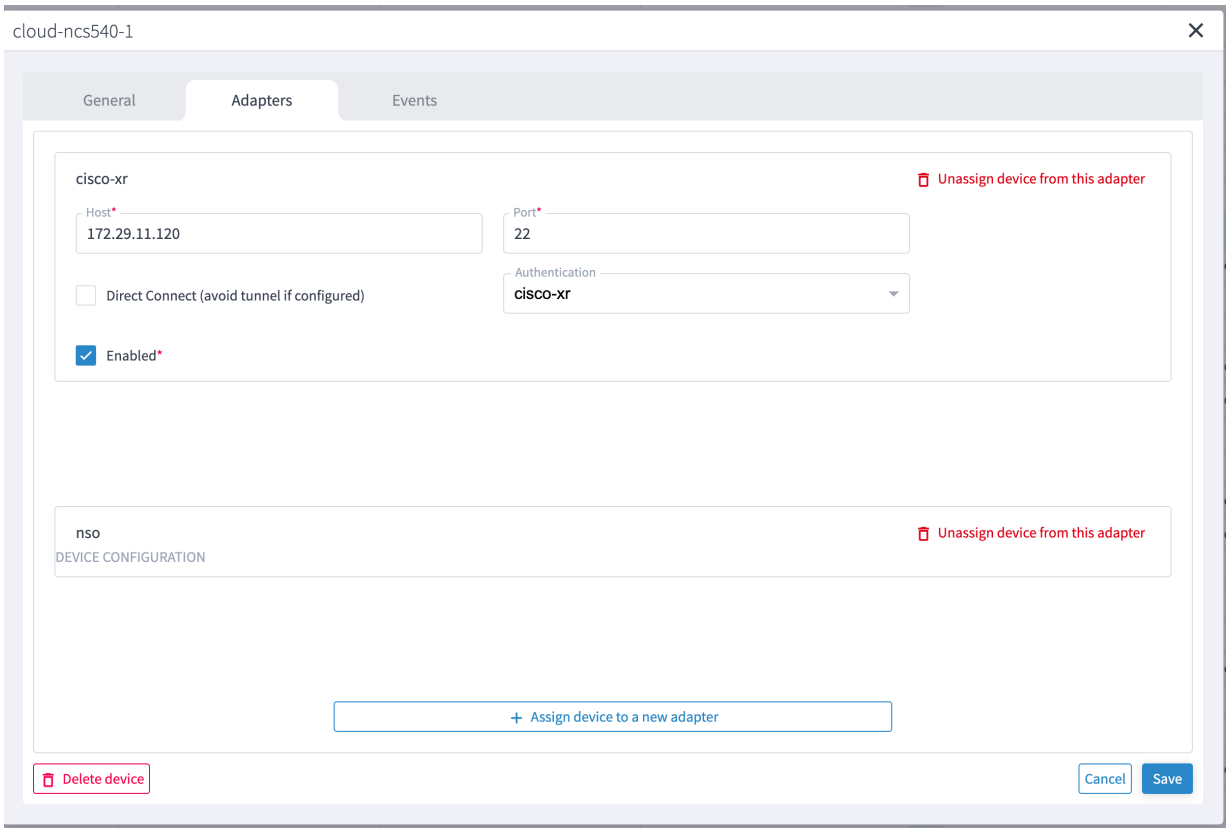
  **Note**

  - If using the internal NSO, the Routed Optical Networking 3.0 Core Function Pack must be installed on the NSO instance.
  - If using the internal NSO, devices must be added to that NSO, since adding them to Hierarchical Controller does not automatically onboard them into the internal NSO.

*Figure 16: NSO adapter—General tab*




Begin configuring your NSO and IOS-XR adapters.




The selected adapters are configured and ready for device assignment.

# Configure SSO in Crosswork Hierarchical Controller

Enable Single Sign-On (SSO) in Crosswork Hierarchical Controller using Crosswork Network Controller as the identity provider.

Use this task when you need to configure SSO in Crosswork Hierarchical Controller with Crosswork Network Controller as Identity Provider. You can use the same SSO configuration to set up SSO for Cisco Optical Network Controller Release 3.1.

### Procedure

**Step 1** Configure Crosswork Hierarchical Controller.

**a.** Click **Settings** > **Security** > **SAML Configuration**.

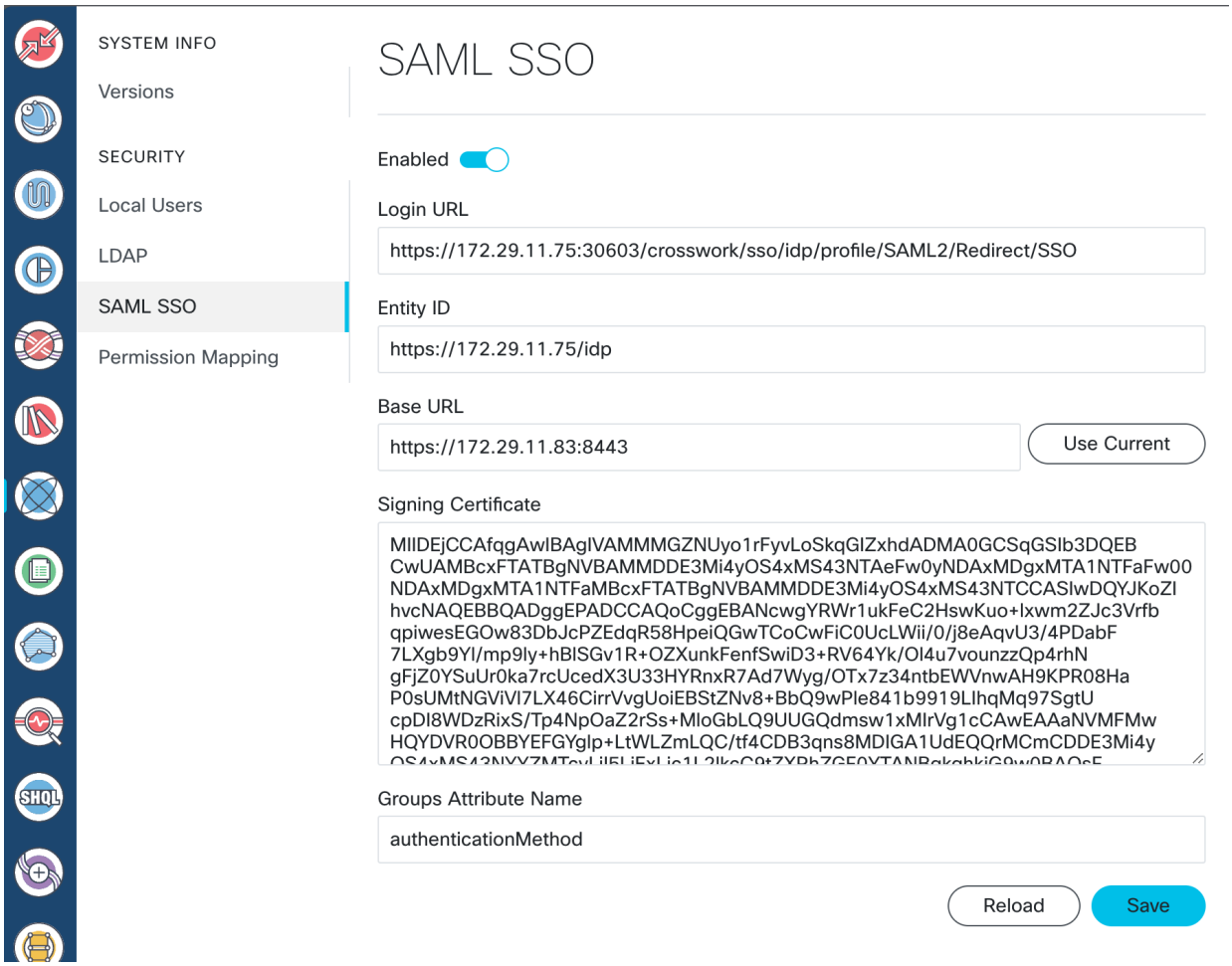
Enter the required information:

- **Login URL**: Visit https://<*CNC_IP_address*>:<*port*>/crosswork/sso/idp/profile/SAML2/Redirect/SSO
- **Entity ID**: Visit https://<*CNC_IP_address*>/idp

Sample end-to-end configuration

- **Signing Certificate**: Copy the metadata from Crosswork Network Controller at https://**<CNC_IP_address>**:<*port*>crosswork/sso/idp/metadata
- **Groups Attribute Name**: Type `authenticationMethod`.

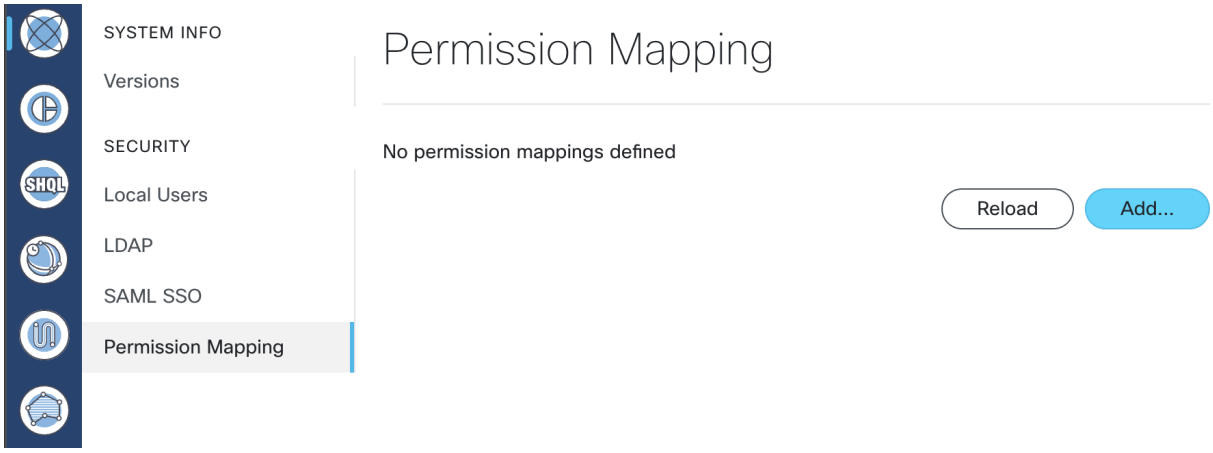
***Figure 17: Crosswork Hierarchical Controller provider configuration sample***




**b.** Click **Settings** > **Security** > **Permission Mapping**.

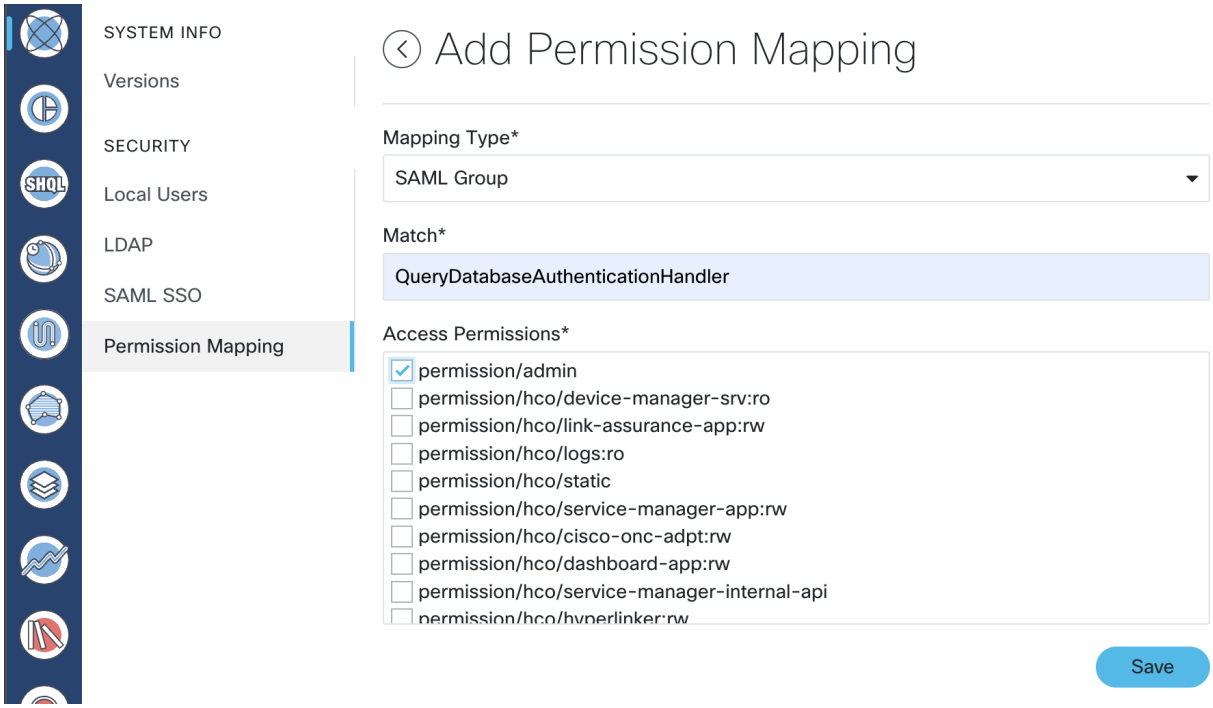
Sample end-to-end configuration

*Figure 18: Crosswork Hierarchical Controller permission-mapping sample*




**c.** Add a **Match** condition for **SAML Group** of **QueryDatabaseAuthenticationHandler** with a permission of `permission/admin`.

*Figure 19: Crosswork Hierarchical Controller permission-mapping sample*




**Step 2** Copy the SAML metadata from Crosswork Hierarchical Controller to a file.

The metadata is at https://<*HCO_IP_address*>:<*port*>/sso/metadata. This file is a sample.

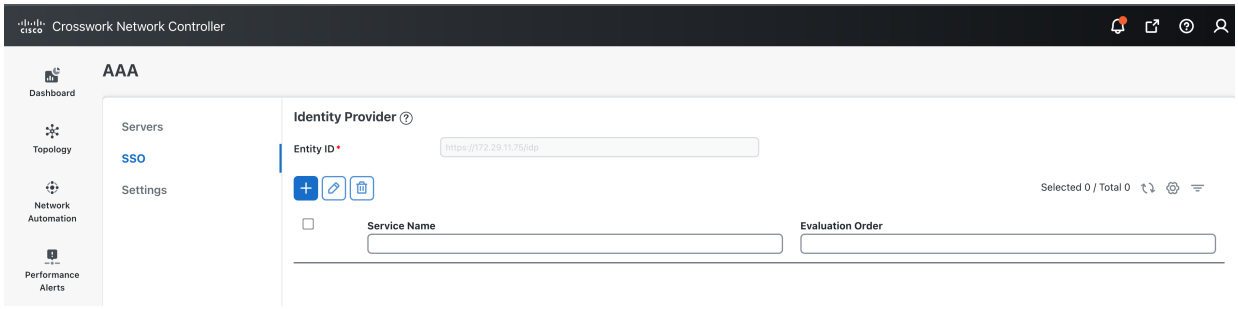
```
<EntityDescriptor entityID="https://172.29.11.83:8443" xmlns="urn:oasis:names:tc:SAML:2.0:metadata"
 xmlns:assertion="urn:oasis:names:tc:SAML:2.0:assertion" xmlns:ds="http://www.w3.org/2000/09/xmldsig#">

    <SPSSODescriptor AuthnRequestsSigned="false" WantAssertionsSigned="false"
protocolSupportEnumeration="urn:oasis:names:tc:SAML:2.0:protocol">
```

```
    <NameIDFormat>urn:oasis:names:tc:SAML:1.1:nameid-format:emailAddress</NameIDFormat>
    <SingleLogoutService Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-Redirect"
Location="https://172.29.11.83:8443/sso/logout">
    </SingleLogoutService>
    <AssertionConsumerService index="0" Binding="urn:oasis:names:tc:SAML:2.0:bindings:HTTP-POST"
Location="https://172.29.11.83:8443/sso/acs">
    </AssertionConsumerService>
    </SPSSODescriptor>
</EntityDescriptor>
```

**Step 3** Configure Crosswork Network Controller.

**a.** Log in to Crosswork Network Controller and click **Administration** > **AAA** > **SSO**.

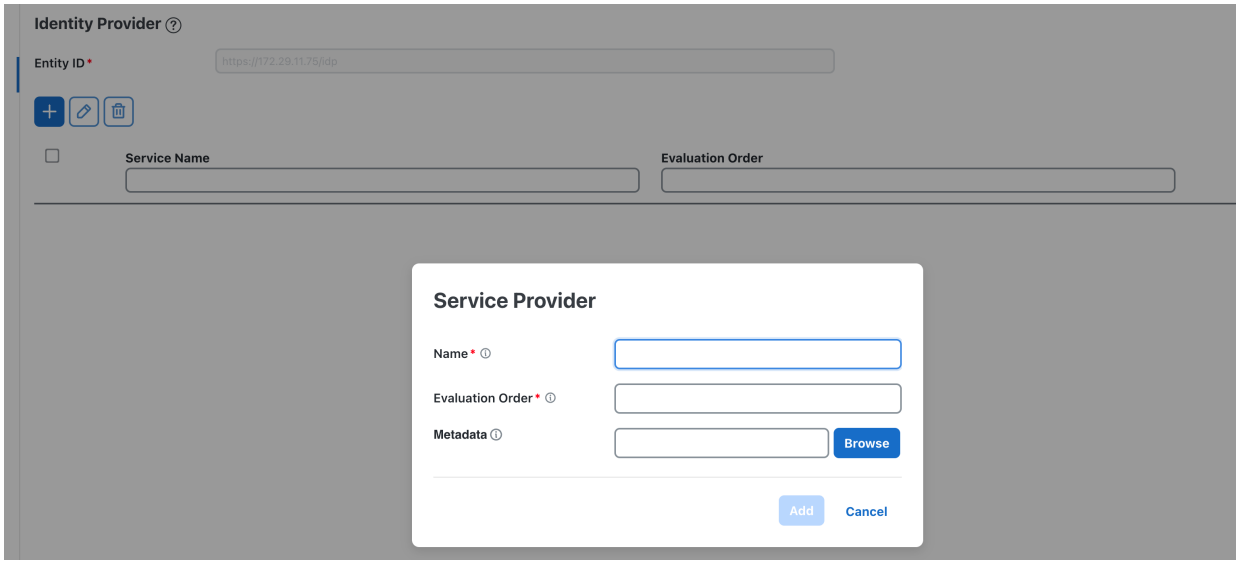
***Figure 20: Crosswork Network Controller AAA***




**b.** Click + and enter the required information:

- Enter a name.
- Enter a unique evaluation order number.
- Upload the metadata file of HCO in XML format.

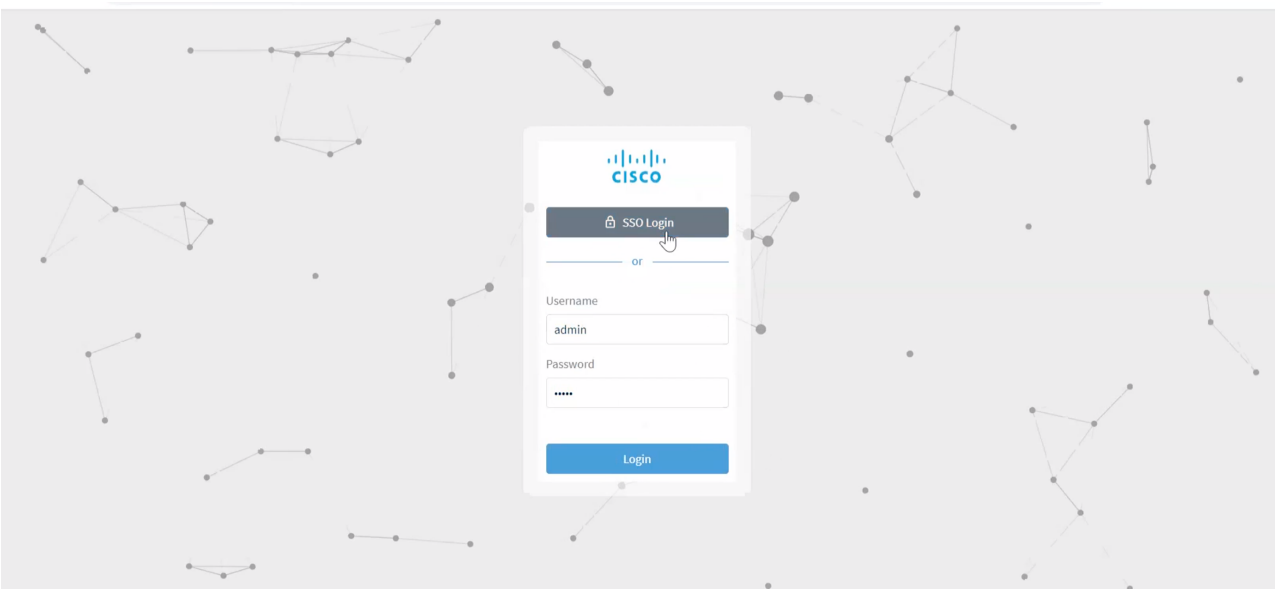
***Figure 21: Crosswork Network Controller-add new service provider***




**c.** Click **Save**.

**Step 4** Log in to Crosswork Network Controller.

***Figure 22: Crosswork Network Controller AAA***




**Troubleshooting Cisco Crosswork Hierarchical Controller SSO**

- Use the **sedo logs security audit** in the Crosswork Hierarchical Controller to get the logs.
- Ensure that the time between Cisco Crosswork Hierarchical Controller and Cisco Crosswork Network Controller is synchronized
- If there is an error related to `QueryDatabaseAuthenticationHandler`, add the SAML group mapping in Crosswork Hierarchical Controller configuration and map to group Admin.

Crosswork Hierarchical Controller enables SSO for authorized users.

# Cross-launch from Crosswork Hierarchical Controller

SSO is supported across Crosswork Hierarchical Controller 8.0, Crosswork Network Controller 6.0, Cisco Optical Network Controller, and Cisco Optical Site Manager.

**Procedure**

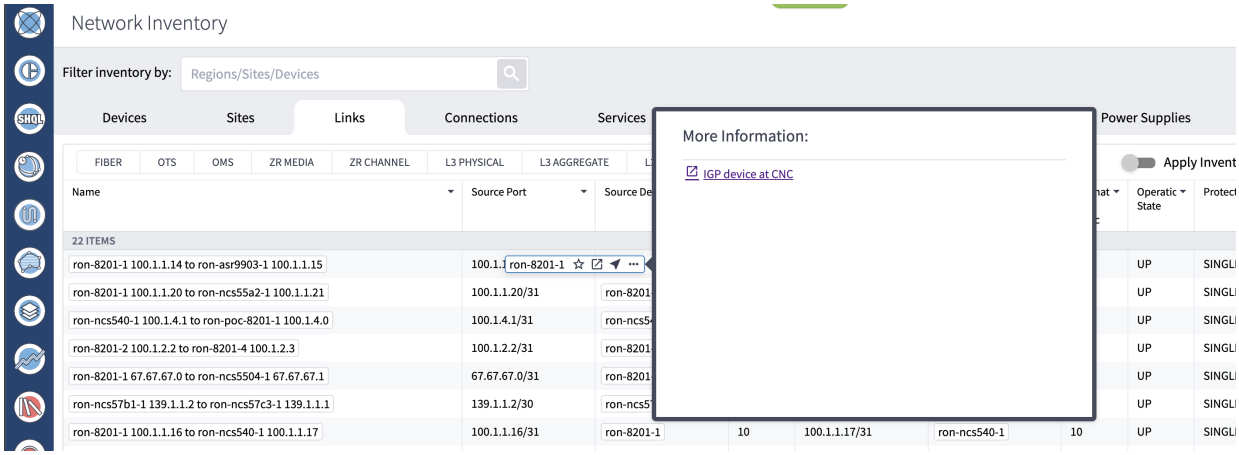
**Step 1** Cross launch from the IGP link source or destination router in Crosswork Hierarchical Controller to Crosswork Network Controller.

**a.** Click **Links** > **IGP** .

**b.** Hover over the source device or the destination device. Click the ellipsis and then click **IGP device at Crosswork Network Controller**.

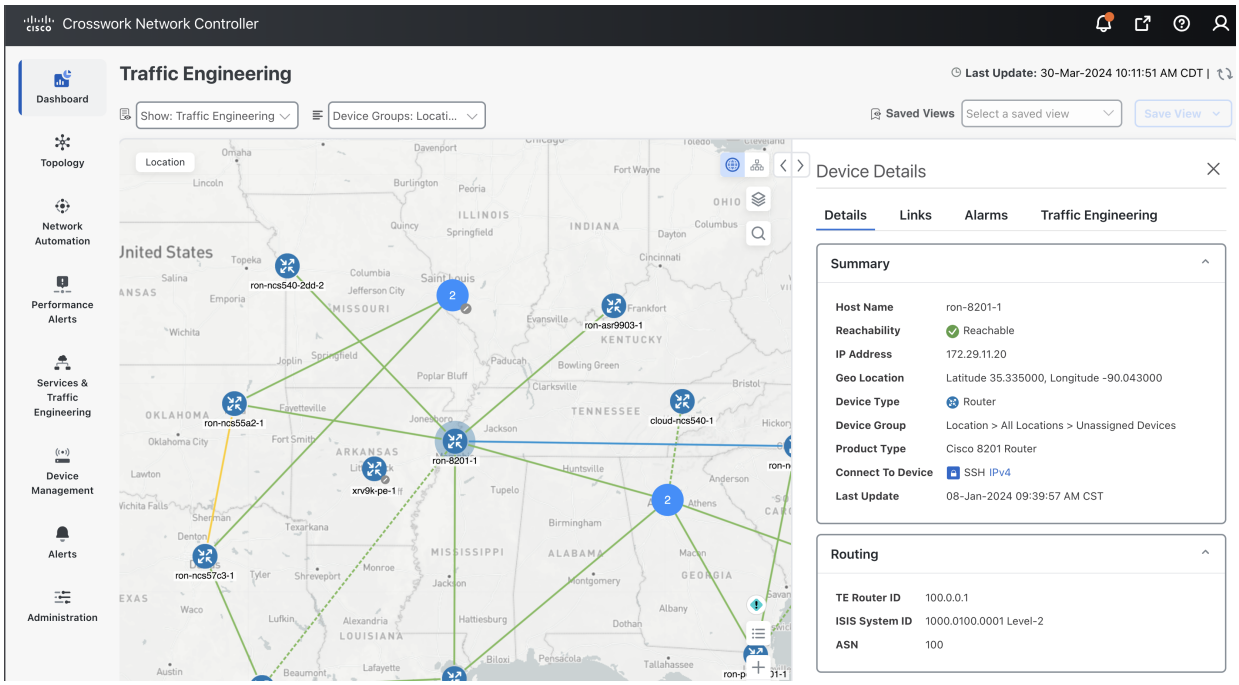
Sample end-to-end configuration

*Figure 23: Network inventory*




This operation displays router traffic engineering information in Crosswork Network Controller.

*Figure 24: Traffic engineering*



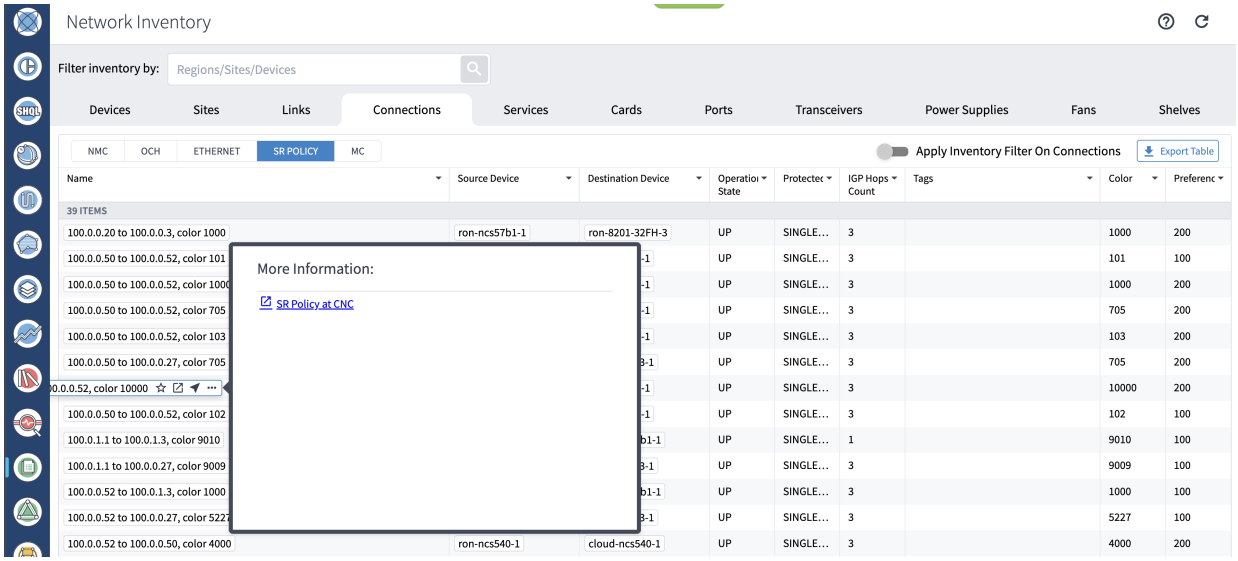

**Step 2** Cross launch from Crosswork Hierarchical Controller SR Policy to Crosswork Network Controller.

**a.** Click **Connections** > **SR Policy**.

**b.** Hover over a policy, and click the ellipsis to open cross launch.

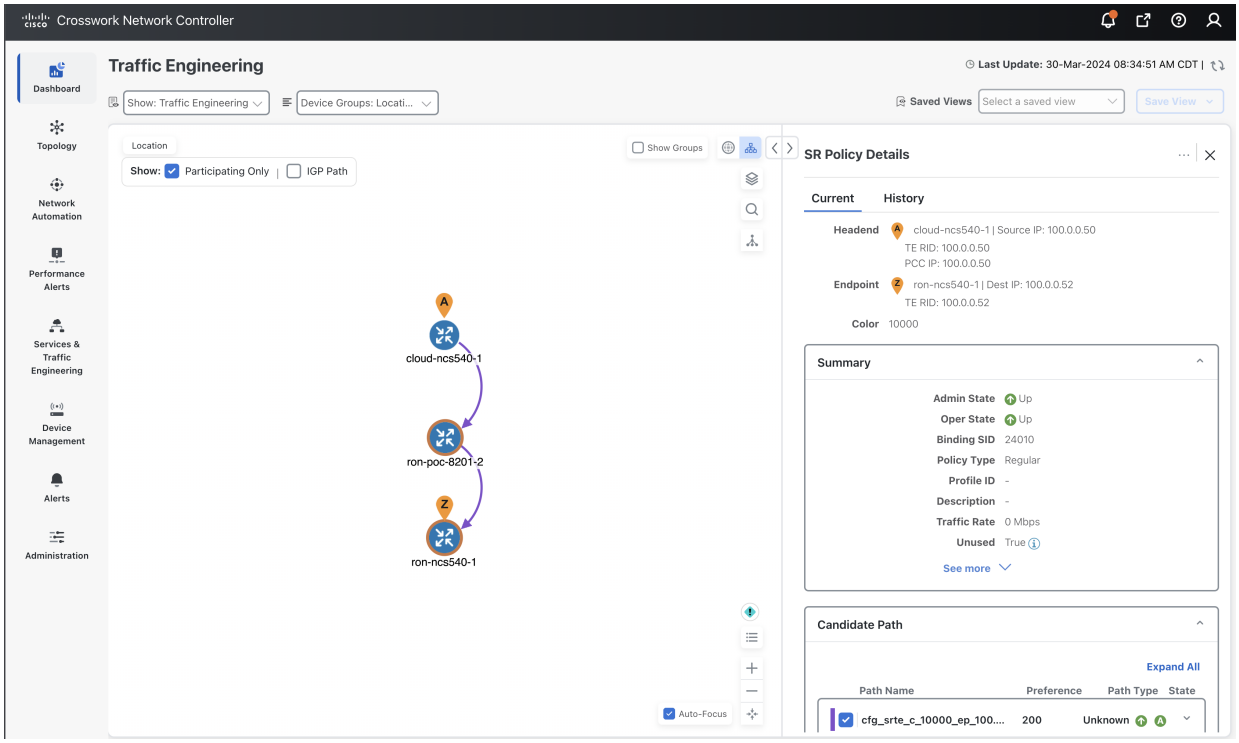
Sample end-to-end configuration

*Figure 25: Network inventory*




This operation displays detailed policy information in Crosswork Network Controller.

*Figure 26: Traffic engineering*



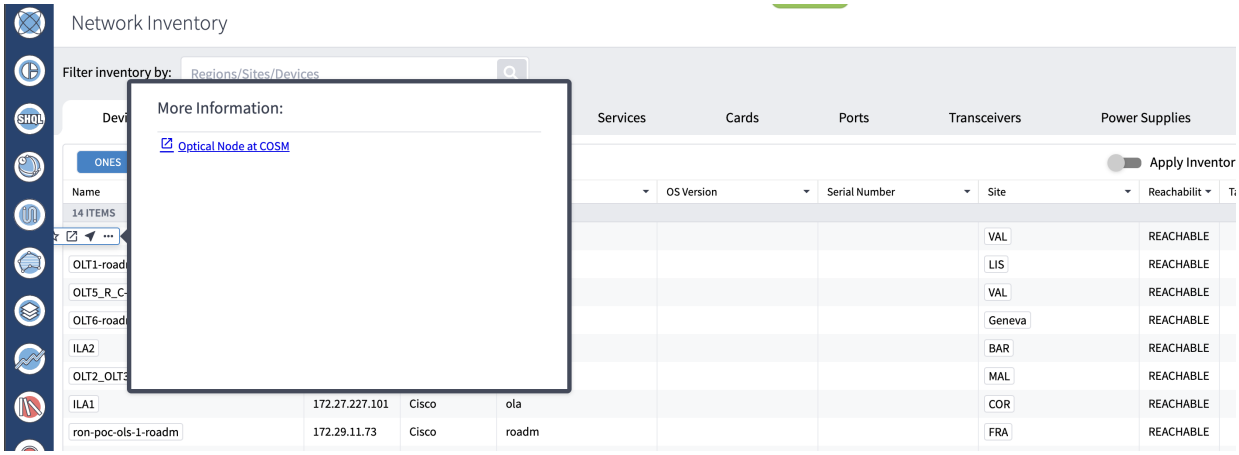

**Step 3** Cross launch from Crosswork Hierarchical Controller optical node to Cisco Optical Site Manager.

**a.** Click **Devices** > **ONS**.

**b.** Hover over a device, click the ellipsis, and then click **Optical Node at COSM**.

Sample end-to-end configuration

*Figure 27: Network inventory*

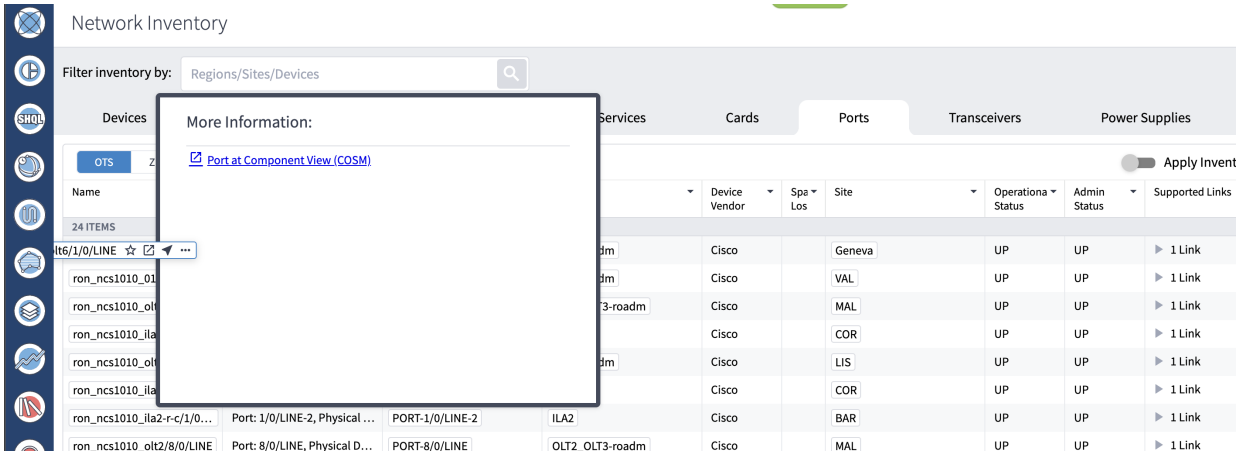



**Step 4** Cross launch from Crosswork Hierarchical Controller optical port to Cisco Optical Site Manager.

**a.** Click **Ports** > **OTS**.

**b.** Hover over a port, click the ellipsis, and then click **Optical Port at COSM**.

*Figure 28: Network inventory*



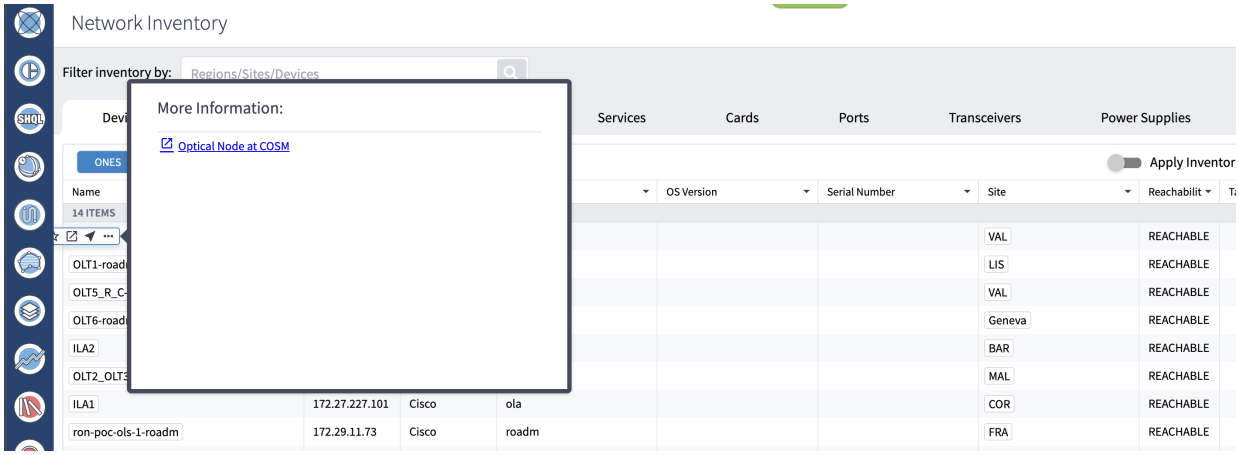

**Step 5** Cross launch from Crosswork Hierarchical Controller Link Assurance node to Cisco Optical Site Manager or SVO.

**a.** Click **Link Assurance** > **Inspect links**.

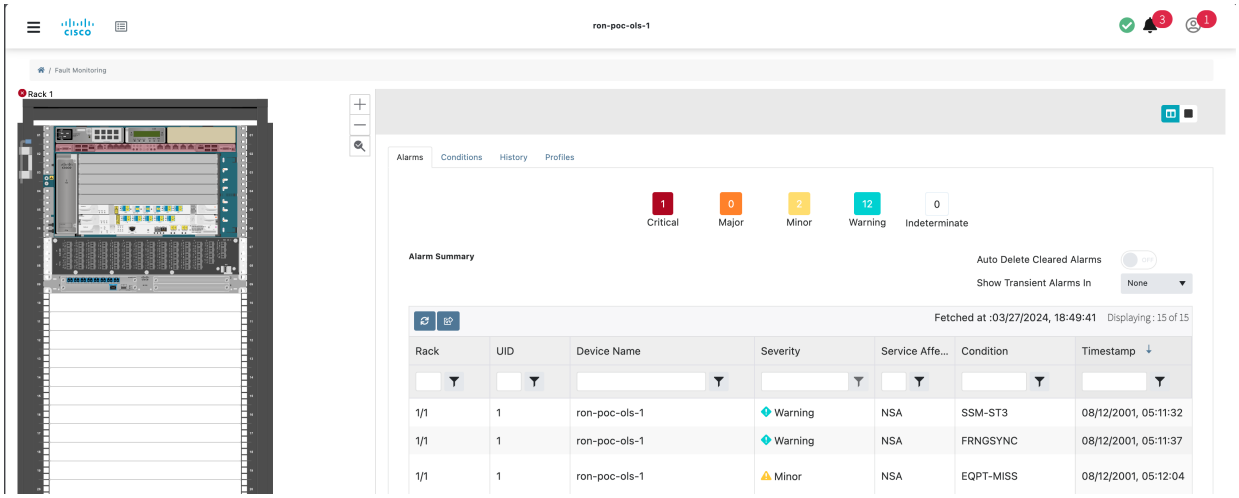
**b.** Hover over a node, click the ellipsis, and then click **Optical Node at COSM**.

Sample end-to-end configuration

*Figure 29: Link assurance*




This operation displays the node functional view in Cisco Optical Site Manager for NCS 1000 series devices or in SVO for NCS 2000 series devices.




**Step 6** Cross launch from Crosswork Hierarchical Controller Link Assurance port to Cisco Optical Site Manager.

**a.** Click **Link Assurance** > **Inspect links**.

**b.** Hover over a port, click the ellipsis, and click **Optical Port at COSM**.

*Figure 30: Link assurance*


# Provision an ML service using NSO Routed Optical Networking CFP

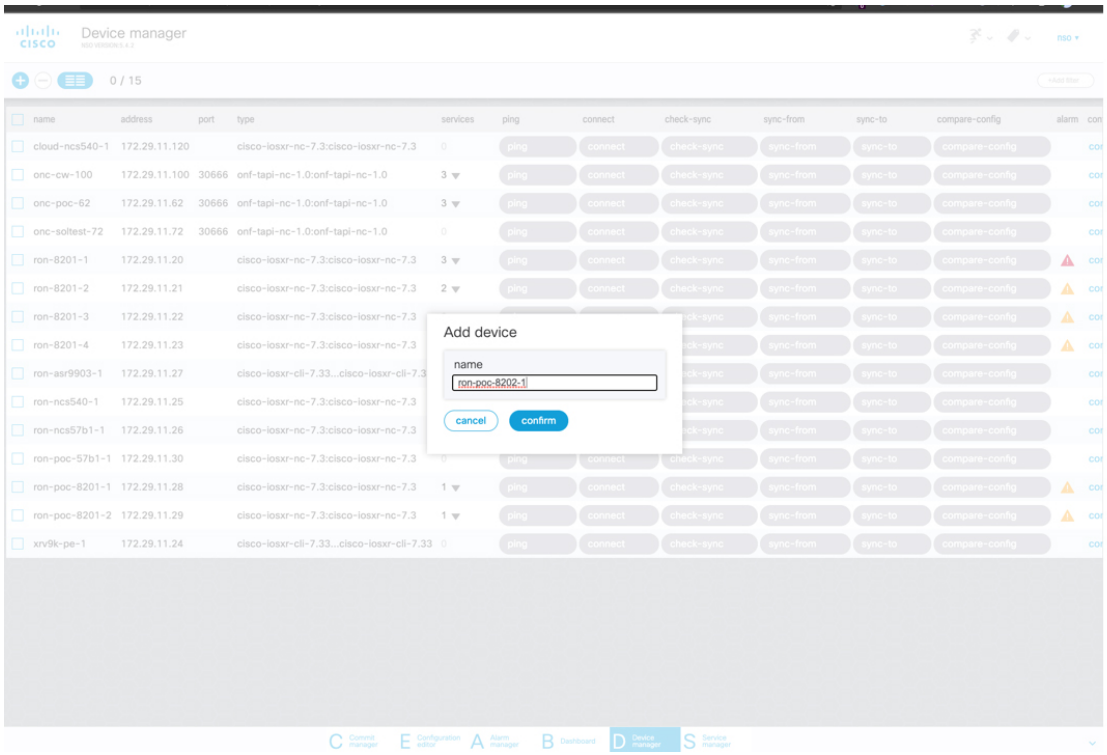
Follow these steps to provision the Routed Optical Networking ML service using the NSO Web UI.

## Procedure

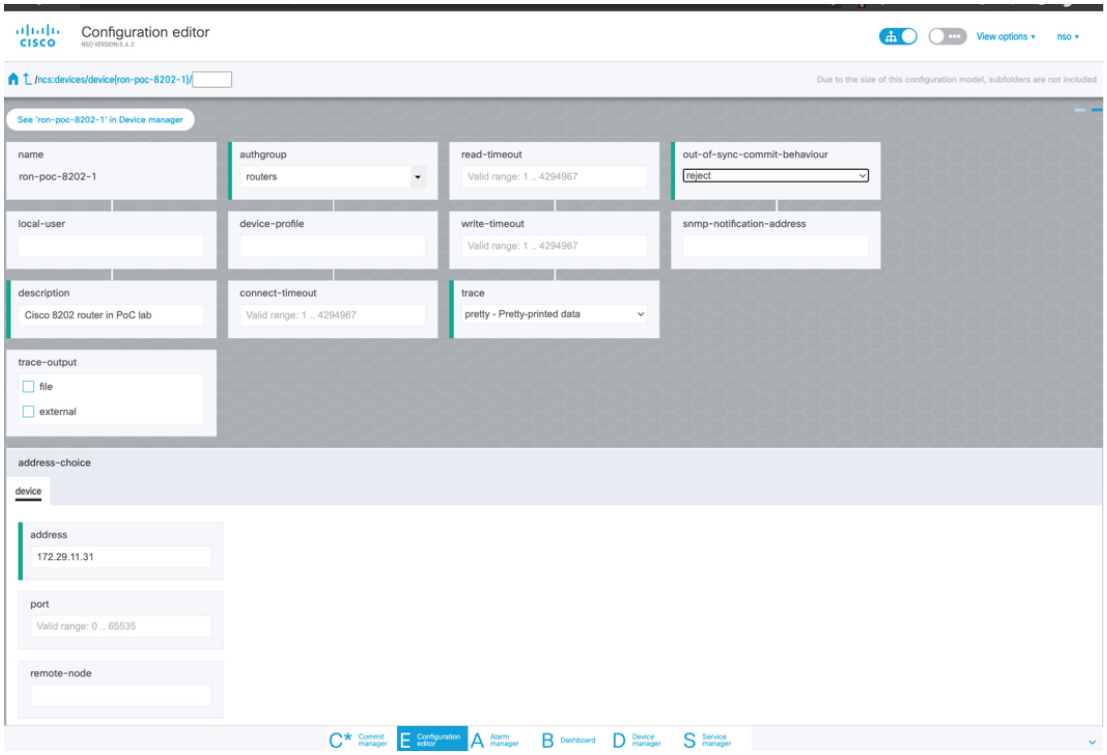
**Step 1** To add a new device, perform these steps:

**a.** In the Device manager, click the + to add a new device. Specify a name for the new device and click **Confirm**.

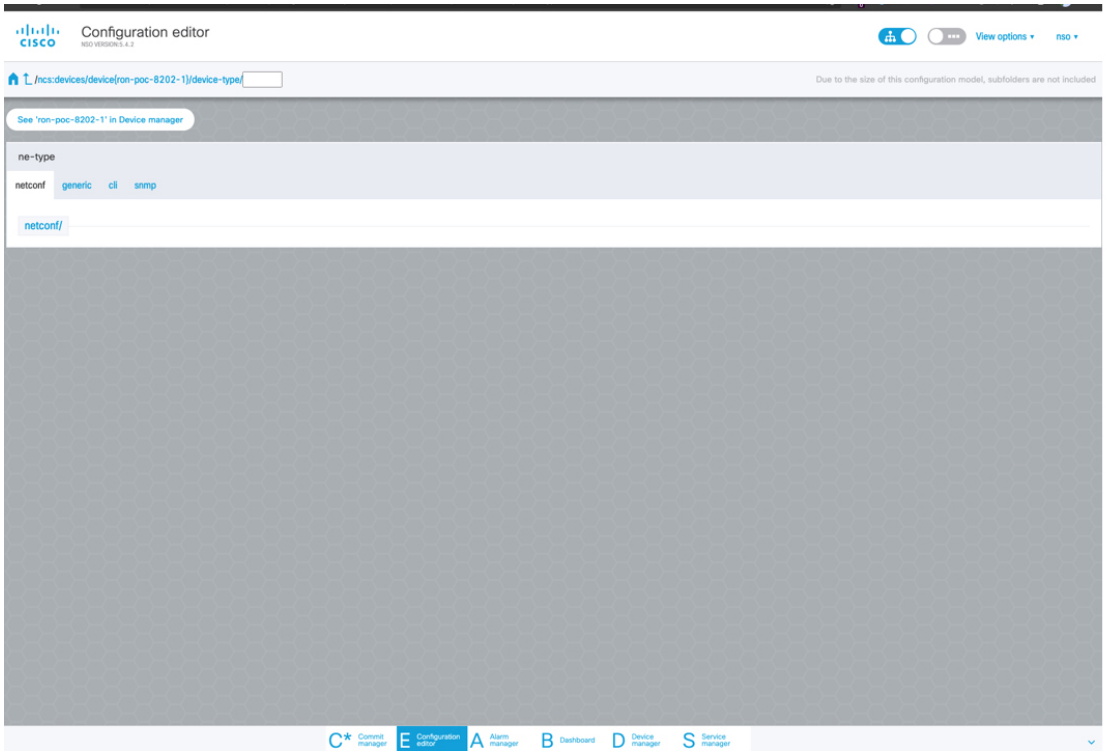
Sample end-to-end configuration




**b.** After creating the new device, click its name. Then, enter both required and optional parameters. In this screen, you must provide the authgroup and the IP address of the device.

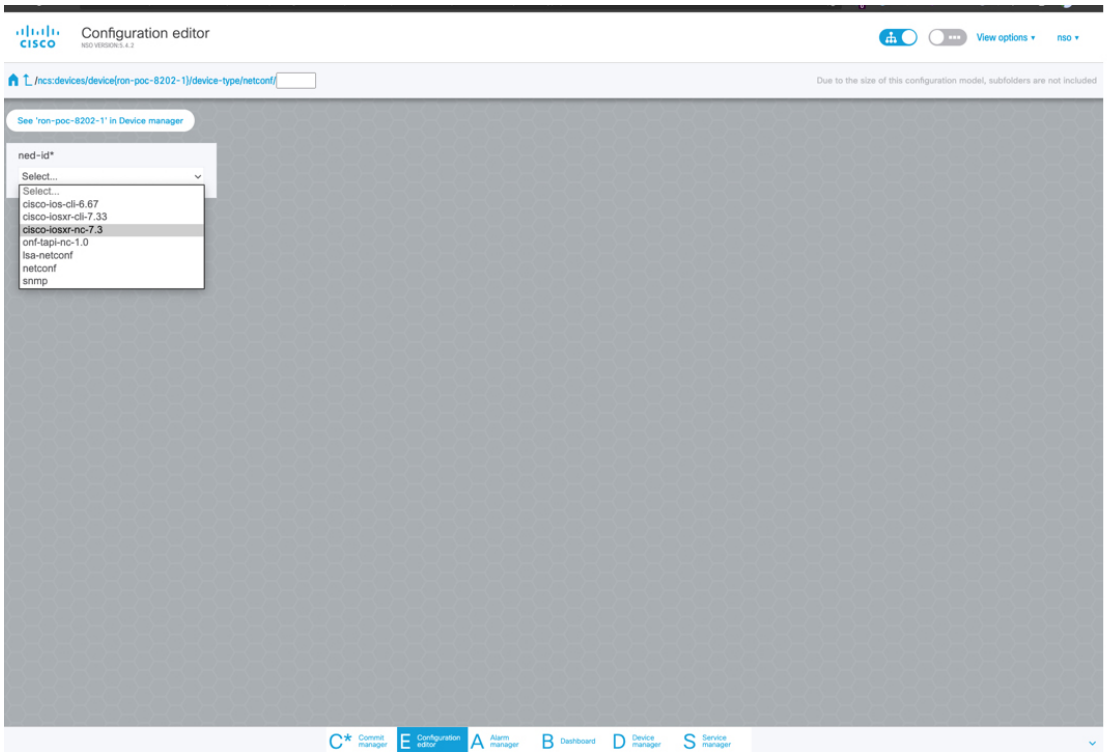


c. Scroll down in the device configuration screen. Click 'device-type' to open the device type selection screen. The supported device type for Routed Optical Networking ML FP is IOS-XR CLI NED.




d. Click NETCONF to select the appropriate NED. The Routed Optical Networking ML FP requires the use of the **cisco-iosxr-nc-7.3** NED.

Sample end-to-end configuration



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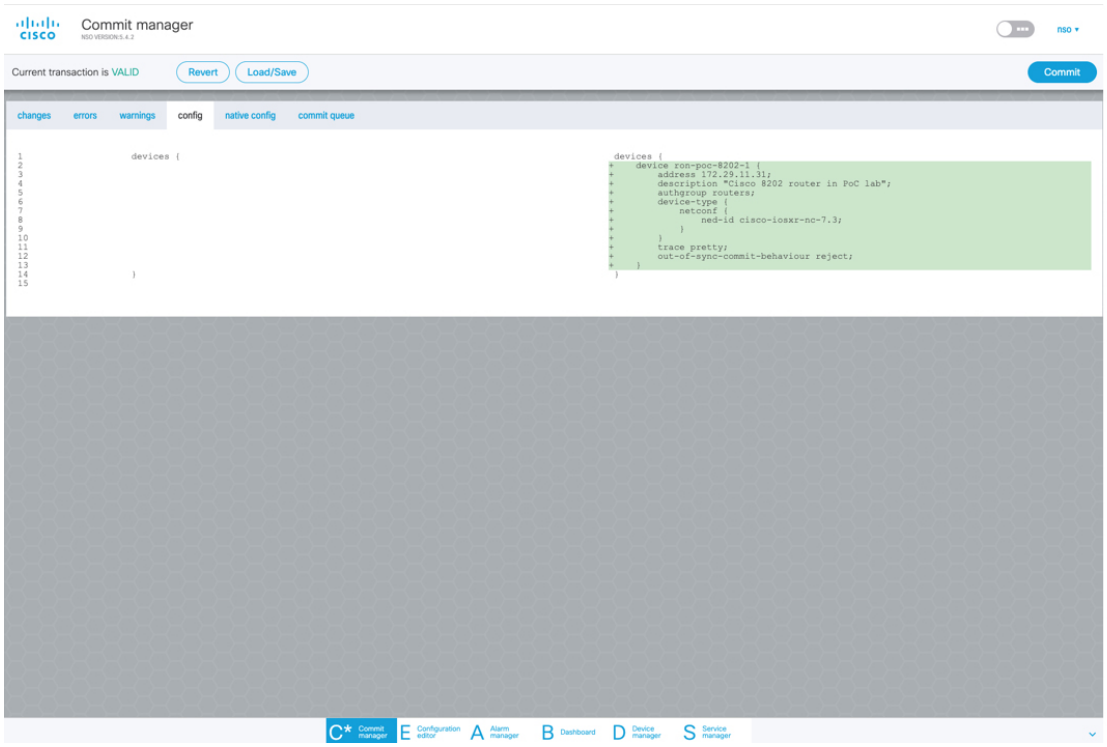
**e.** Click the Commit manager to view the NSO CLI configuration being applied. Click **Commit** to save the device configuration to NSO.



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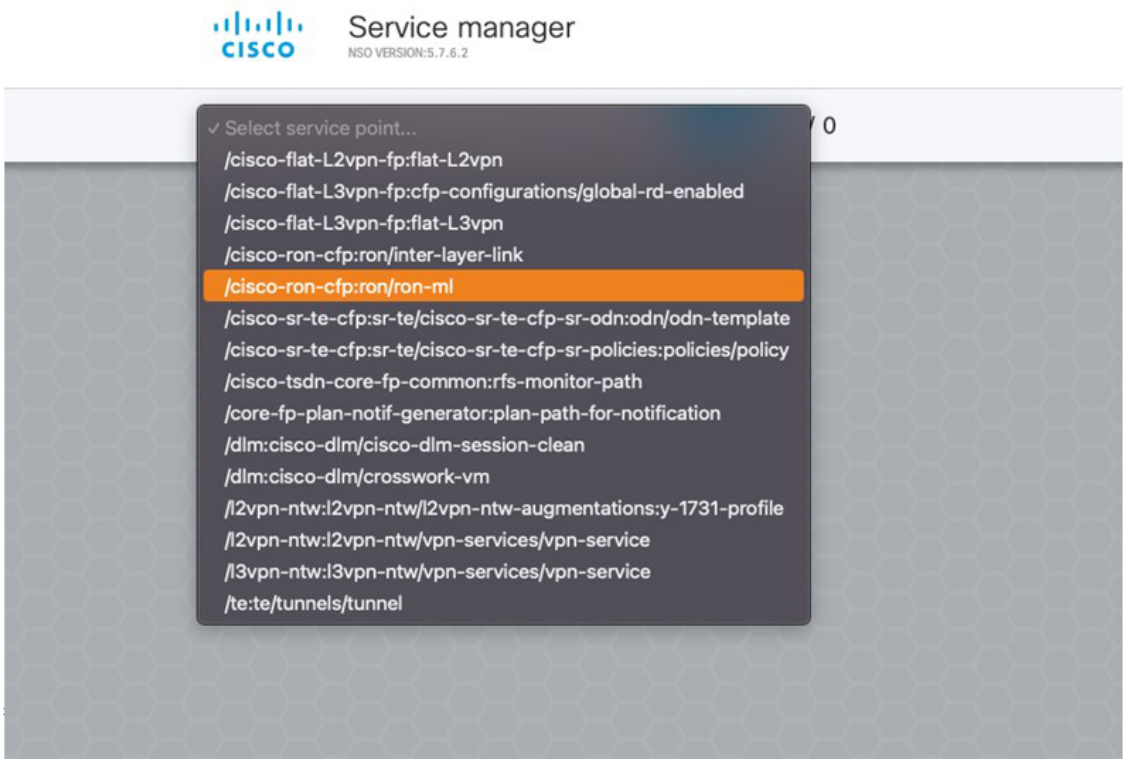
**Note**

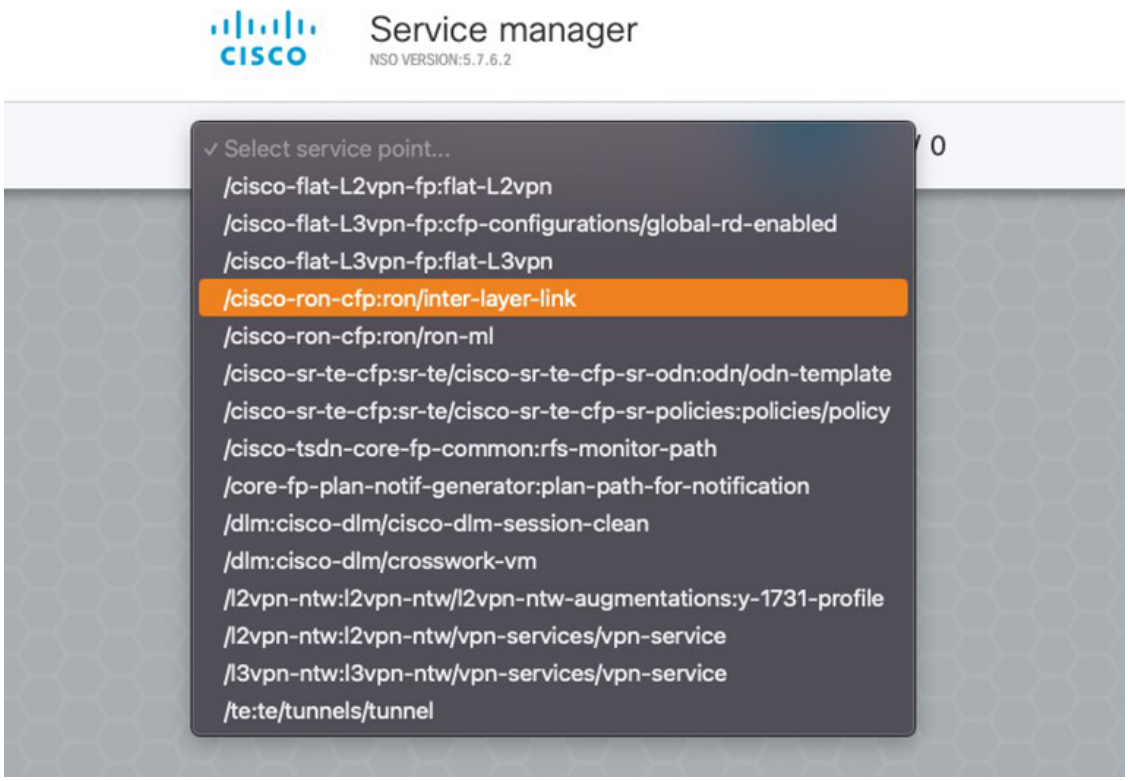
Next we add the multilayer end-to-end service to configure and provision both the optical line system and routers. We recommend you to click **check-sync** in the Device manager to ensure that the device configuration is properly in sync with NSO before provisioning. Initial provisioning fails if the device is out of sync.



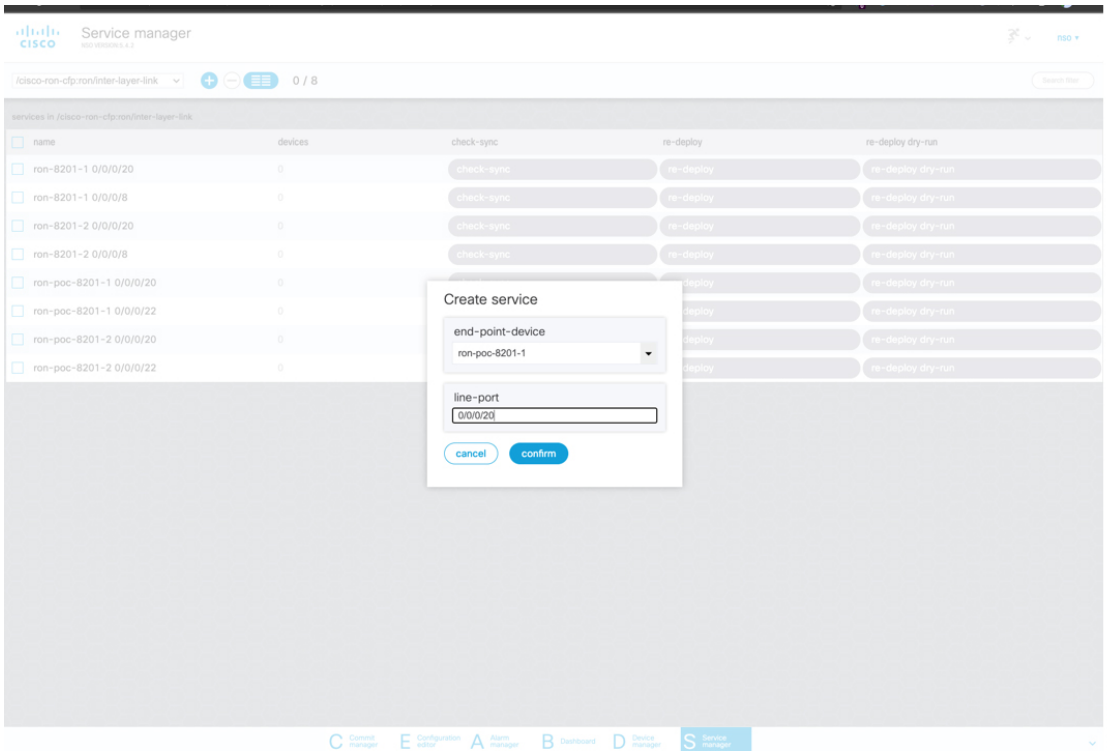

**Step 2** To configure the interlayer link service in NSO, perform these steps:

**a.** In the Service manager, select the inter-layer-link service point from the drop-down list.

Sample end-to-end configuration

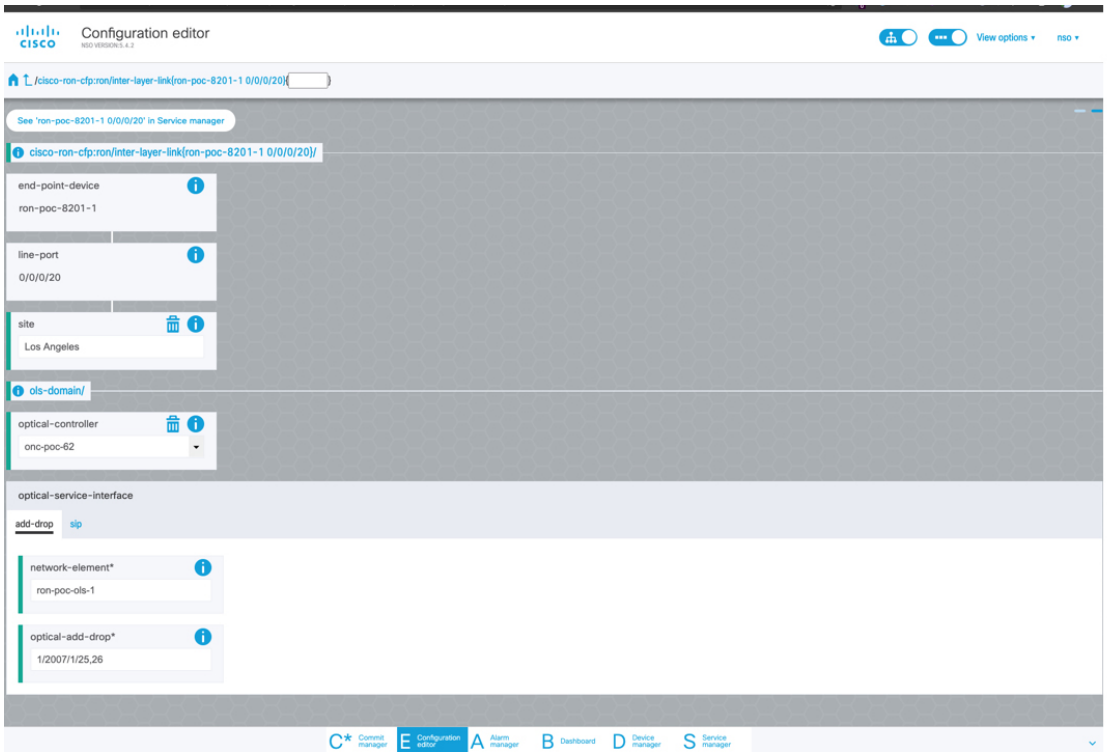



**b.** Specify the end-point-device and the line port. These are required values. The endpoint device is the 8201 router. Specify the router optics port that is connected to the optical line system add-drop port in the line port field. Click **Confirm**.




c. In the Configuration editor, edit the inter-layer-link service by clicking the newly created draft service to complete the information required. In this example, we add the site name, optical add-drop network element, and the optical add-drop port. The optical controller field specifies which Optical Network Controller instance is used for provisioning. This parameter is optional if a global instance is defined. A global Cisco Optical Network Controller instance can be set in NSO and will be used if the field is not populated. The add-drop port uses the inventory ID of the physical port on the NCS1K-MD-64-C multiplexer for frequency XXXX.YY. The add-drop reference includes both RX and TX directions. In addition to specifying the network-element and add-drop in R/S/I/P form, a TAPI SIP can also be used to identify the add-drop port.

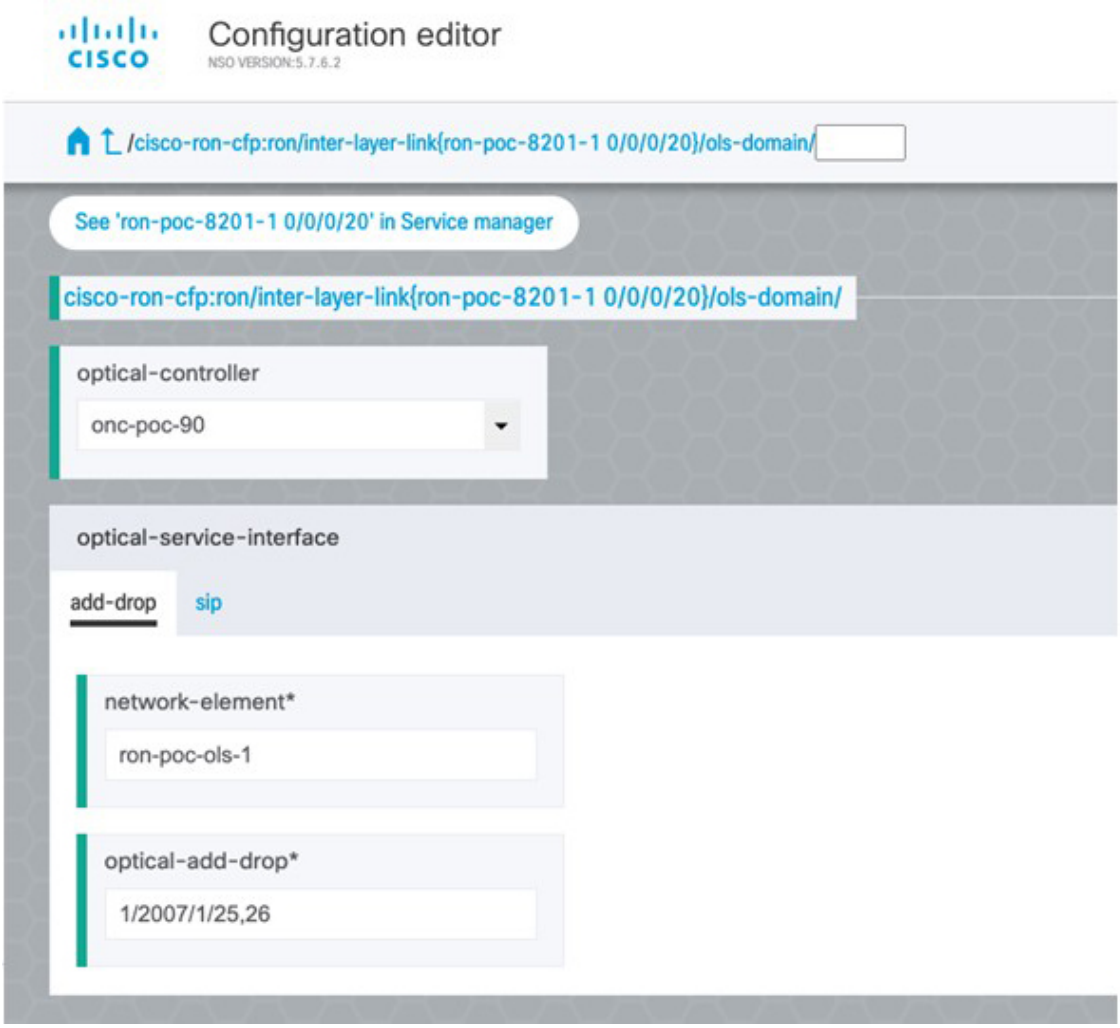
Sample end-to-end configuration




These elements are the only required elements in the inter-layer-link service type.

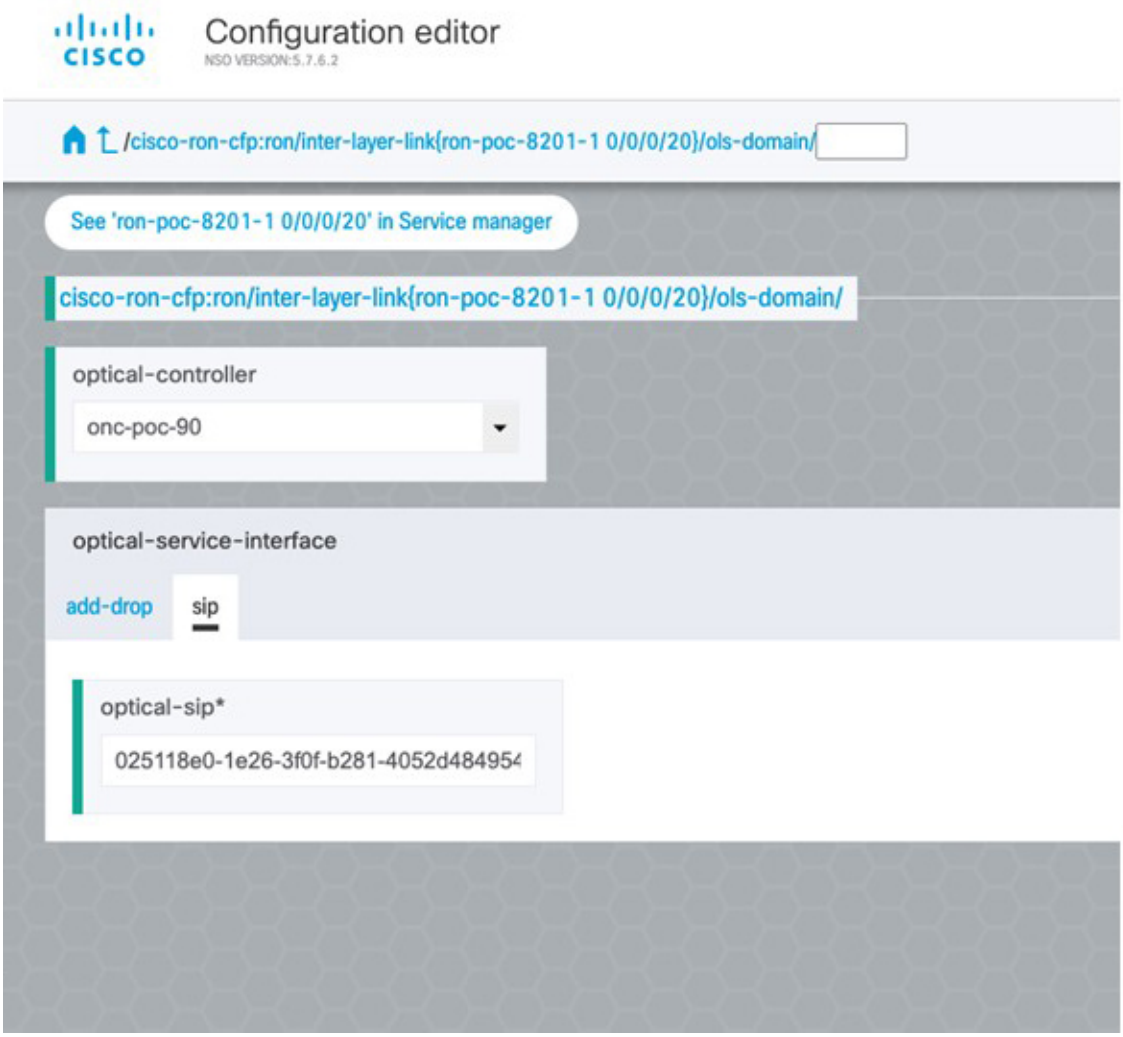
**d.** Perform Ols-domain optical-service-interface configuration.

- Optical-controller specifies the Cisco Optical Network Controller instance managing the OLS.
- Network-element specifies the optical element name as shown in TAPI topology.
- Optical-add-drop specifies the port to be used on the optical network element.

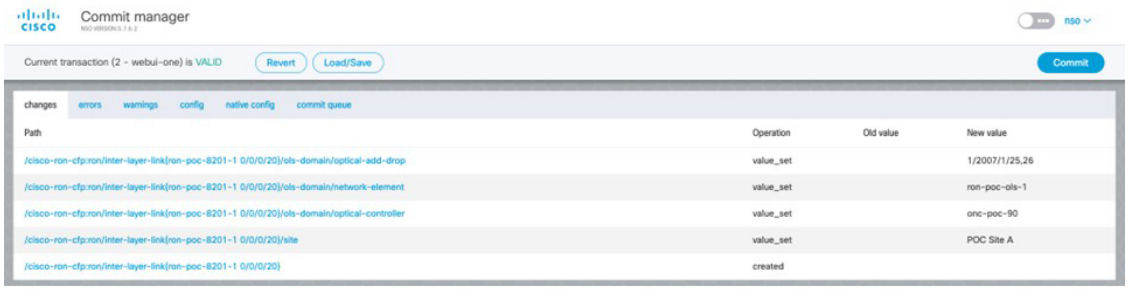



- The optical-service-interface can also be added as a TAPI SIP UUID.

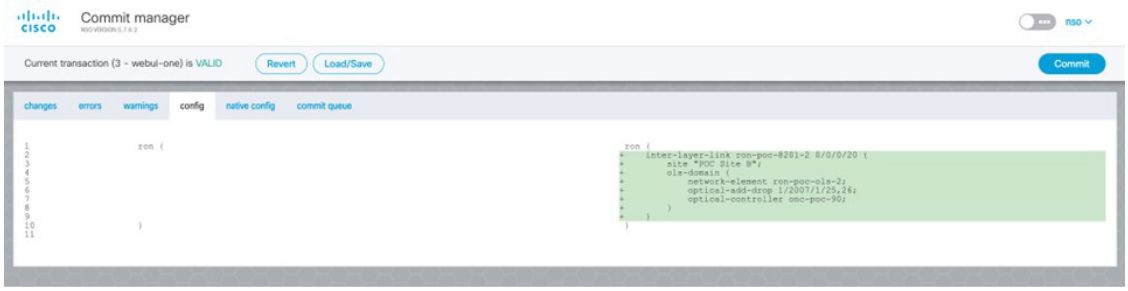
Sample end-to-end configuration



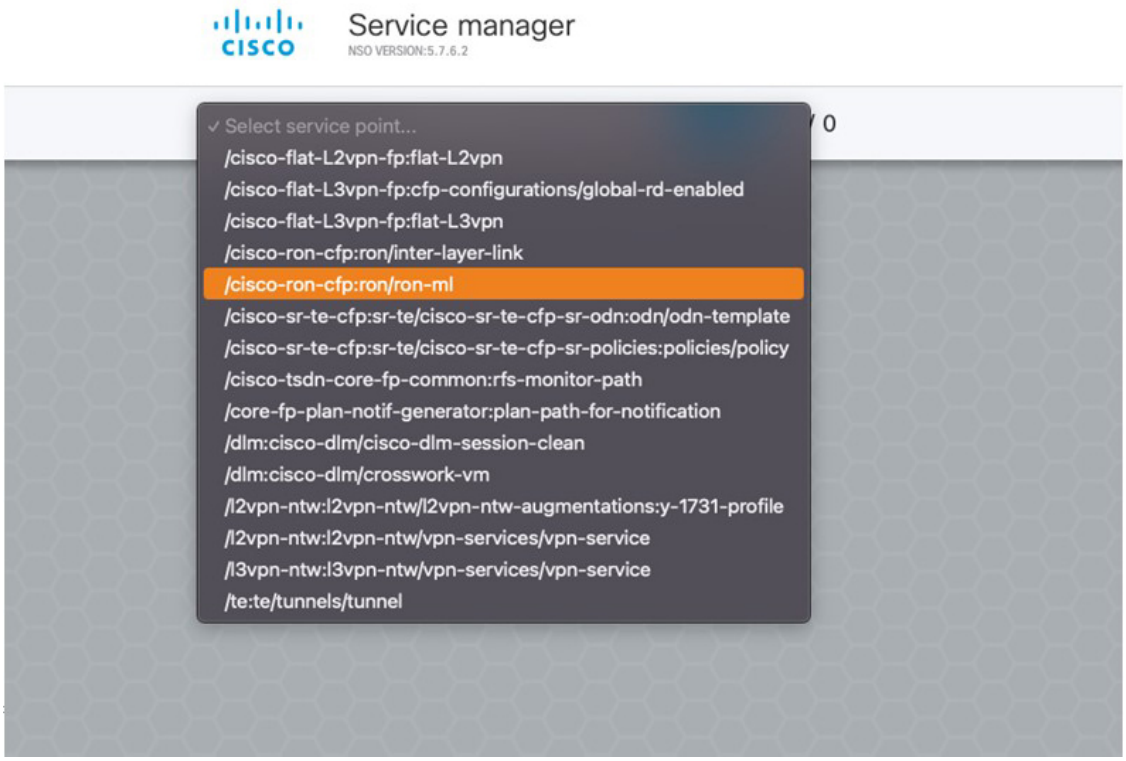

**e.** Click the config tab in the Commit manager to see the NSO CLI configuration that will be committed to NSO.




**f.** Click **Commit** in the upper right corner to commit the service. An end-to-end service requires two inter-layer-links, one for each router connected to its optical line system add-drop port.



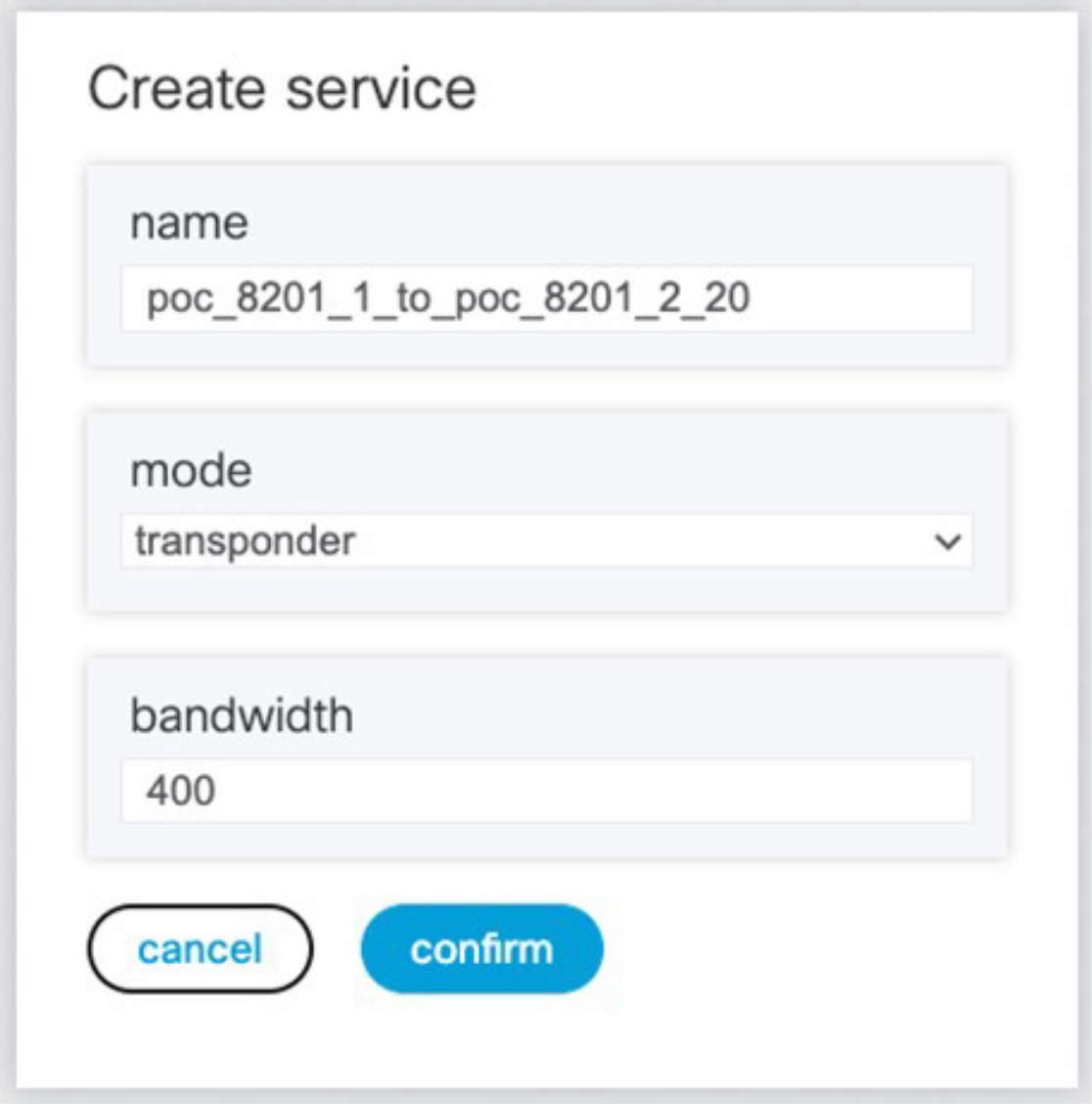

**Note**
Next we add the multilayer end-to-end service to configure and provision both the optical line system and routers. We recommend you to click **check-sync** in the Device manager to ensure that the device configuration is properly in sync with NSO before provisioning. If the device is out of sync, initial provisioning fails.




**Step 3** To create Routed Optical Networking ML service, perform these steps:

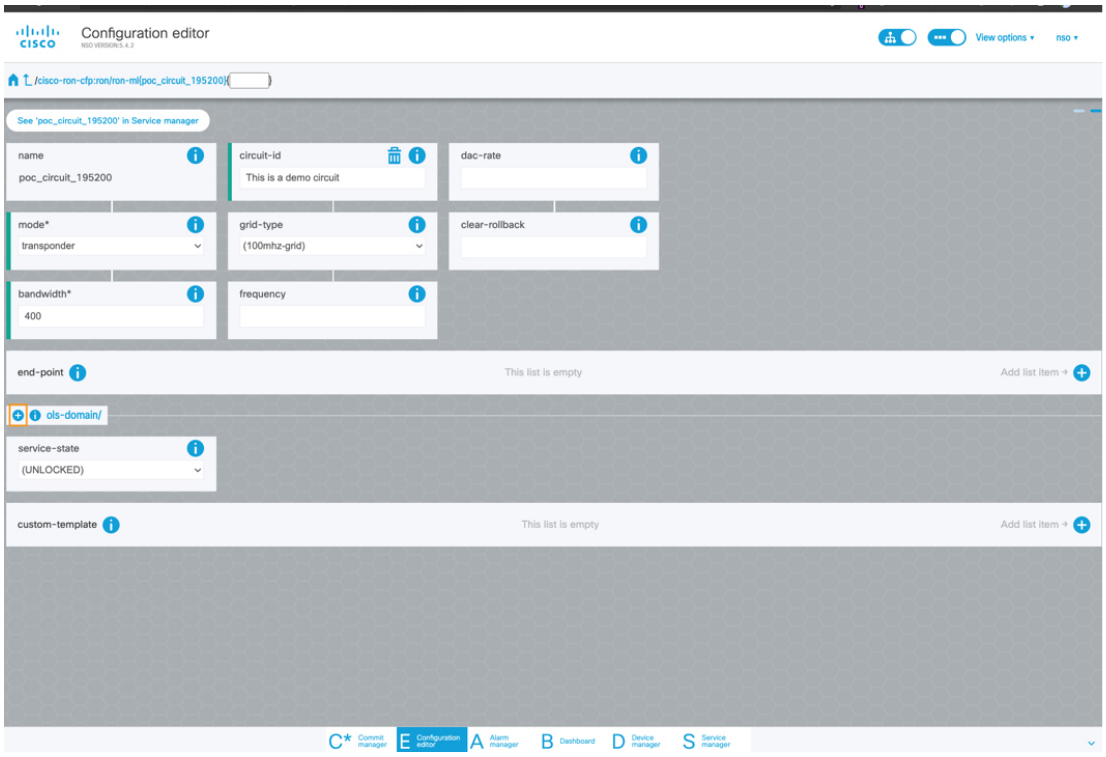
**a.** In the Service manager, select the Routed Optical Networking ML service point from the drop-down list. When we create the new Routed Optical Networking ML service, the required components are the service name, mode of the service (transponder or muxponder), and the bandwidth. The bandwidth corresponds to the line rate of the ZR or ZR+ optics. Click **Confirm**.

Sample end-to-end configuration




**b.** In the Configuration editor, click the newly created service name for editing the additional parameters that are required for the service. In this example, set the circuit-id name in the global parameters. The frequency is set by the optical

controller based on the specified optical add-drop port. The dac-rate is set to the default value.

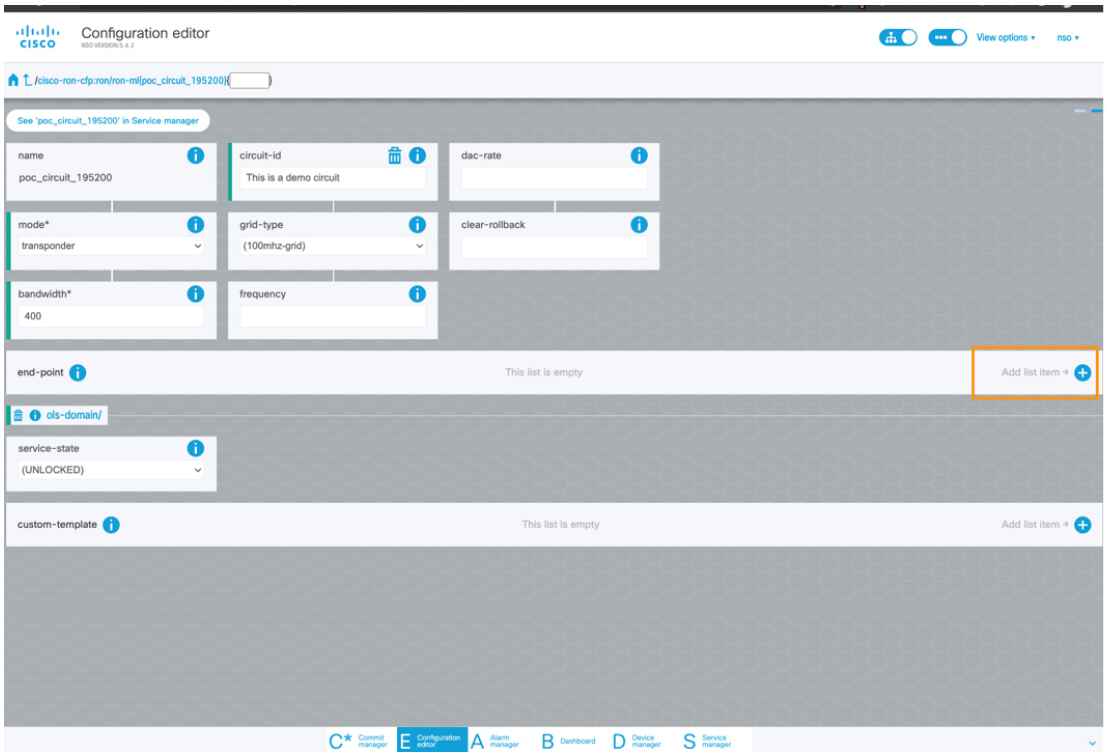



**Note**

- User configuration global options are frequency and dac-rate.
- Dac-rate controls the TX shaping parameters: 1x1.25 = enabled, 1x1 = disabled. If you leave this field blank, the system uses the default setting of enabled.
- Modulation of 16 QAM is available for 2x100G muxponder mode.

**c.** After the ols-domain is added, you must add end-points to the circuit. Two end-points are always required. The end-points are the routers with ZR/ZR+ optics.

Sample end-to-end configuration

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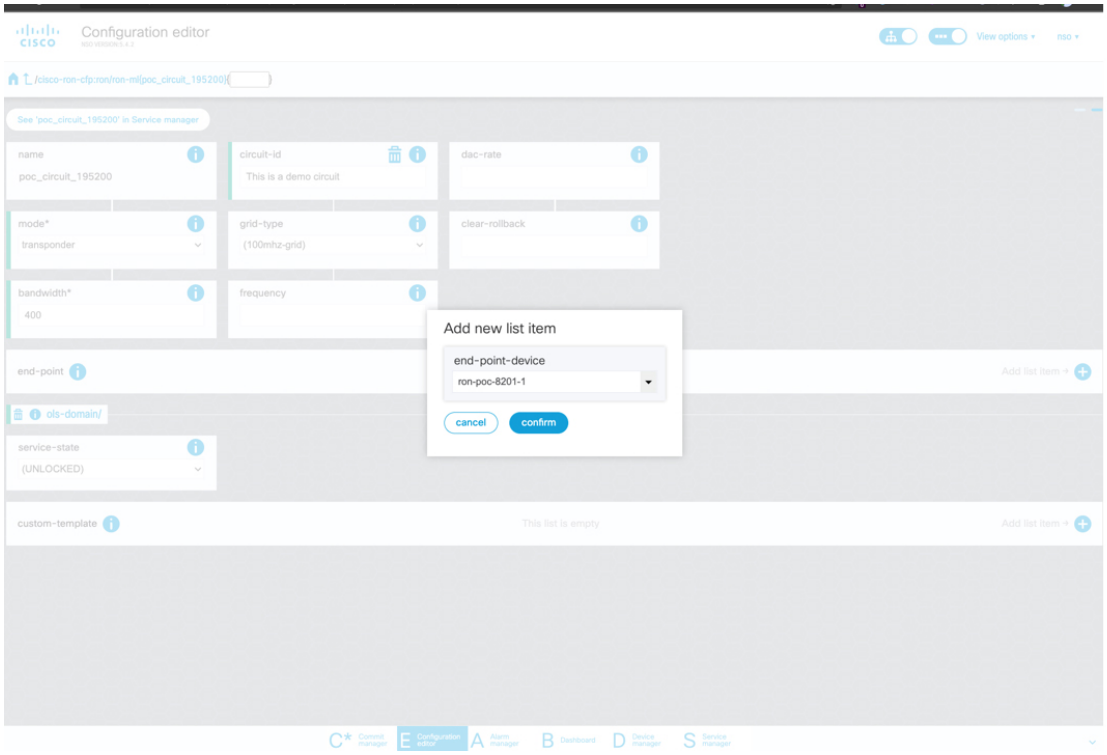
**d.** Add the end-point-device to the service. Click **Confirm**.

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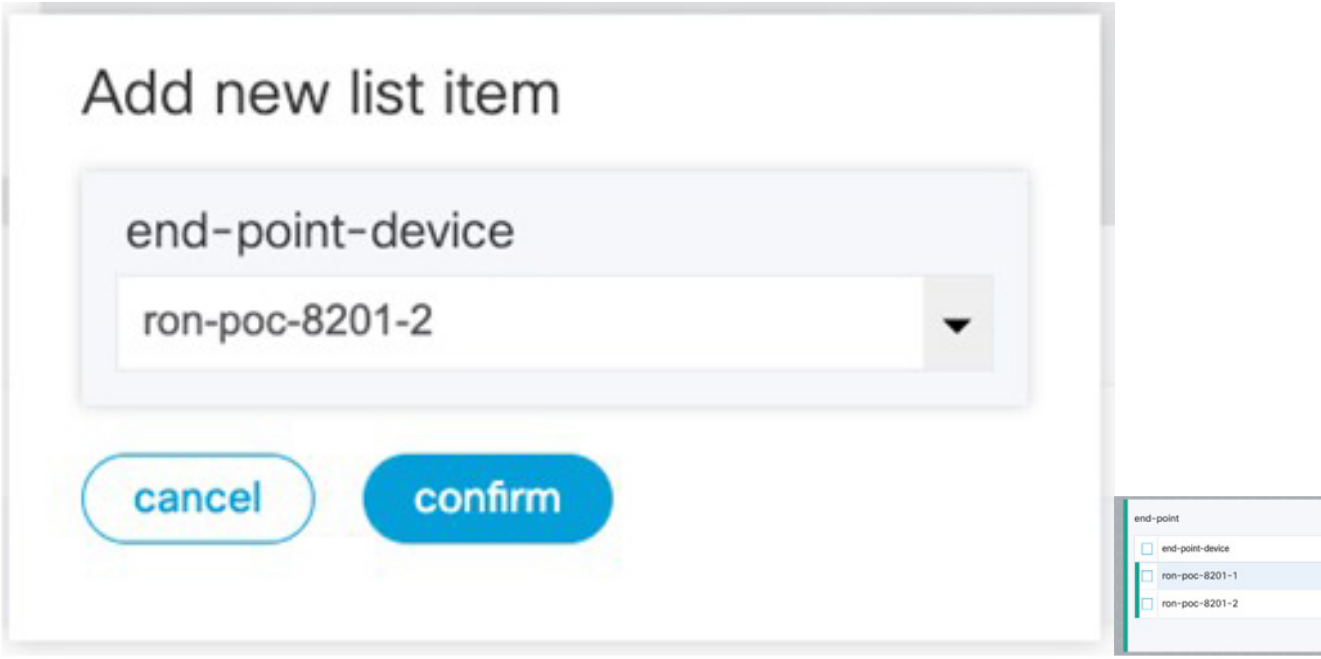
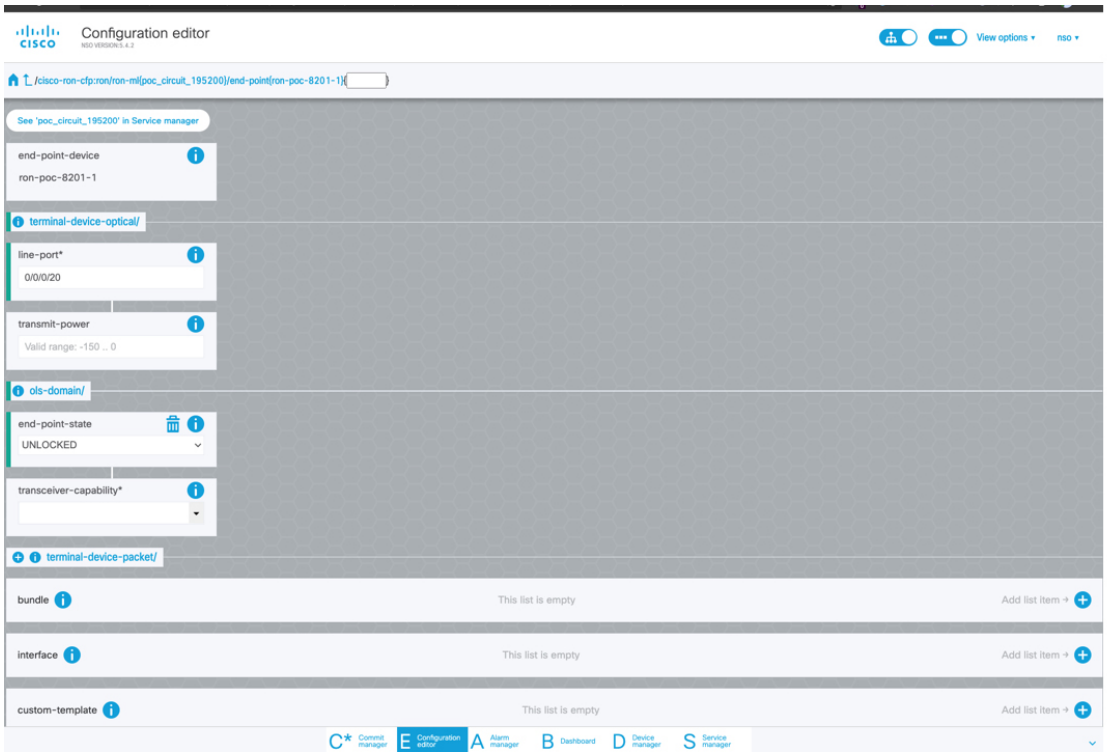
After the end-point is created, click the end-point to edit the end-point parameters. The line port is a required parameter and refers to the optics port on the router. In this example, the line port for the end-point matches the value specified in the inter-layer-link service.



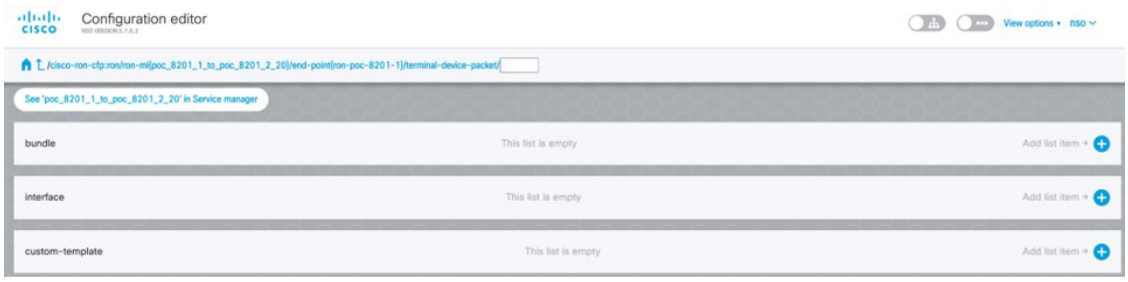

The transmit-power is an optional parameter for end-to-end provisioning. If you omit this parameter, the Cisco Optical Network Controller provides the transmit power.Transmit power sets the transmit power, the value is calculated as 100 times the value in 0.1 dBm increments. For example, a value of –100 equals –10 dBm. If you do not specify a value, the system uses a default of –10 dBm for QDD-400G-ZR-S or QDD-400G-ZRP-S, and 0 dBm for DP04QSDD-HE0 (Bright ZR+). The transceiver-capability field specifies the optic type and is only required if no packet layer configuration is being performed. In this example, you are performing packet layer provisioning so specifying the transceiver capability is not required.

Add the line port of 0/0/0/20 to the Routed Optical Networking ML service.

Sample end-to-end configuration




**e.** Click endpoint to return to the top-level endpoint configuration, click **terminal-device-packet** to configure Ethernet/IP parameters




**Note**

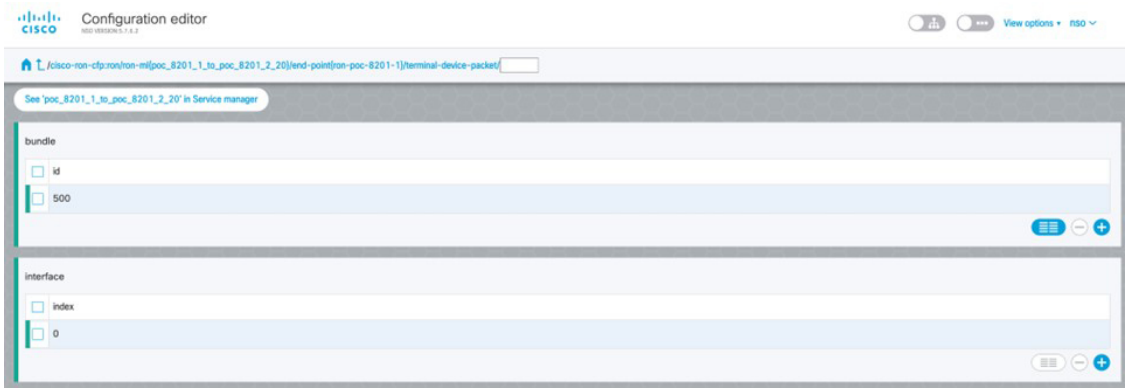
- Ethernet and IP configuration is optional.
- Bundle configuration adds an interface to an existing bundle or creates a new bundle and adds the newly created IP interface to it.

  Interface configuration is used for configuring IP address parameters on newly created Ethernet interfaces.

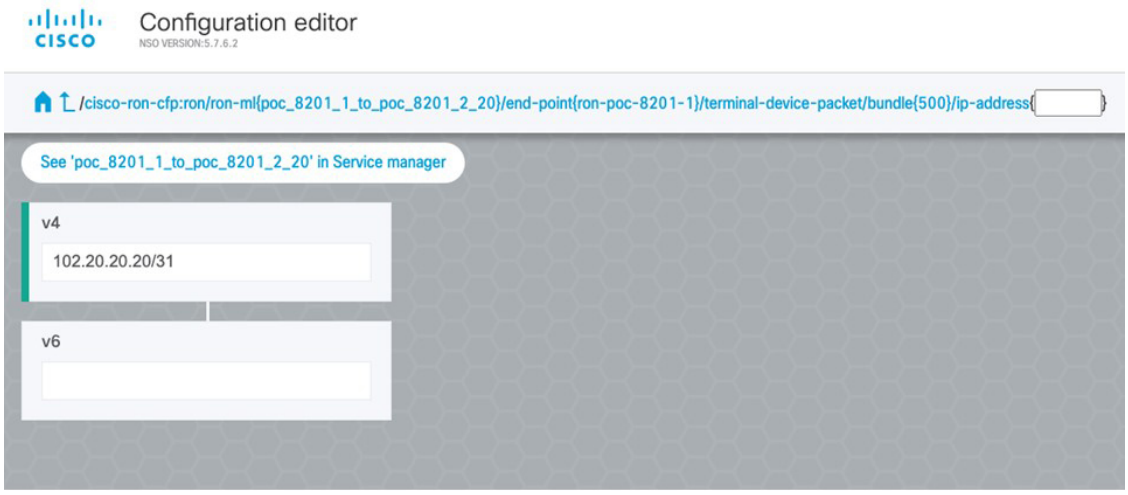
  In this example, we add a new Bundle and assign an IP address to the Bundle.

**f.** Click the plus sign next to the bundle to create a bundle with the identifier 500. This action creates a bundle interface, Bundle-Ether 500, on the endpoint router.

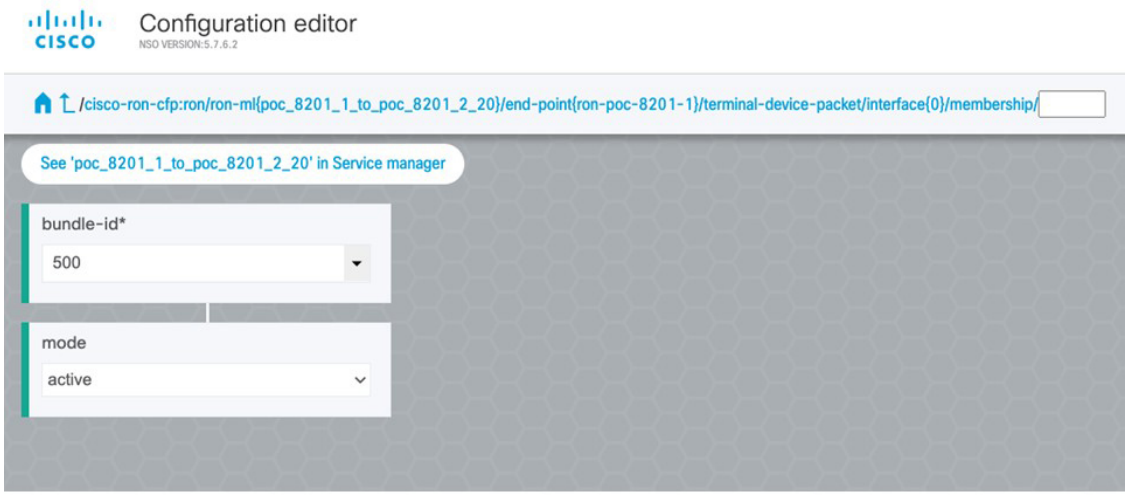
The interface index for a bundle use case is always 0. In a non-bundle configuration in muxponder mode, the index can be 0 to 3, representing the number of interfaces created as part of the muxponder configuration.




**g.** Click the bundle number and *ip-address* to configure an IP address on the bundle.




**h.** Return to the top-level endpoint configuration. Select index 0 that you created previously, and click **membership** to add the interface to the bundle.

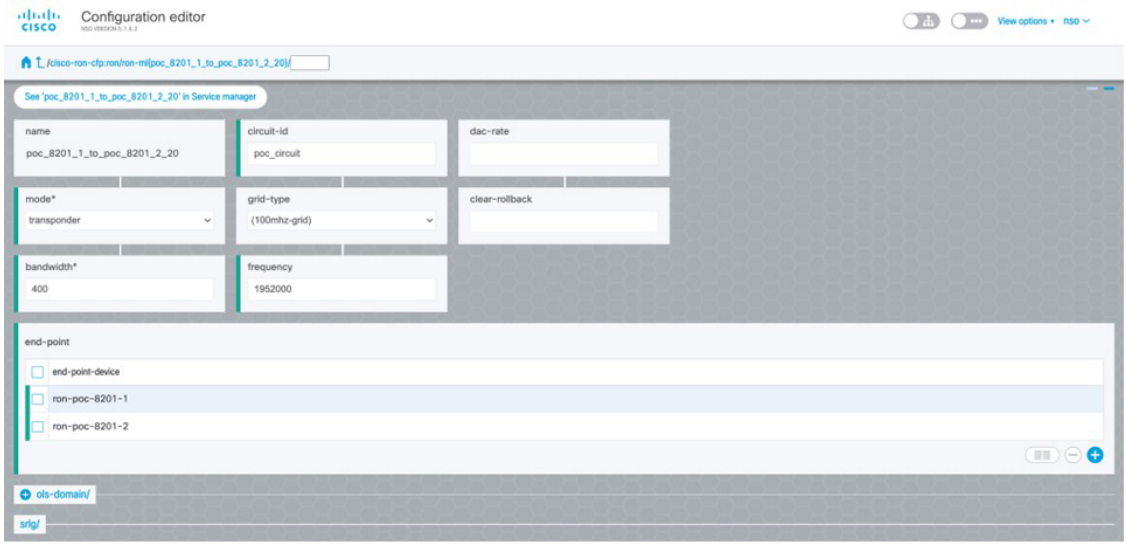



**Note**

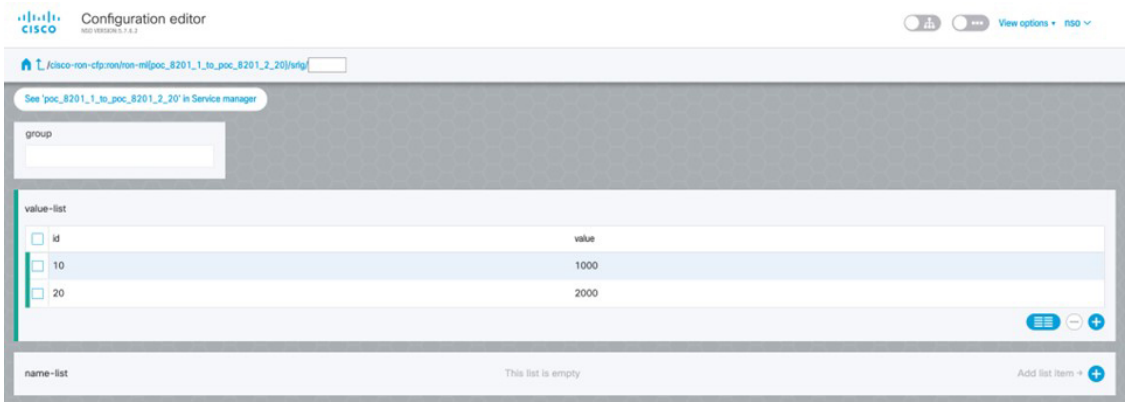
- Bundle-id selects the previously created bundle.

- Mode sets the bundle LAG signaling mode. Active=LACP, passive=LACP listener only, on=No active signaling, inherit=Inherit signaling from Bundle interface configuration. Default is active.

**i.** Return to the top level of the service configuration. Then configure the second endpoint in the same manner.




**j.** Click **SRLG** to perform SRLG configuration

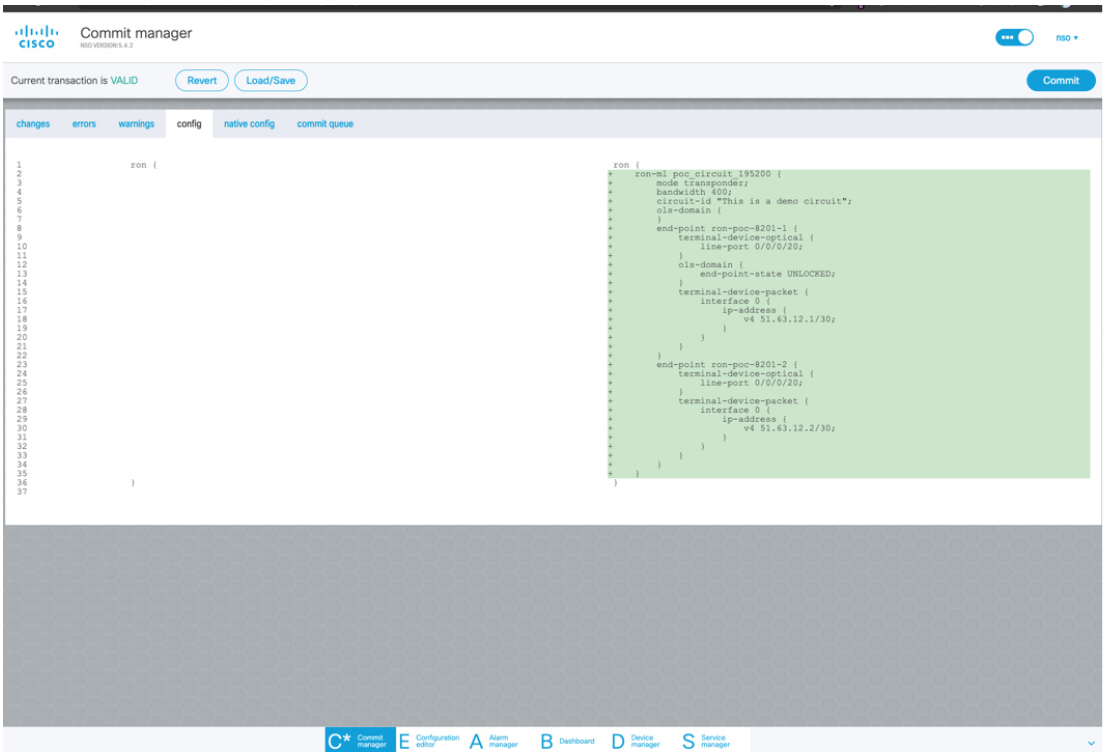



**Note**

- Configuration options are to specify a preconfigured group, a list of numeric SRLG values, or a list of SRLG names associated with preconfigured name:value pairs.
- Each type can be populated in the same configuration.
- In this example we specify a list of explicit numeric values. An index is used along with the numeric value.

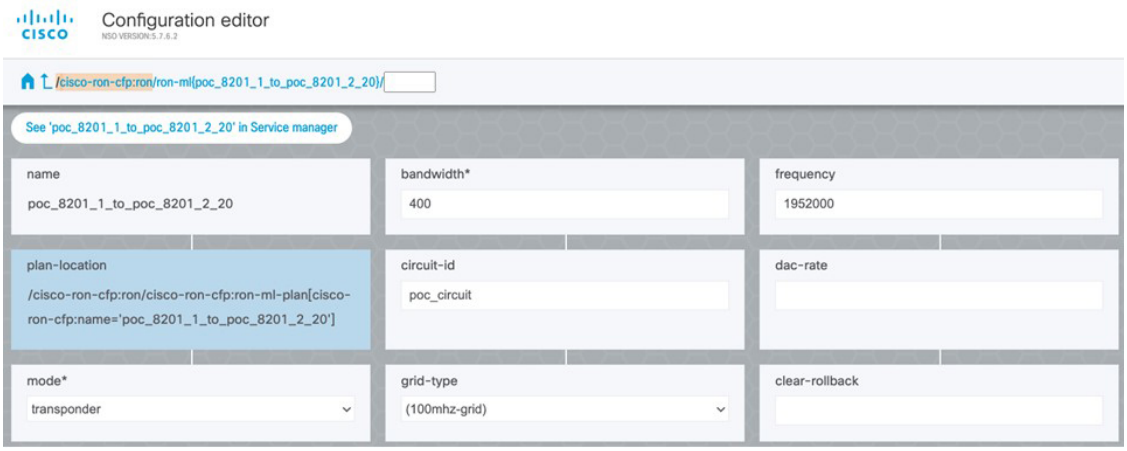
**Step 4** In the Commit manager, click the config tab. The NSO CLI configuration for the end-to-end service is displayed. If the ols-domain component is not specified in the global configuration, no optical line system provisioning is performed, only router provisioning. You can preview and then commit the configuration.

Sample end-to-end configuration

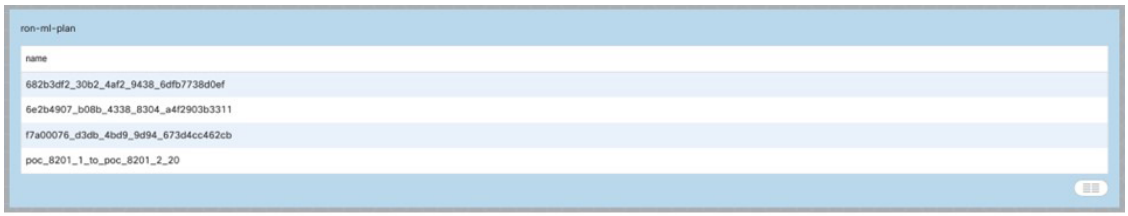



**Step 5** Verify status in NSO UI.

You can verify the status by inspecting the plan associated with the service. You can find the plan under the main ron-ml configuration which you can access by clicking the top portion of the service configuration. An example is highlighted in this image.




**a.** Inspect the plan by clicking on the newly created service




If all steps are green and complete, the service has been properly deployed to the network

```
RP/0/RP0/CPU0:ron-poc-8201-1#show configuration commit changes last 1
Mon Oct 17 09:51:11.625 PDT
Building configuration...
!! IOS XR Configuration 7.7.1
srlg
 interface Bundle-Ether500
  10 value 1000
  20 value 2000
 !
!
interface Bundle-Ether500
 ipv4 address 102.20.20.20 255.255.255.254
!
controller Optics0/0/0/20
 description poc_circuit
 transmit-power -100
 fec OFEC
 dwdm-carrier 100MHz-grid frequency 1952000
 DAC-Rate 1x1.25
!
interface FourHundredGigE0/0/0/20
 bundle id 500 mode active
!
End
```

```
RP/0/RP0/CPU0:ron-poc-8201-1#show controllers optics 0/0/0/20
Mon Oct 17 09:57:25.475 PDT

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 FEC State: FEC ENABLED

 Optics Status

         Optics Type:  QSFPDD 400G ZRP
         DWDM carrier Info: C BAND, MSA ITU Channel=19, Frequency=195.20THz,
         Wavelength=1535.822nm

         Alarm Status:
         -------------
         Detected Alarms: None
```

**b.** Inspect router configuration.

The **show configuration commit changes last 1** command shows the CLI config applied to the device during the NSO provisioning.

The **show optics controller 0/0/0/20** command verifies the operational status.

```
RP/0/RP0/CPU0:ron-poc-8201-1#show configuration commit changes last 1
Mon Oct 17 09:51:11.625 PDT
Building configuration...
!! IOS XR Configuration 7.7.1
srlg
 interface Bundle-Ether500
  10 value 1000
  20 value 2000
 !
!
interface Bundle-Ether500
 ipv4 address 102.20.20.20 255.255.255.254
!
controller Optics0/0/0/20
 description poc_circuit
 transmit-power -100
 fec OFEC
 dwdm-carrier 100MHz-grid frequency 1952000
 DAC-Rate 1x1.25
!
interface FourHundredGigE0/0/0/20
 bundle id 500 mode active
!
End
```

```
RP/0/RP0/CPU0:ron-poc-8201-1#show controllers optics 0/0/0/20
Mon Oct 17 09:57:25.475 PDT

 Controller State: Up

 Transport Admin State: In Service

 Laser State: On

 LED State: Green

 FEC State: FEC ENABLED

 Optics Status

         Optics Type:  QSFPDD 400G ZRP
         DWDM carrier Info: C BAND, MSA ITU Channel=19, Frequency=195.20THz,
         Wavelength=1535.822nm

         Alarm Status:
         -------------
         Detected Alarms: None
```

# Provision a Routed Optical Networking ML service using Crosswork Hierarchical Controller

Follow these steps to provision Routed Optical Networking ML service using Crosswork Hierarchical Controller.

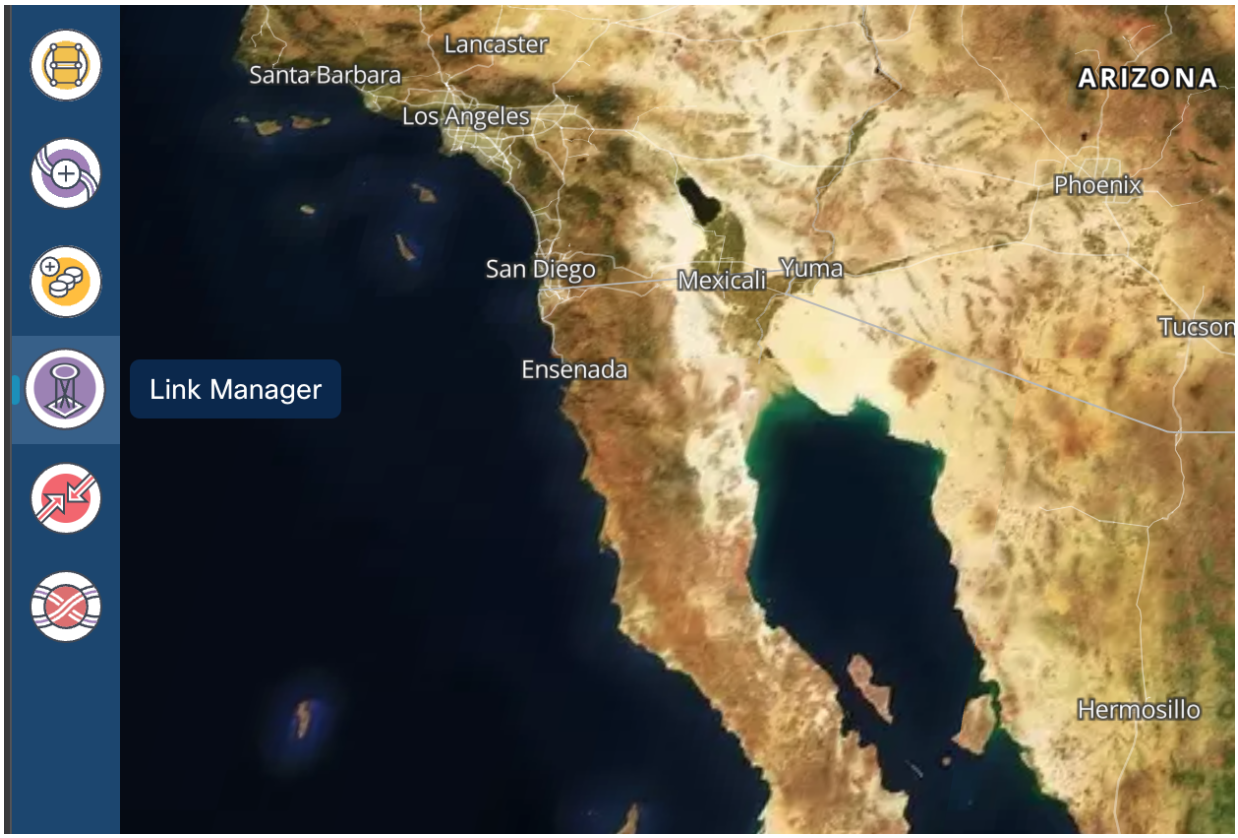
## Procedure

**Step 1** If you are performing both router and optical line system provisioning, you must create NMC Cross Links between router optics port and optical line system add-drop port.

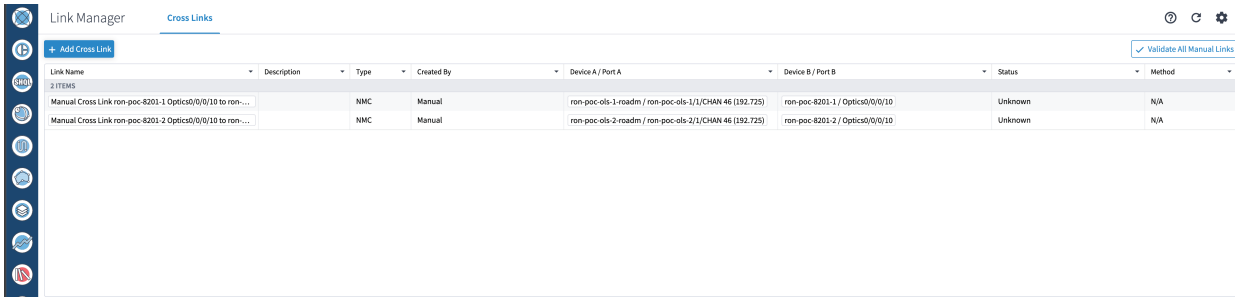
Crosswork Hierarchical Controller 8.0 in Routed Optical Networking 3.0 also supports “router only” provisioning. This type of provisioning applies optical parameters to the router optics port and IP layer parameters, but does not provision the optical line system.

**a.** Select **Link Manager** application.

***Figure 31: Crosswork Hierarchical Controller***



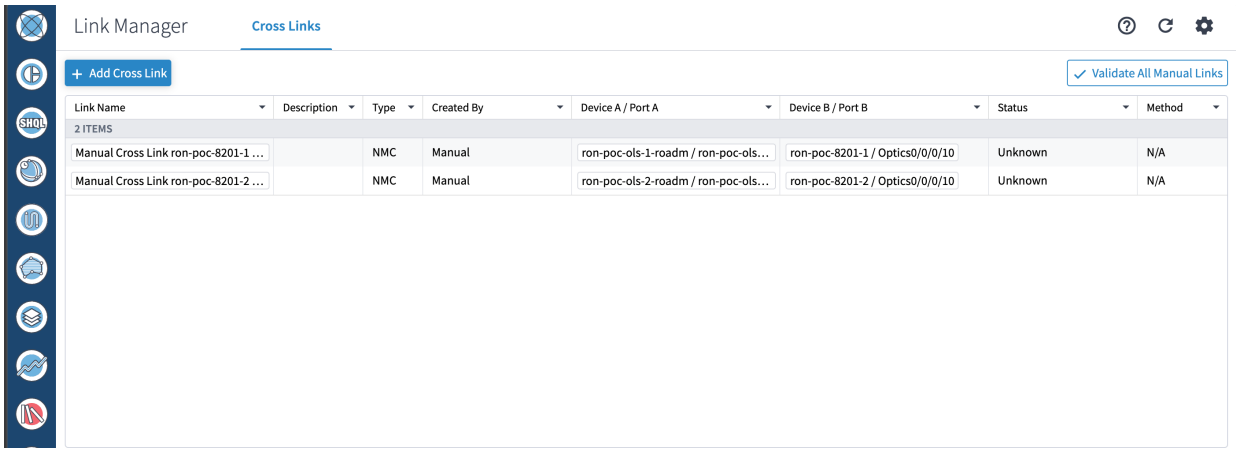

The initial view displays a list of cross links.



Sample end-to-end configuration

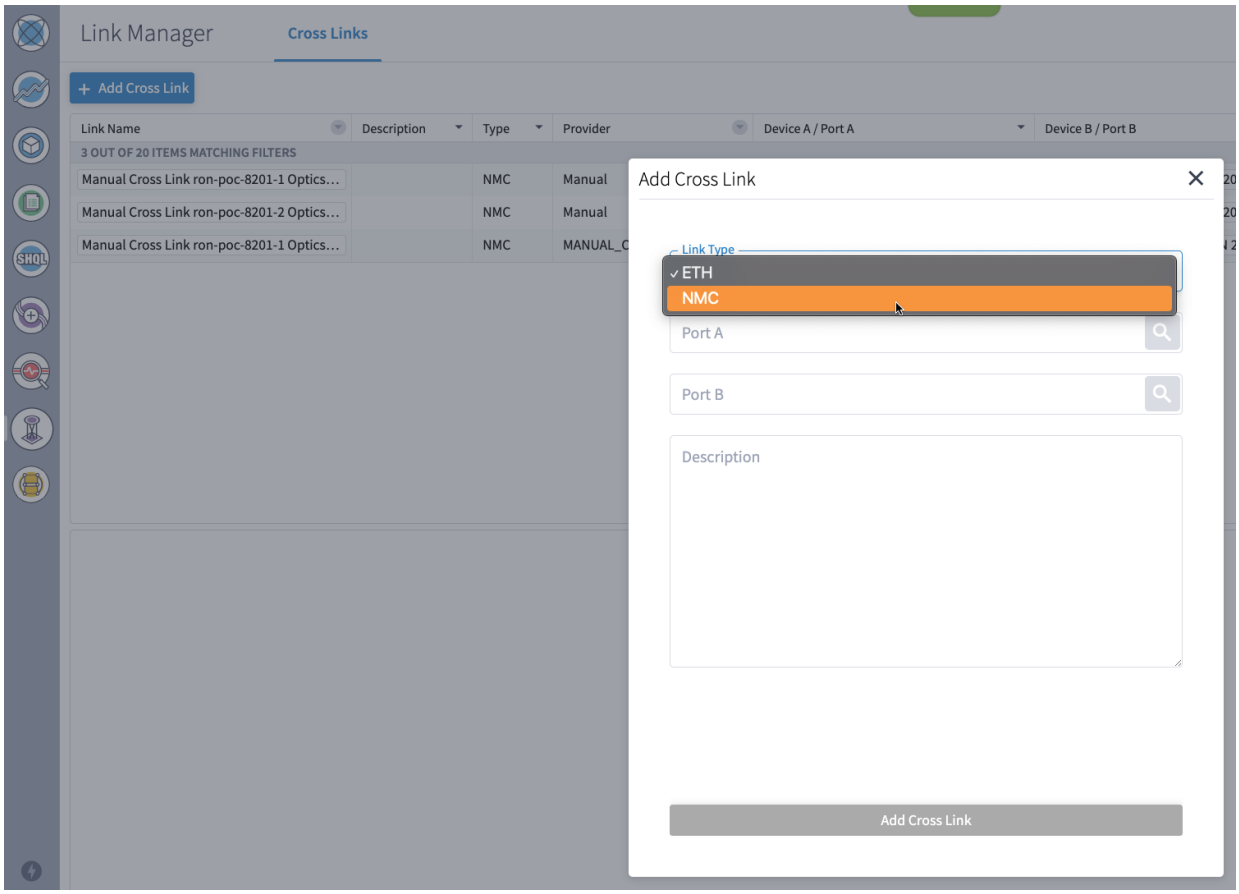
**b.** Click **Add Cross Link**.

***Figure 32: View with list of cross links***



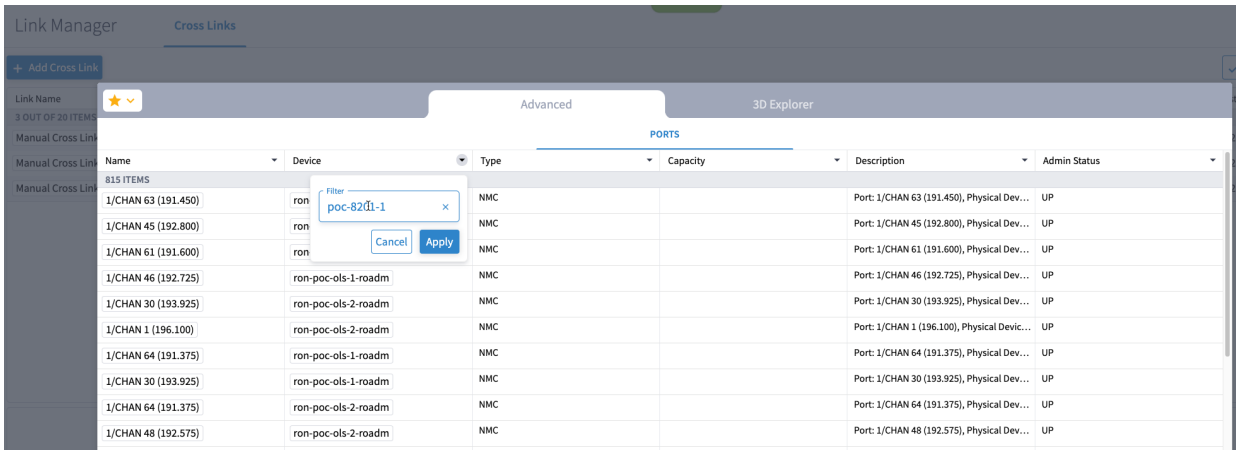

**c.** Select the NMC cross-link type. Cross Link Manager supports ETH and NMC cross links.

***Figure 33: Add cross links screen***

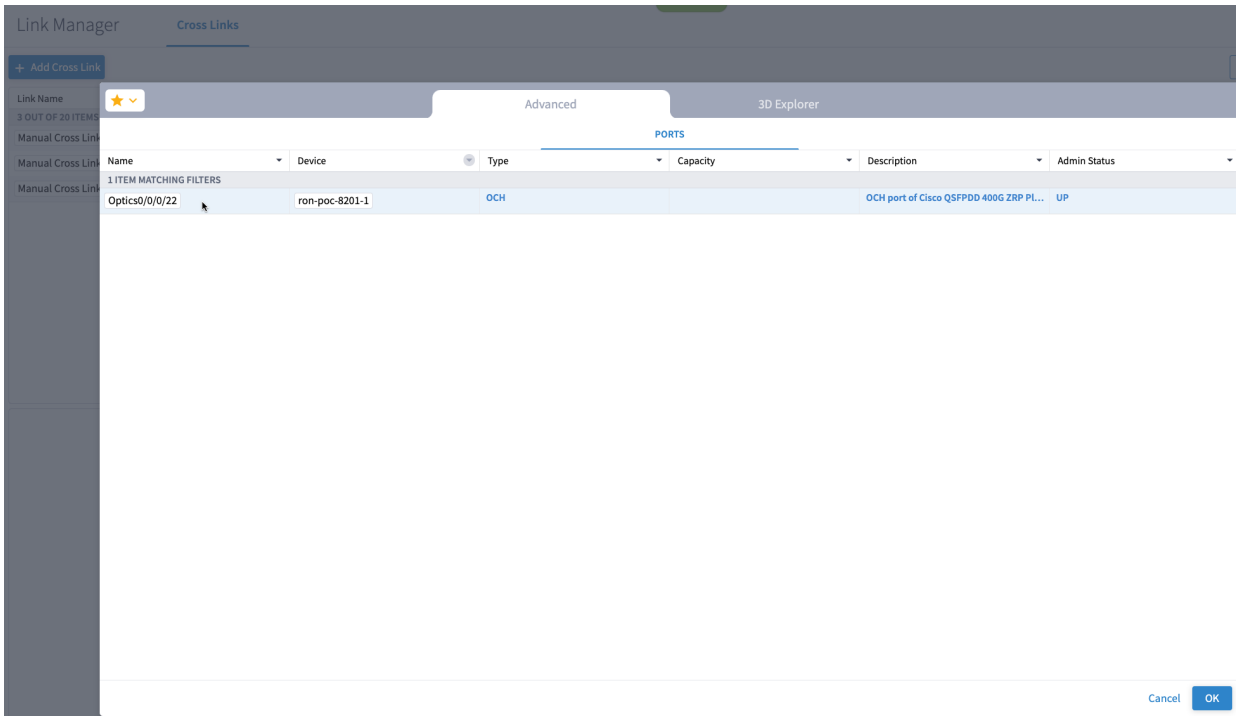



**d.** ou can select either the router DCO port or the optical add-drop port first using the Link Manager application. In this example, port filtering is performed by the router device used for the NMC cross-link.

Sample end-to-end configuration

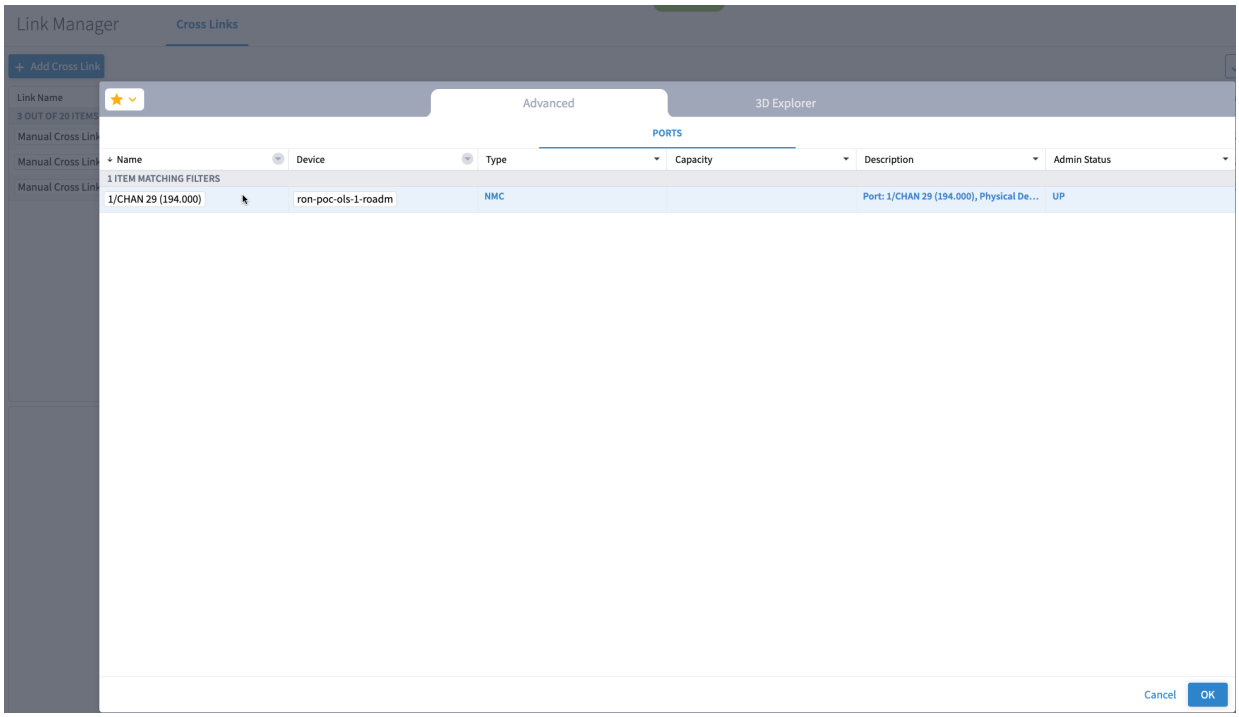



**e.** The filtered list shows that the router, *ron-poc-8201-1*, has a single ZR+ optics port. Select this port and click OK.




**f.** Select the second port, which is the optical add-drop port. To filter for the add-drop port, set the device to *ron-poc-ols-1* and the name to *194.000*.

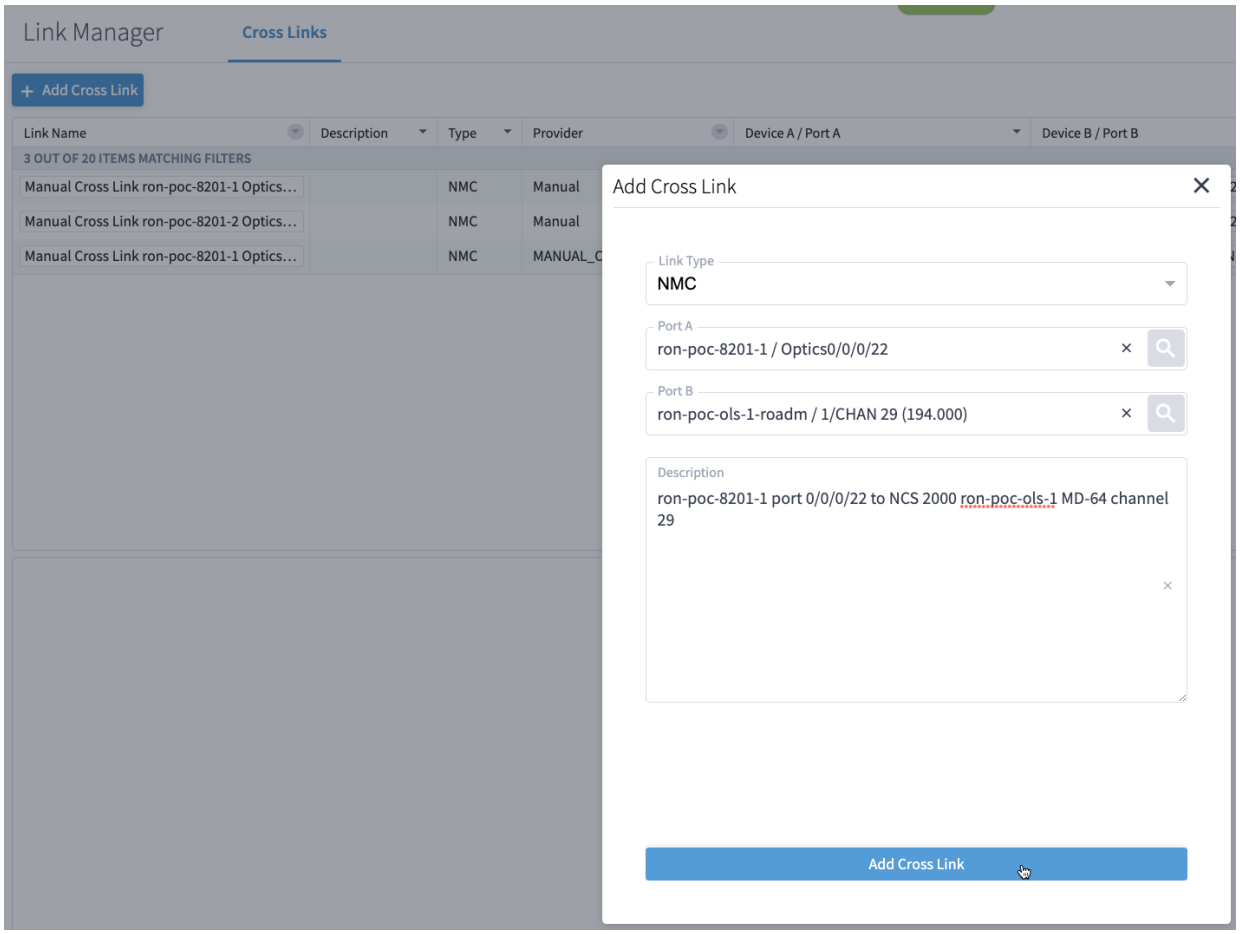
Sample end-to-end configuration



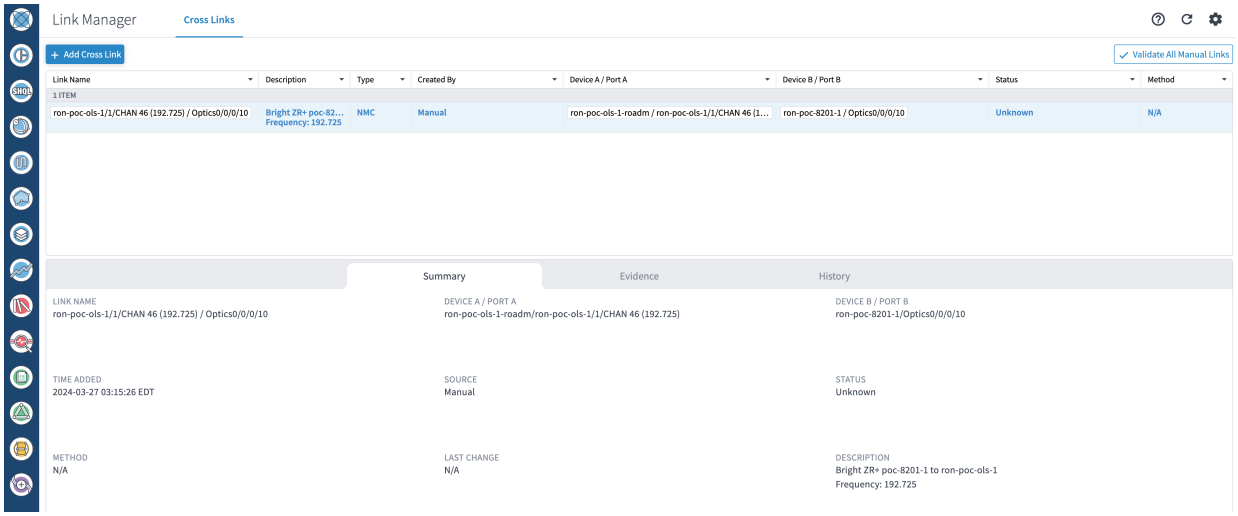

**g.** Select the two ports, Ethernet and OCH, in your NMC cross-link. Click **Add Cross Link**.

(Optional) Add a description.

Sample end-to-end configuration

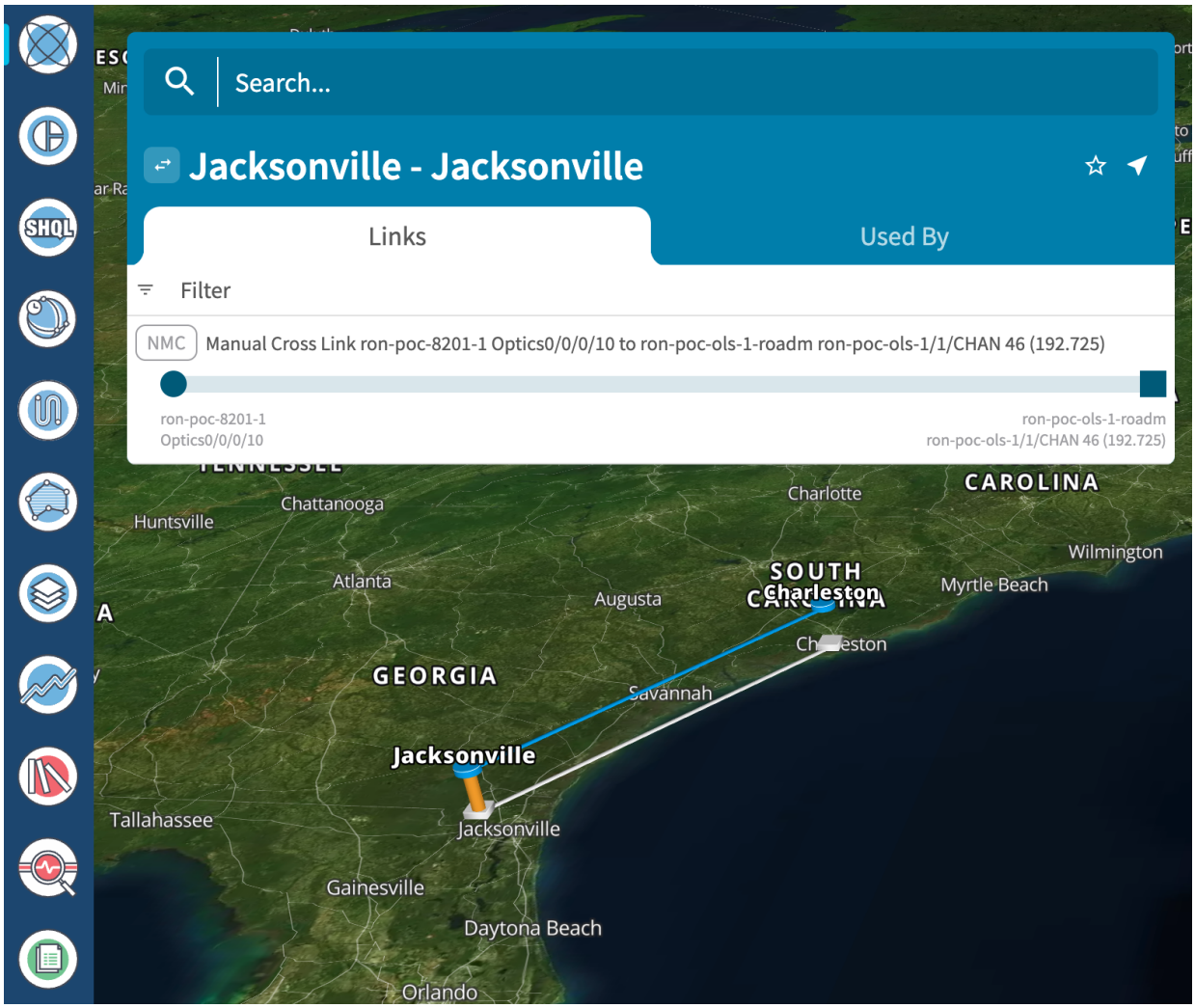



**h.** Click the added cross-link to see its attributes.

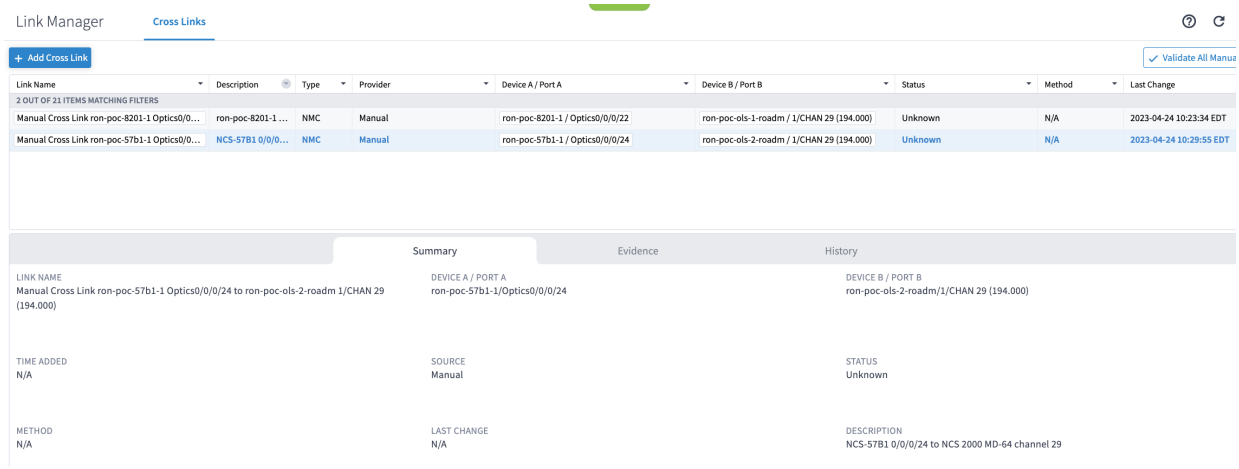



**i.** To view the added cross-link in the explorer app, click the link.

Sample end-to-end configuration

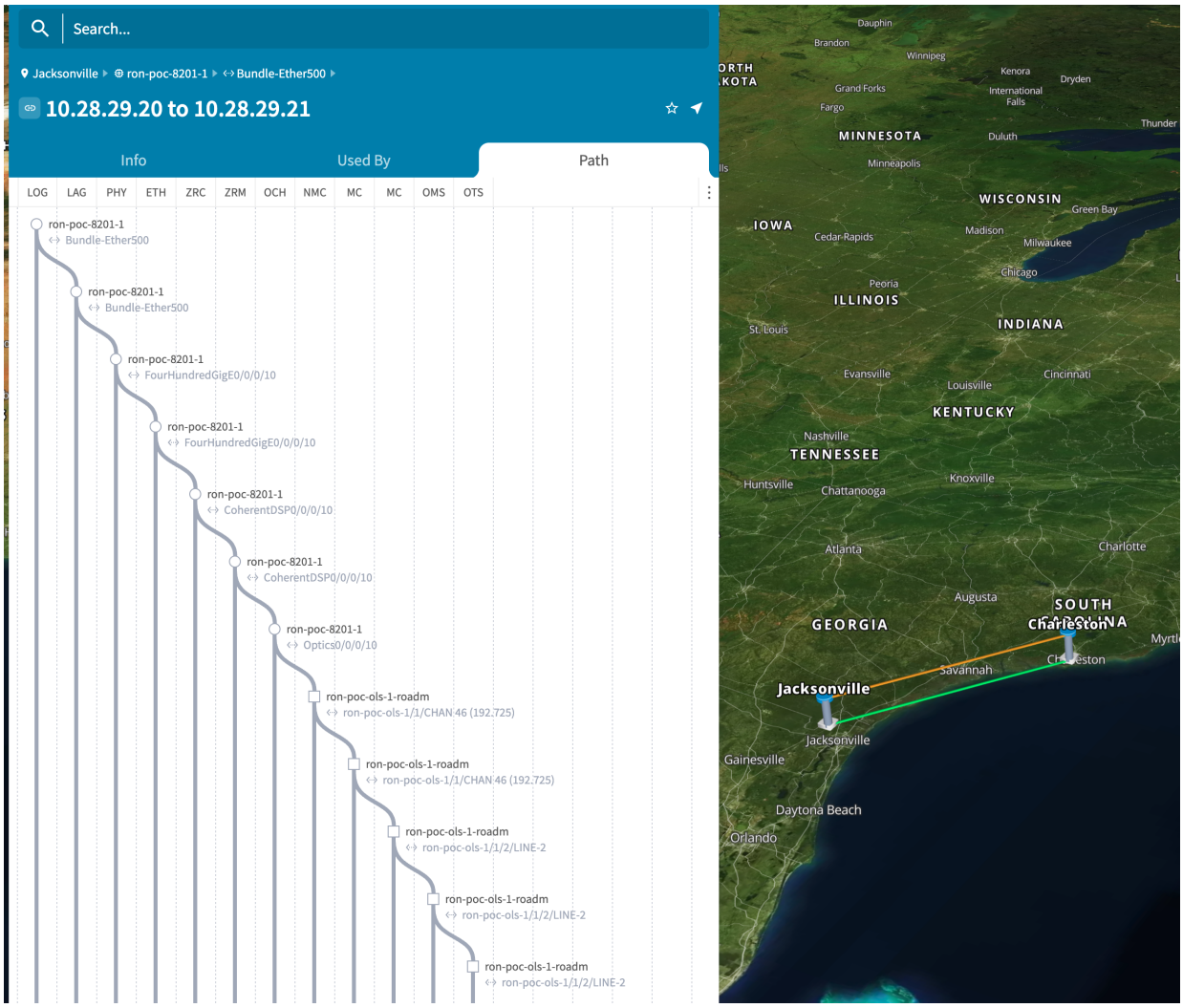



**j.** Create the second NMC cross-link using the same process as in the previous steps.




**k.** View the end-to-end network with both cross-links in the Explorer app.

Sample end-to-end configuration

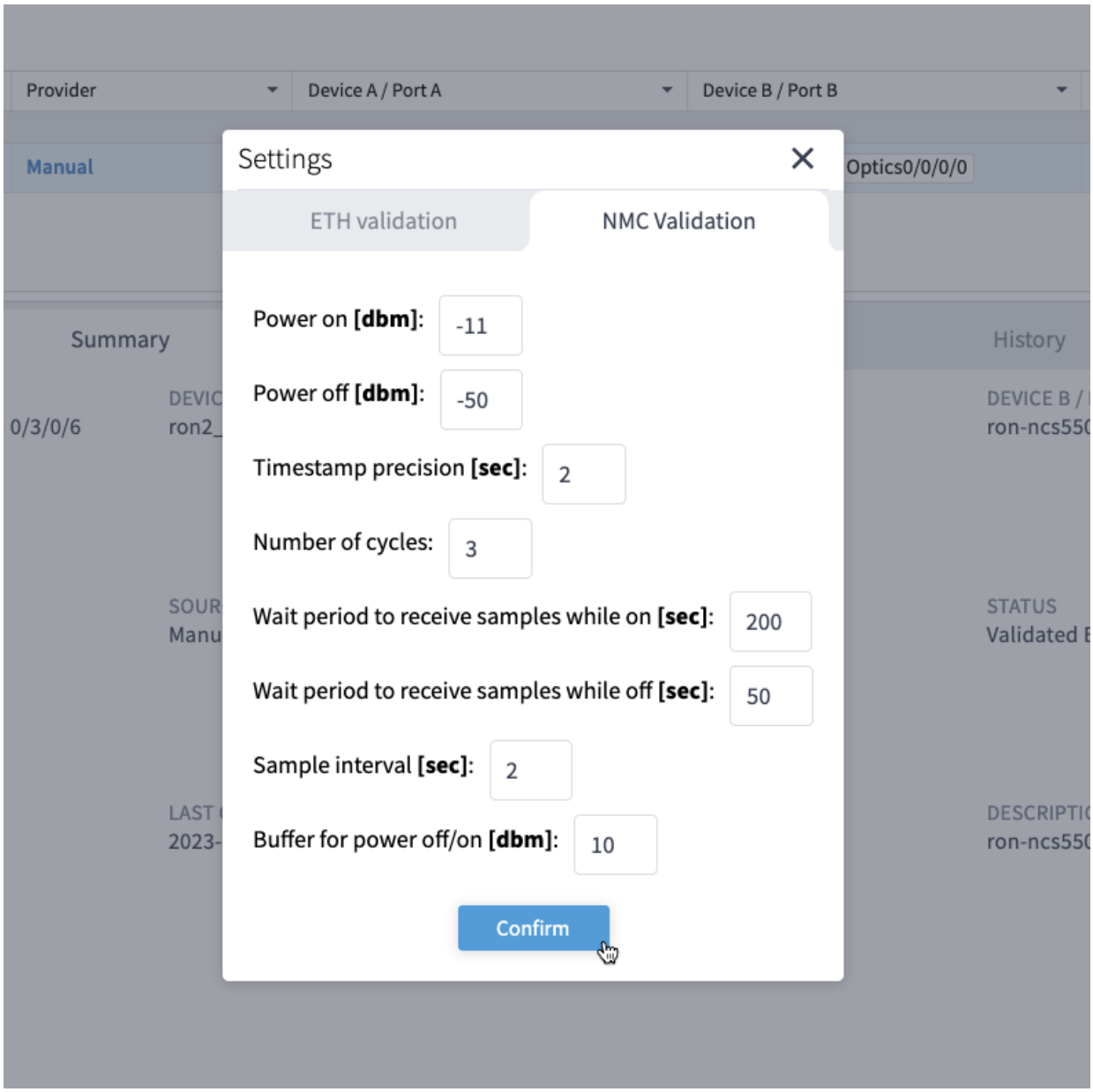



**Step 2** (Optional) Cross-link connectivity verification

- Cross-link connectivity verification is supported on all router platforms and on NCS 1010 with MD-32 and BRK-24 modules.
- Connectivity verification uses NSO CLI NED to modify router port state and transmit power, and is service-affecting.
- When validation starts, Crosswork Hierarchical Controller continuously checks the RX power on the optical add-drop port while performing connectivity verification in the background.

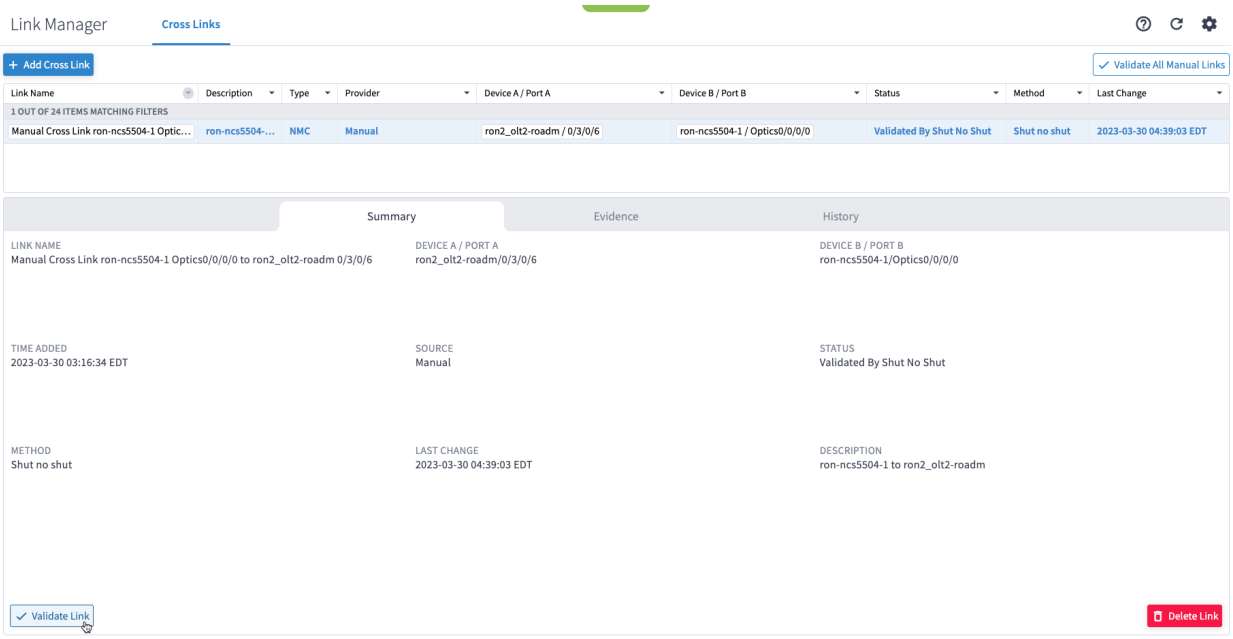
**a.** Configure NMC validation settings to control validation. Set the **Wait period to receive samples while on** to 180 seconds. Set the **Wait period to receive samples while off** to 50 seconds.

Sample end-to-end configuration

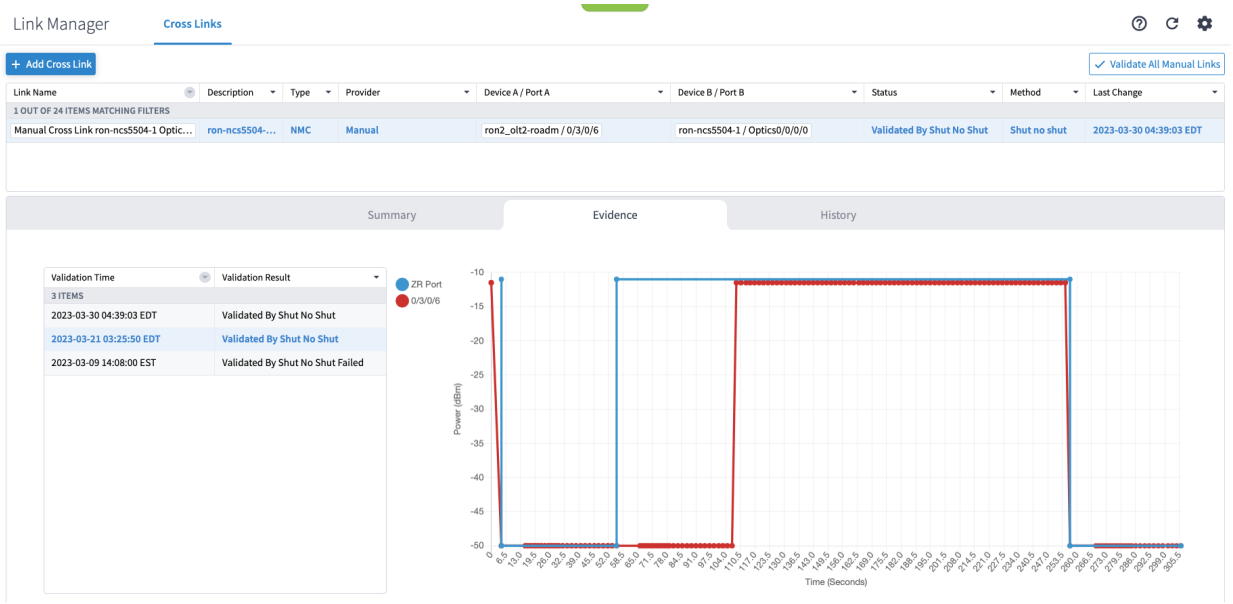



**b.** Select a link and click **Validate Link**. Alternatively, you can click **Validate All Manual Links** to perform connectivity verification for all the links.

Sample end-to-end configuration

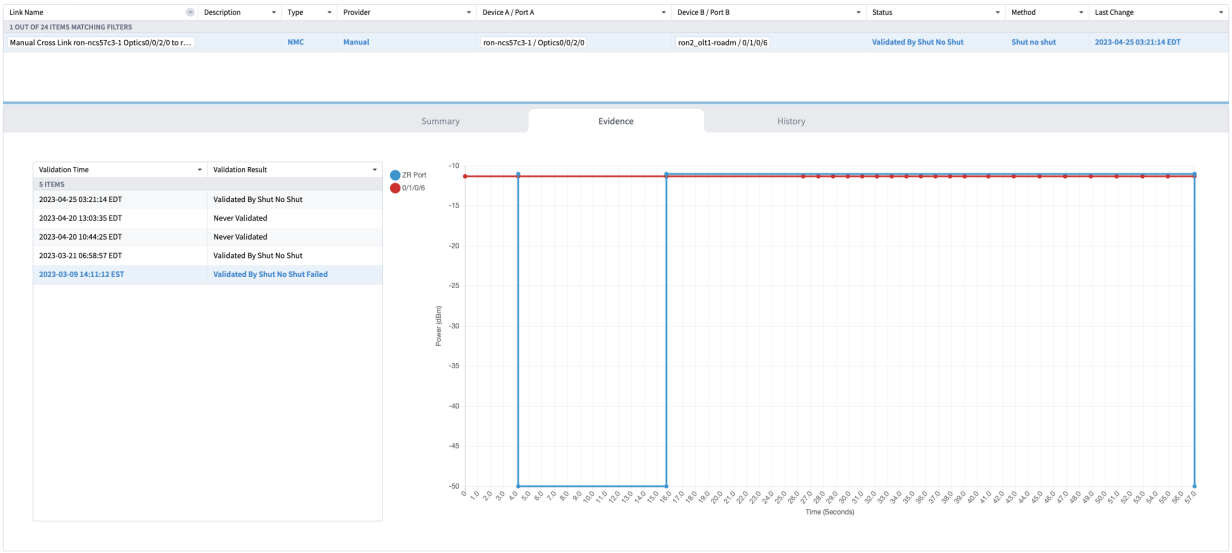



c. After validation completes, inspect the evidence of successful or unsuccessful verification. This image shows a successful verification. The status changes from **Unknown** to **Validated By Shut No Shut**. It typically takes 60 to 80 seconds for the ZR or ZR+ interface to start transmitting after the no shut command is issued.



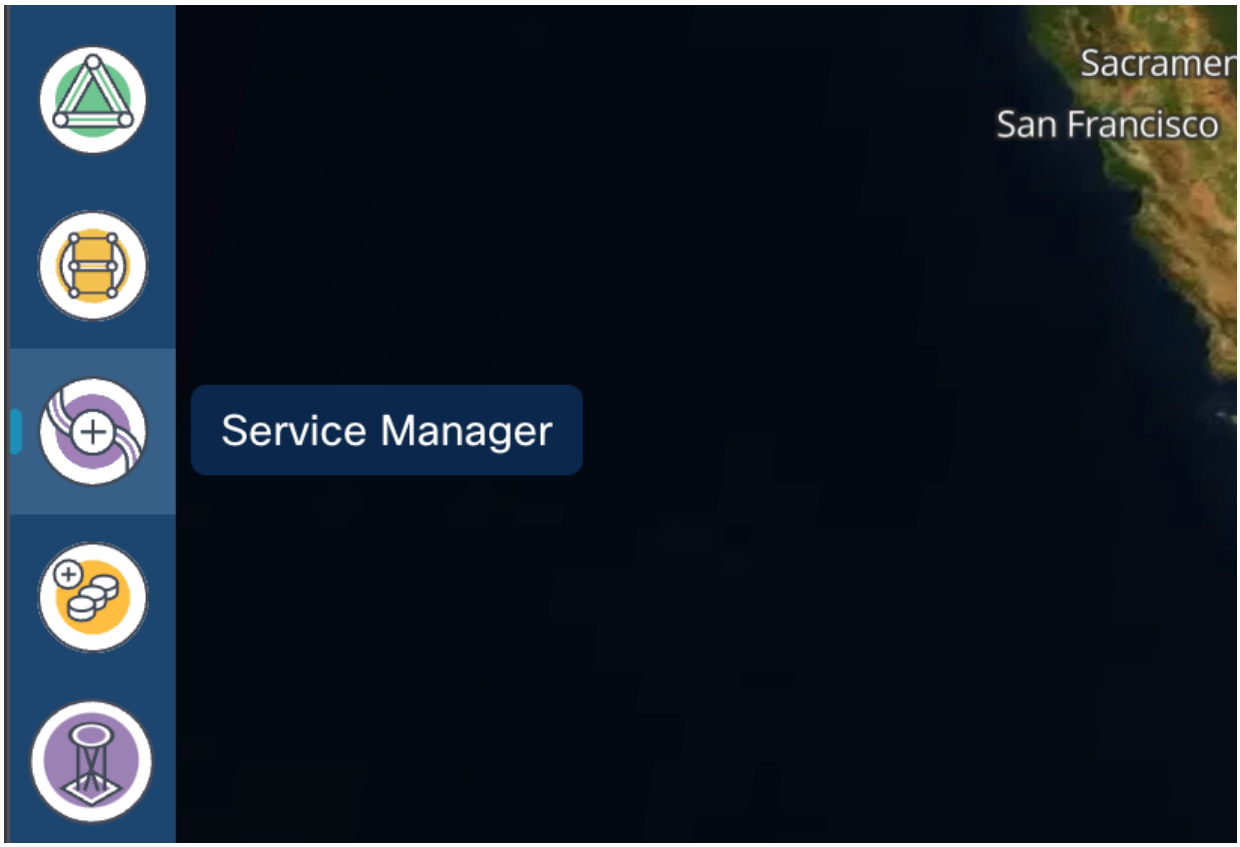

This image shows a failed verification. There is no change in the optical device port power levels after the **no shut** operation.

Sample end-to-end configuration

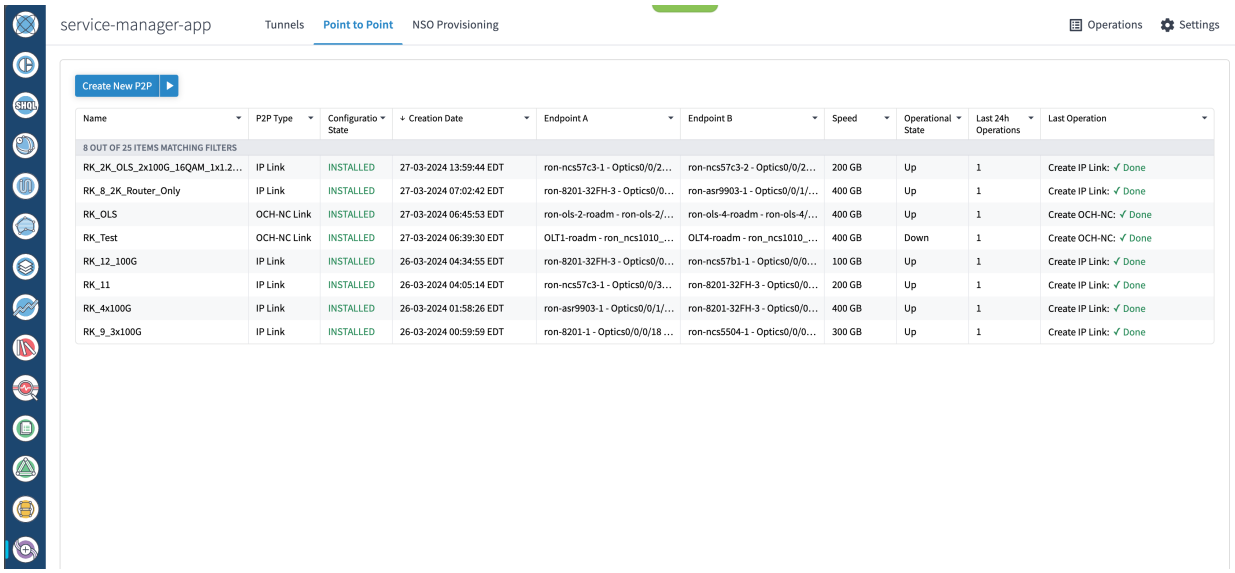



**Step 3** Provision the Routed Optical Networking IP link using these steps:

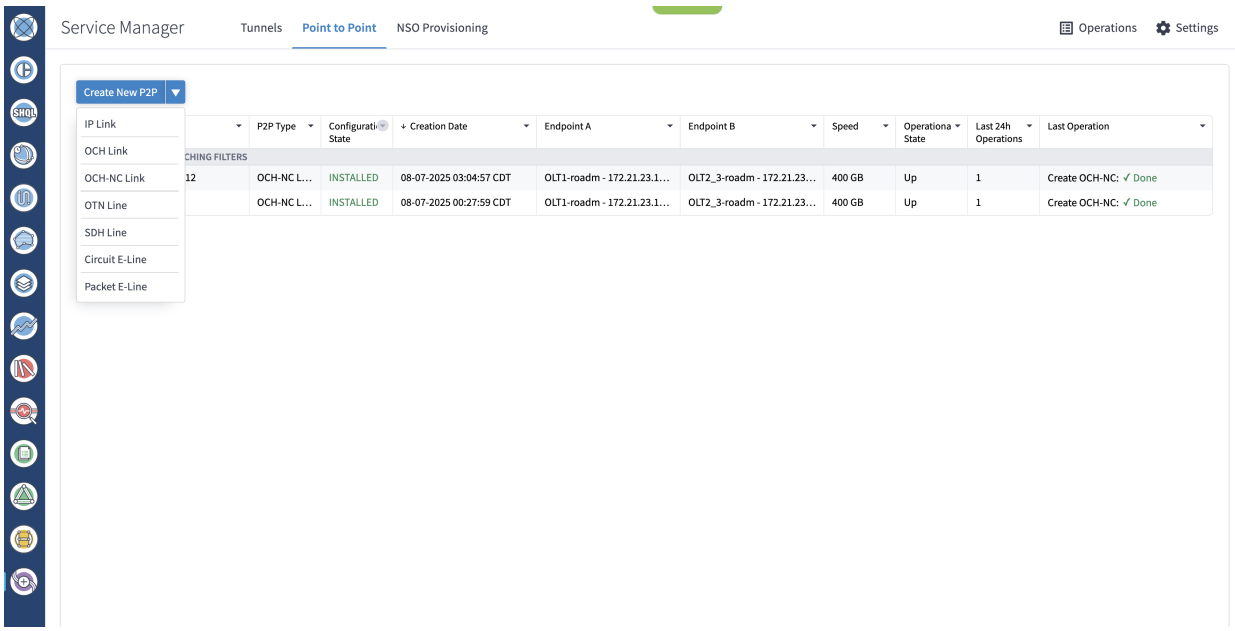
**a.** In the applications bar in the Crosswork Hierarchical Controller, click the **Services Manager** icon.




The Service Manager application shows you a list of services.




**b.** Select the **Point to Point** tab and click **IP Link** from the **Create New P2P** drop-down list to create end-to-end service between router DCO ports.

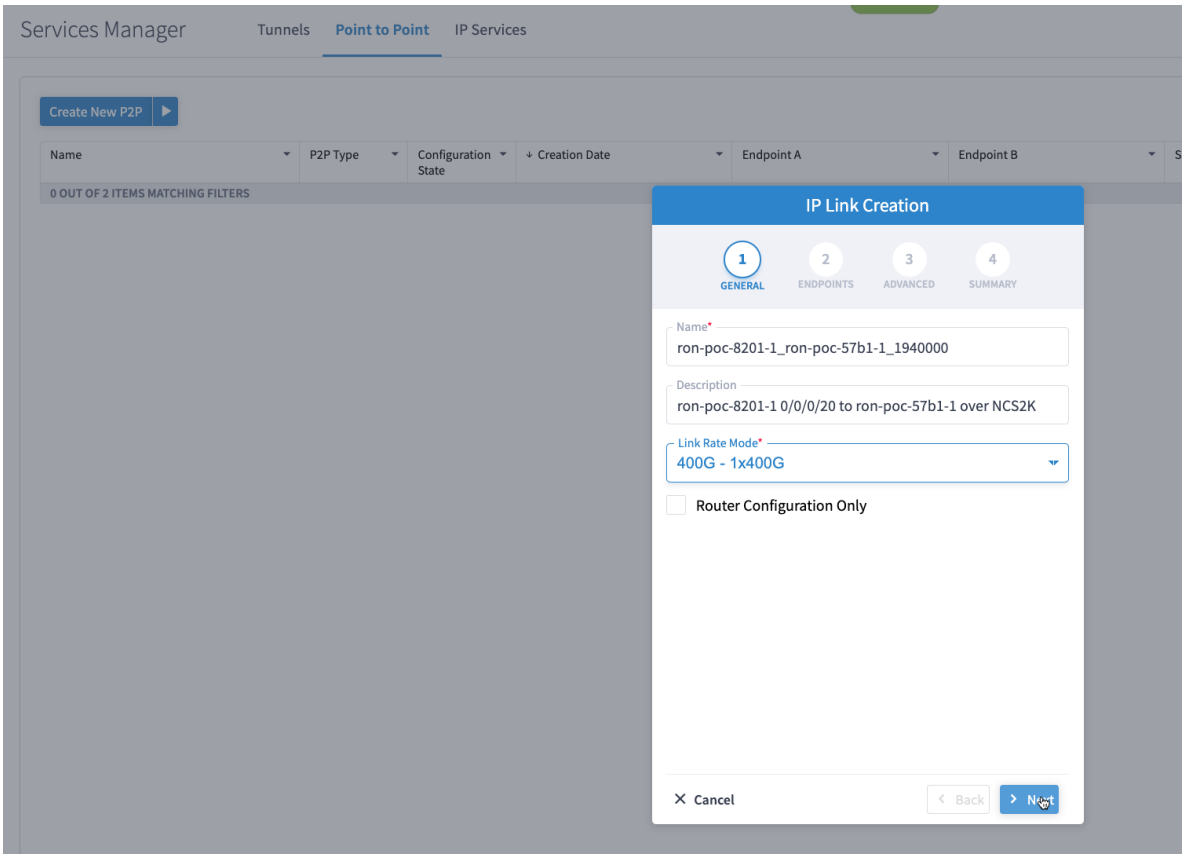



The **IP Link Creation** wizard appears.

**c.** Enter the Cisco Crosswork Hierarchical Controller service name, description of the router optical controller, and the Link Rate Mode in the **General** tab.

- Here, we are creating a 1x400G link. In 2x100G, 3x100G, and 4x100G modes, you can choose to create separate IP links or create a Bundle with each channel link added as a member.

Sample end-to-end configuration




***Alternatively***

- To create a 200G 16-QAM link, select the 200G–2x100G link rate mode.

  200G 16-QAM allows the use of 200G signals on 50Ghz optical line systems. The default value for 200G is QPSK at 60.1Ghz.

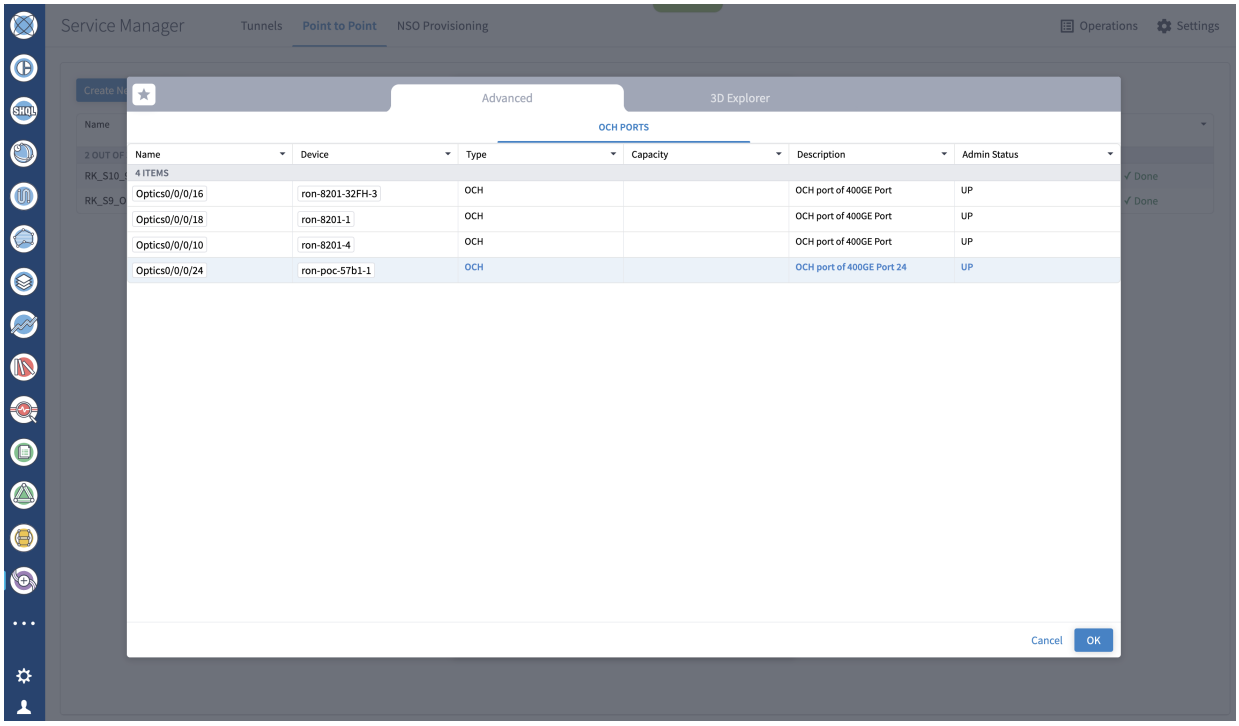
***Alternatively***

- To create a Bundle interface, Select a bundle option from the link rate mode drop down list.

  ou can create a 400G bundle interface (400G Member). You can also create a 300G bundle (3x100G Members) or a 200G bundle (2x100G Members).

(Optional) Check the **Router Configuration Only** check box to configure only the router optical controller and IP information and not the optical line system. This configuration is used when the OCHNC is created outside Cisco Crosswork Hierarchical Controller.

**d.** Select the two router ports in the service. This is done by selecting the site and port. The transmit power for each endpoint is an optional parameter. The default transmit power is used if no value is provided.



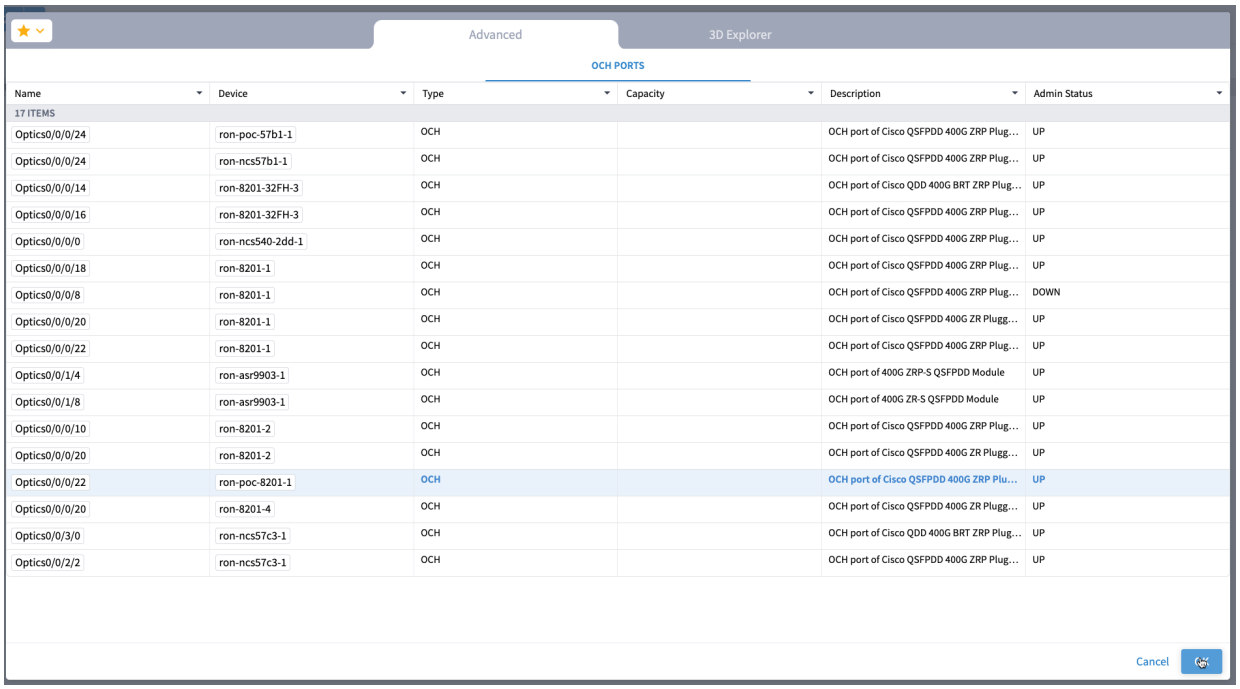

**e.** Click the magnifying glass icon to select the first router port.

The router interface selection displays interfaces on the router that satisfy these criteria:

- is a ZR or ZR+ interface,
- has no existing optics configuration, and
- has a proper NMC cross-connect configured.

This page lists all the available ZR and ZR+ ports currently unused on all the devices. Select the *ron-poc-8201-1 Optics0/0/0/22* port.

Sample end-to-end configuration




**f.** Similar to the previous step, choose *ron-poc-57b1-1 Optics 0/0/0/24* as the second router port.

**g.** (Optional) Set the transmit power in dBm on each port. If OLS provisioning is being performed, the OLS controller returns the optical power. If the OLS controller does not return the optical power or **router only** provisioning is being used, the router default power is used.

**h.** (Optional) Enter the IP address information for interfaces. If IP addresses are not entered, ZR and ZR+ router optical configuration happens; however, IP addresses are not configured.

**i.** Click **Next** to move to **Advanced** configuration.

**j.** (Optional) Set the frequency. If optical provisioning is being performed, the OLS controller can return the frequency to be used, and it may be omitted. If **router only** provisioning is being performed, the frequency must be specified.

**k.** (Optional) Set the DAC rate. A DAC rate setting can be used to enable OpenZR+ compatibility mode, disabling TX shaping and enhanced modem mode.

**l.** (Optional) Set links or nodes to include or exclude in the optical path. This setting is not available in **router only** provisioning.

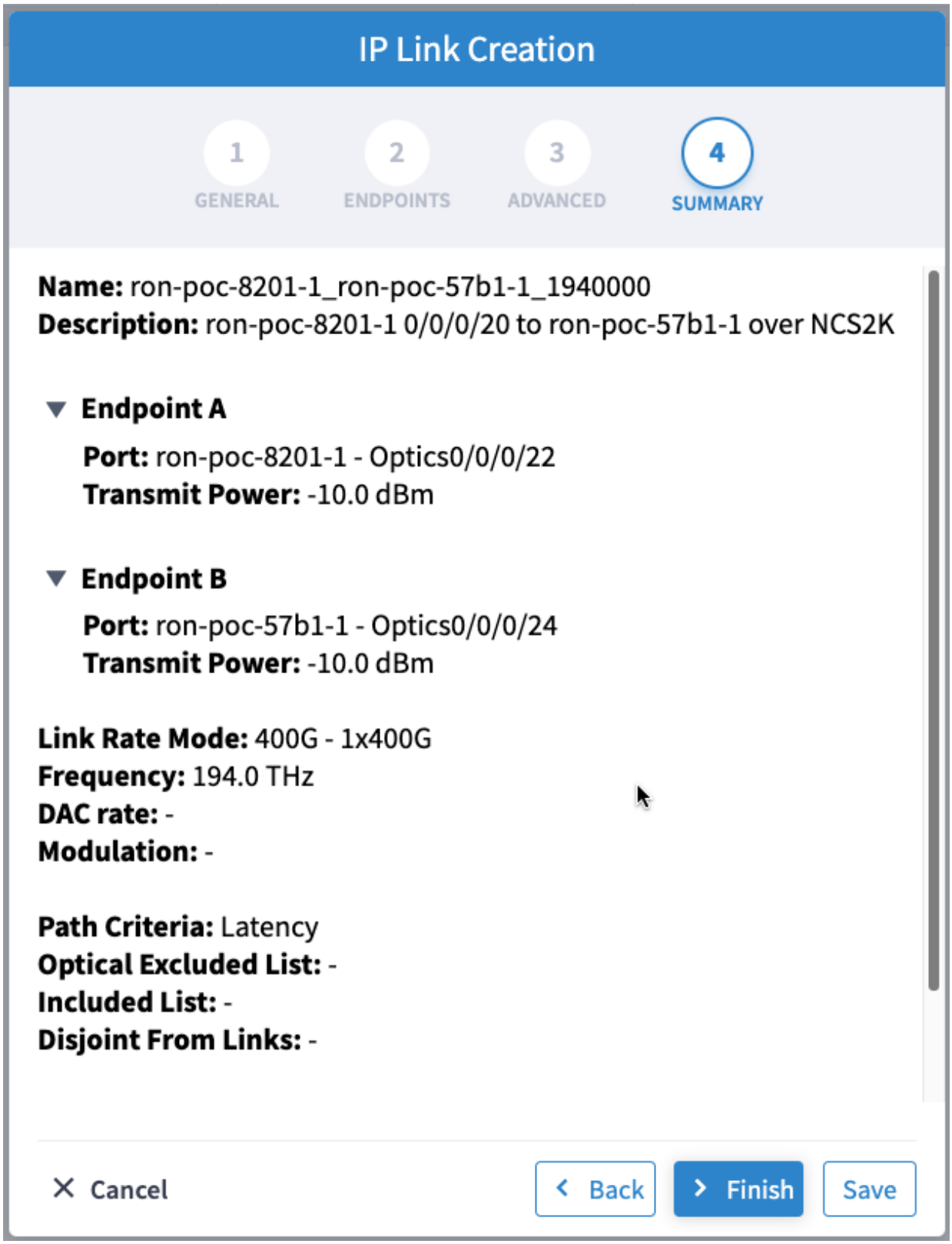
**m.** (Optional) To add the new link or set of links to an existing Bundle LAG interface configured on the routers, choose the bundle from the **Add to existing LAG** drop-down.

**n.** (Optional) If you are configuring a 200G 16-QAM link, set the DAC rate to 1 x 1.25.

200G link rate mode enables the **Modulation** selection drop-down. Modulation selection is not available in any other mode. Select the 16 QAM (30GHz) modulation.

o. Click **Next** to review the final configuration. Verify the router endpoint and optical line system parameters. Click **Finish** to start provisioning, or click **Save** to save for later provisioning.

Sample end-to-end configuration

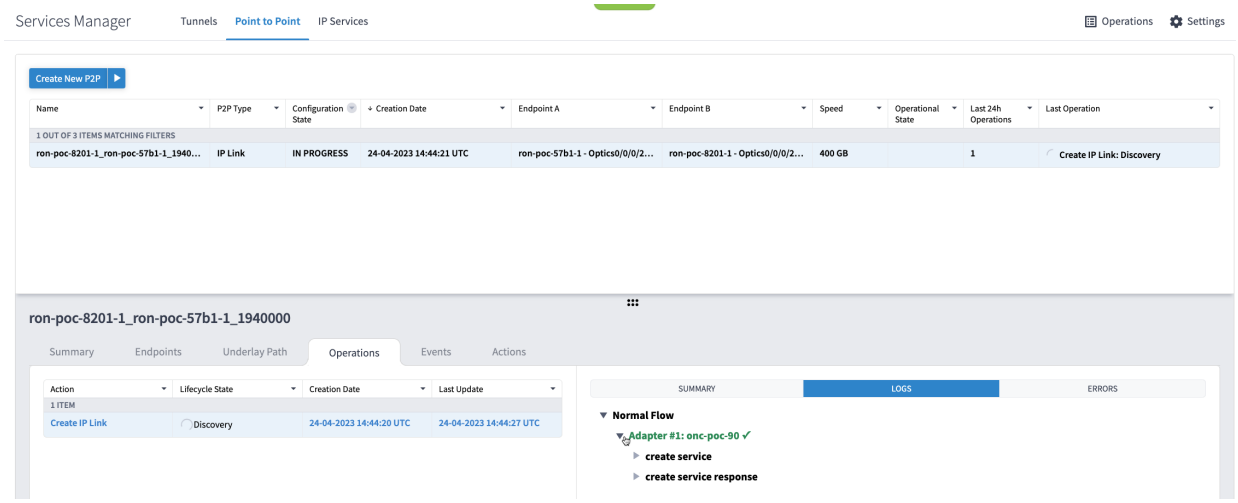


This image shows a sample summary for a 200G 16-QAM link.

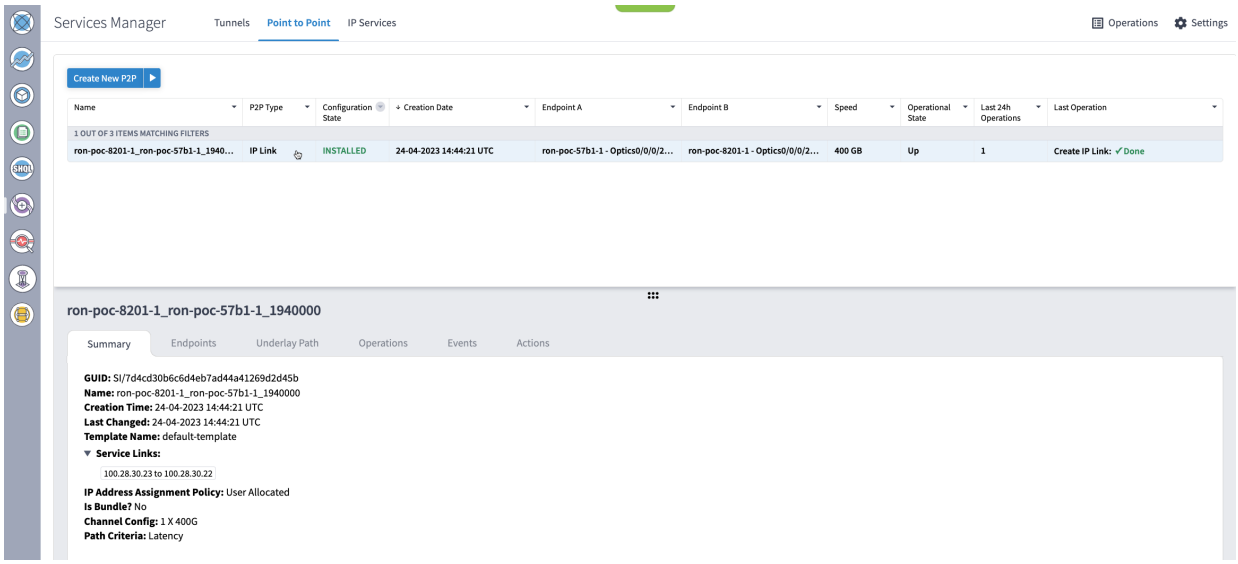
Sample end-to-end configuration

**p.** Go to Services Manager to view provisioning progress.

Click the **Operations** > **Logs** tab to view the provisioning API calls used and responses. The logs show API calls and responses for both optical line system provisioning through Cisco Optical Network Controller and router provisioning through Crosswork Network Controller.



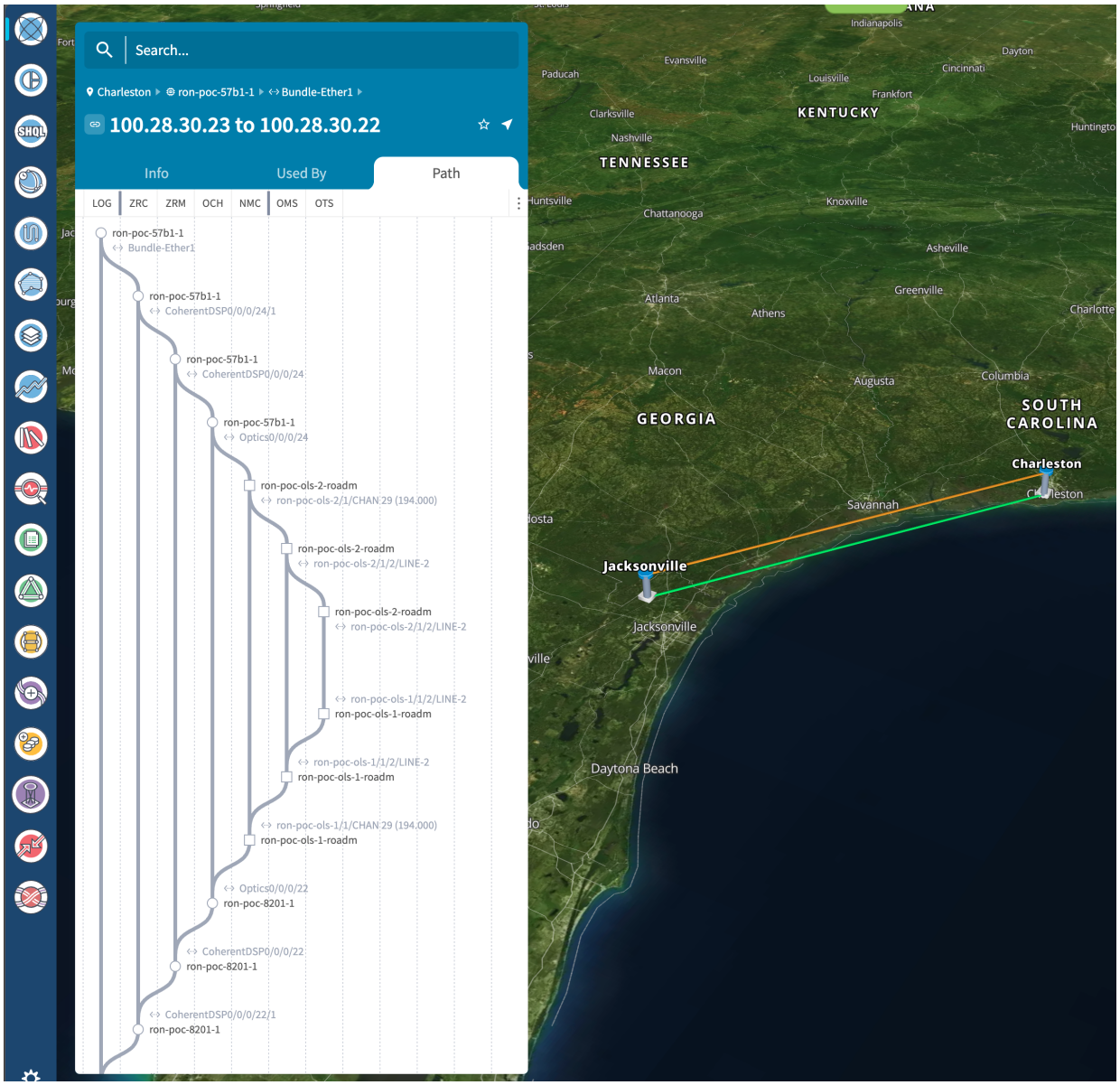

If the provisioning is successful, the **Configuration State** field changes to INSTALLED state and the **Operational State** field changes to UP state.



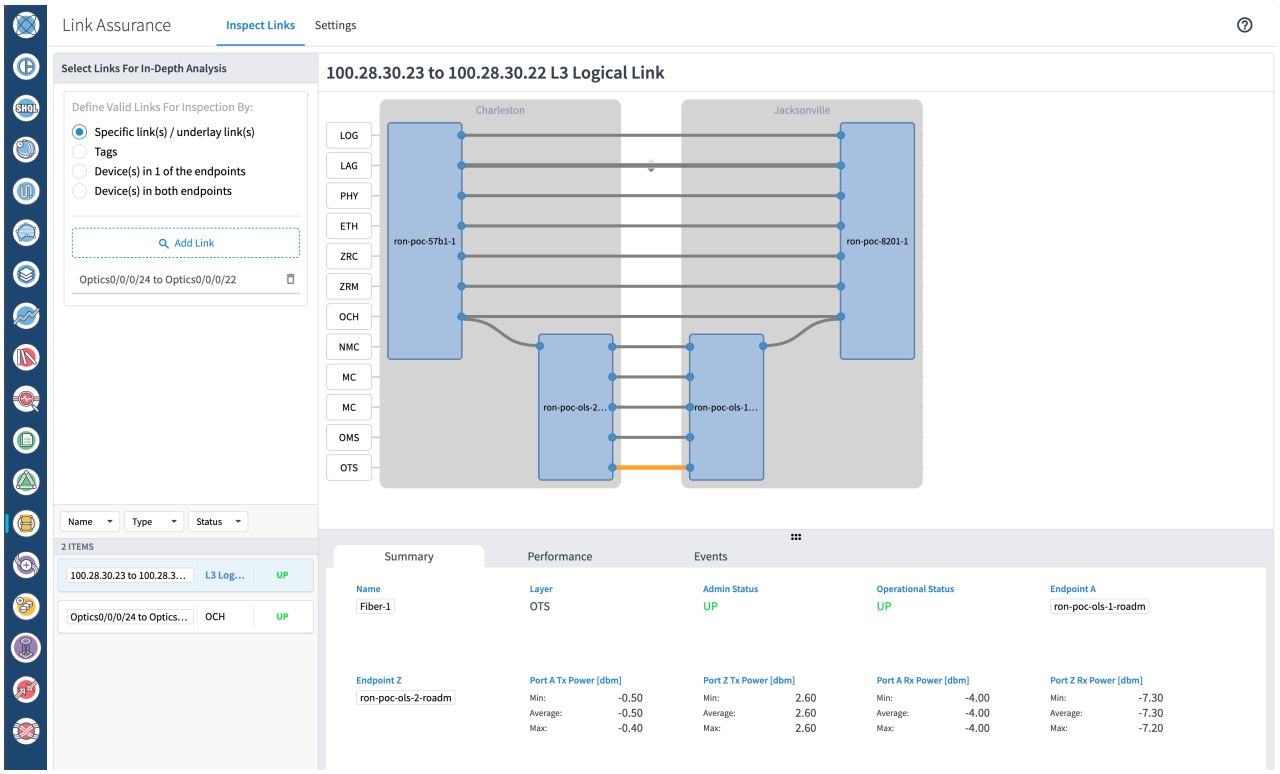

The **Summary** tab displays the new service link.

**q.** Verify the end-to-end link across both IP and optical layers in the Explorer view.

Sample end-to-end configuration




**Step 4** Use the Link Assurance application to verify the end-to-end path and view relevant PM data. Select a link or port to see data on the ZRM, OCH, and OTS layers.




# Operate phase

To monitor ZR or ZR+ optics, use EPNM and Crosswork Health Insights.

1. Use either CLI commands or EPNM to monitor router ZR or ZR+ optics for proper operation. See Monitor ZR or ZR+ optics using EPNM, on page 74.
2. (Optional) Setup router ZR or ZR+ optics data collection in Crosswork Health Insights. See Monitor ZR or ZR+ optics performance Using KPIs, on page 84.

To monitor NCS 1010, use Cisco Optical Network Controller and Cisco Optical Site Manager.

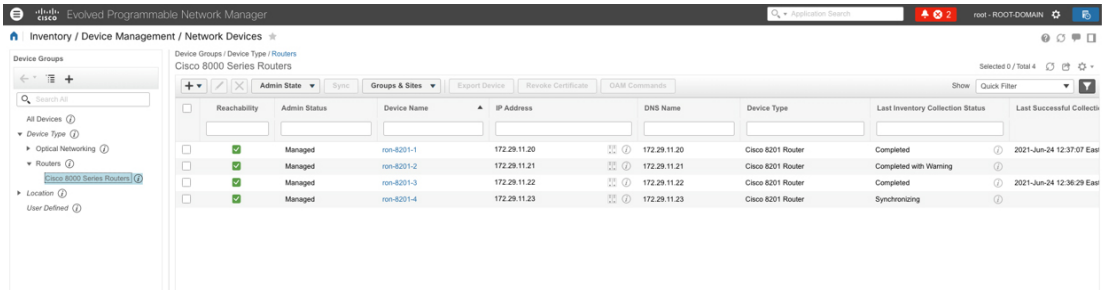
- Monitoring using Cisco Optical Network Controller
- Network and Circuit Monitoring using Workspaces in Cisco Optical Network Controller
- Monitoring Alarms in Cisco Optical Network Controller
- Fault Monitoring using Cisco Optical Site Manager

# Monitor ZR or ZR+ optics using EPNM

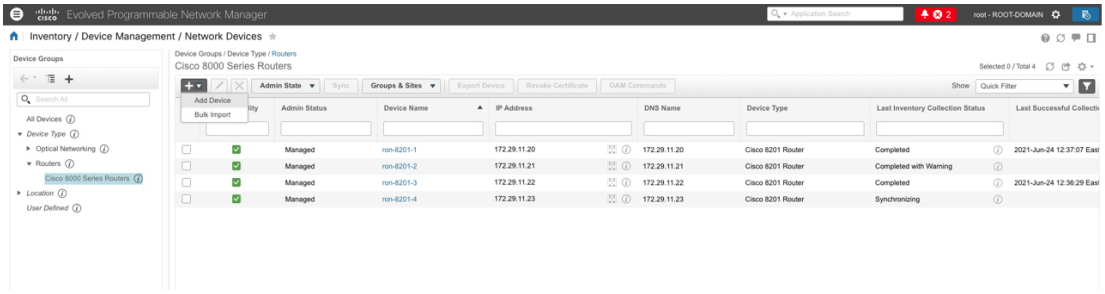
Follow these steps to add the 8201 router to EPNM for monitoring the PM parameters on the ZR or ZR+ optics.

## Procedure

**Step 1** Choose **Inventory > Device Management > Network Devices** to add a new device to EPNM. Click **Routers** or a subgroup if it is already defined in the left panel.

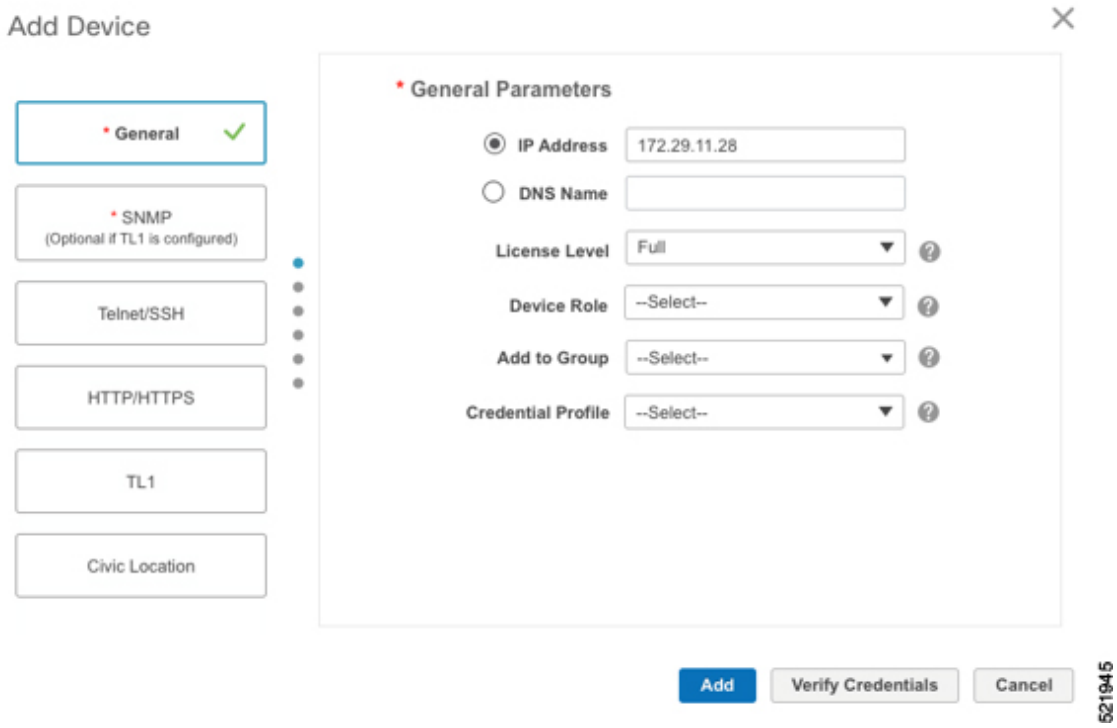


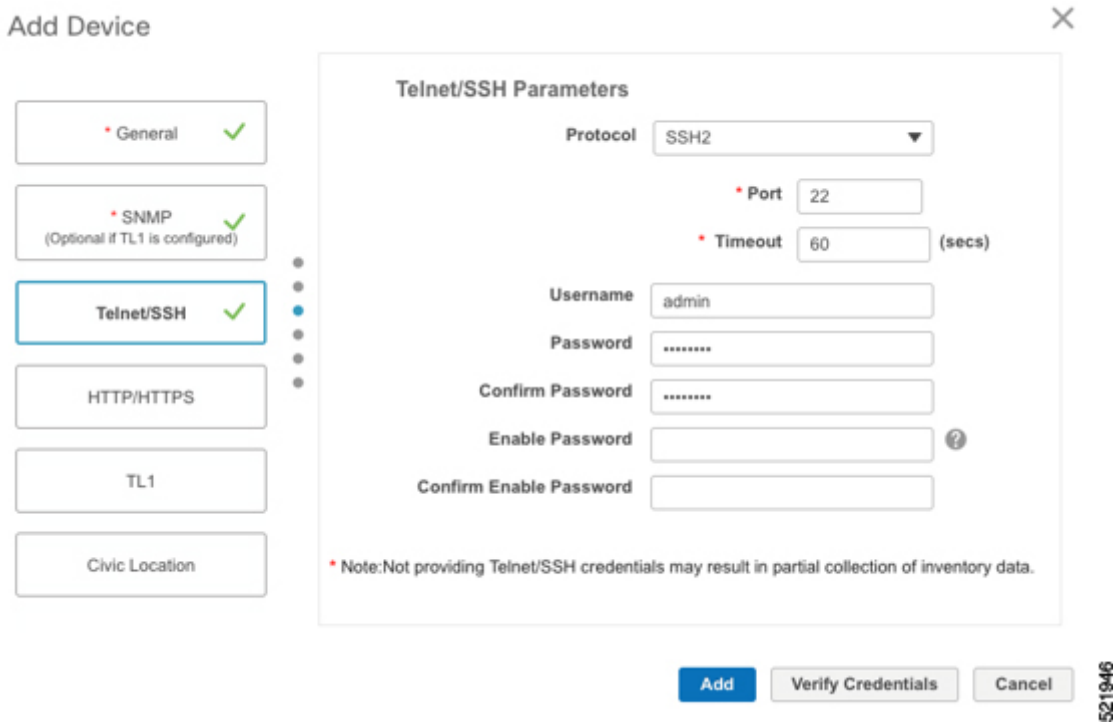

**Step 2** Click the + icon above the Network Devices table, then choose **Add Device**.

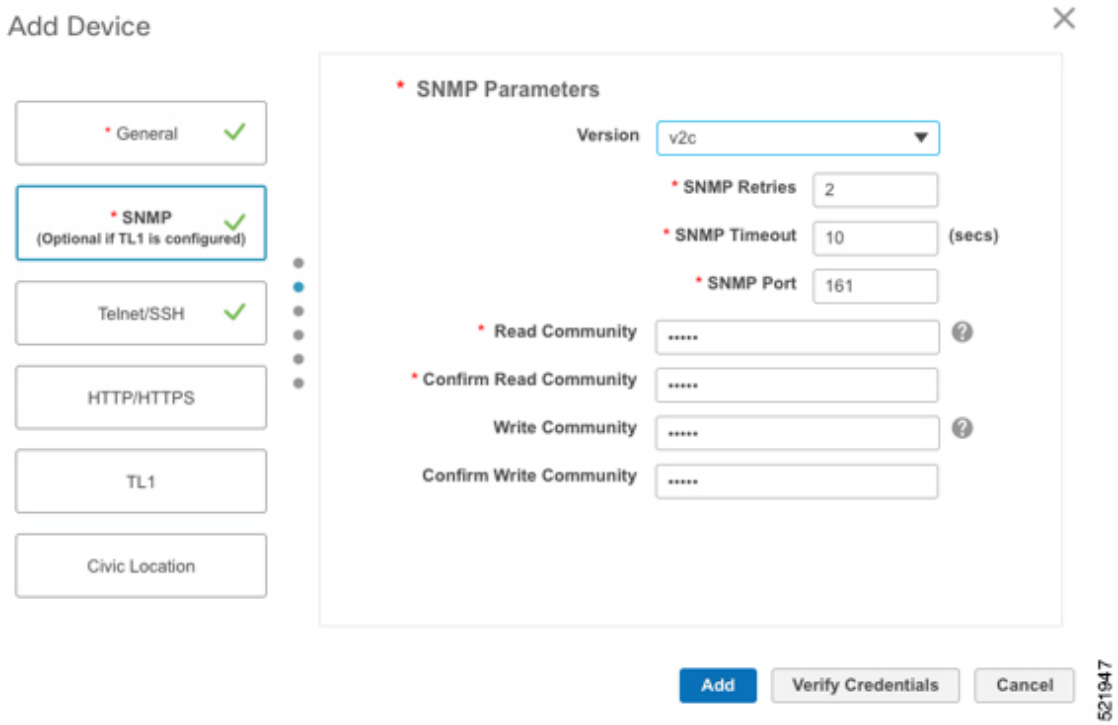



**Step 3** Configure the General, SNMP, and SSH parameters as shown in the figures. Then click **Verify Credentials** to confirm that Cisco EPN Manager can reach the device. Click **Add** to add the device to EPNM.

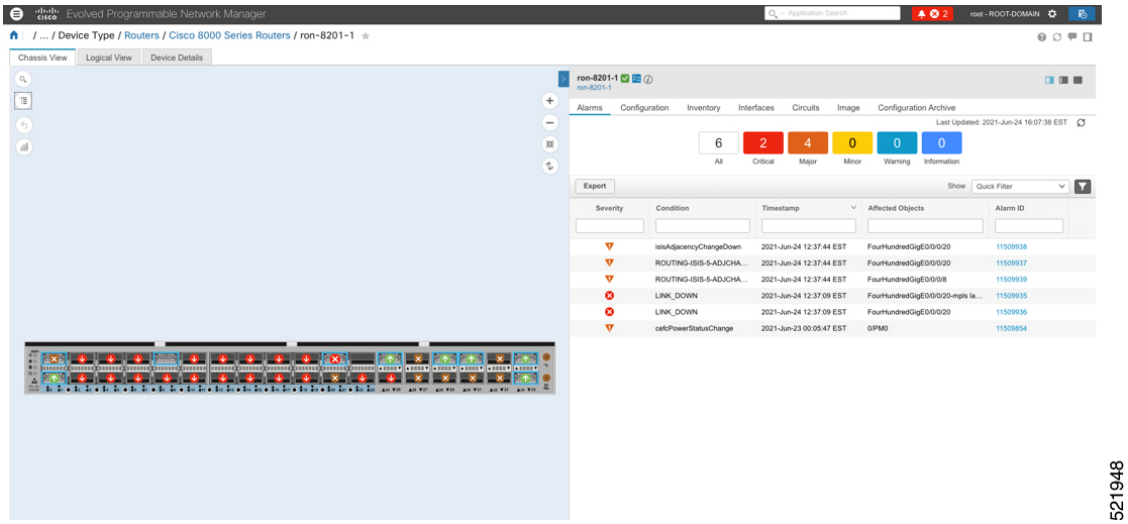
Sample end-to-end configuration



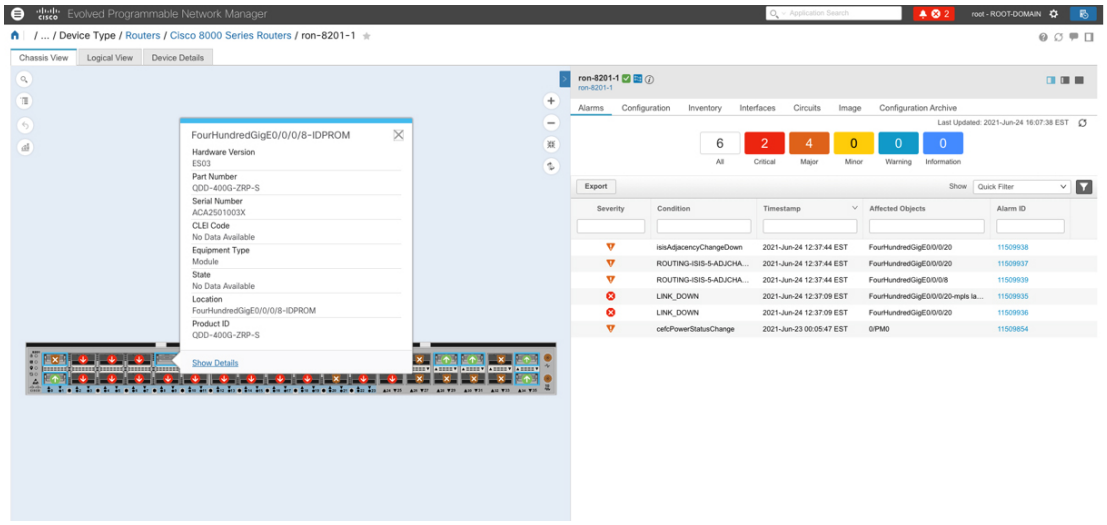



**Step 4** Click the device name link in the Network Devices table to open the chassis view. This figure shows the chassis view of the 8201 router.



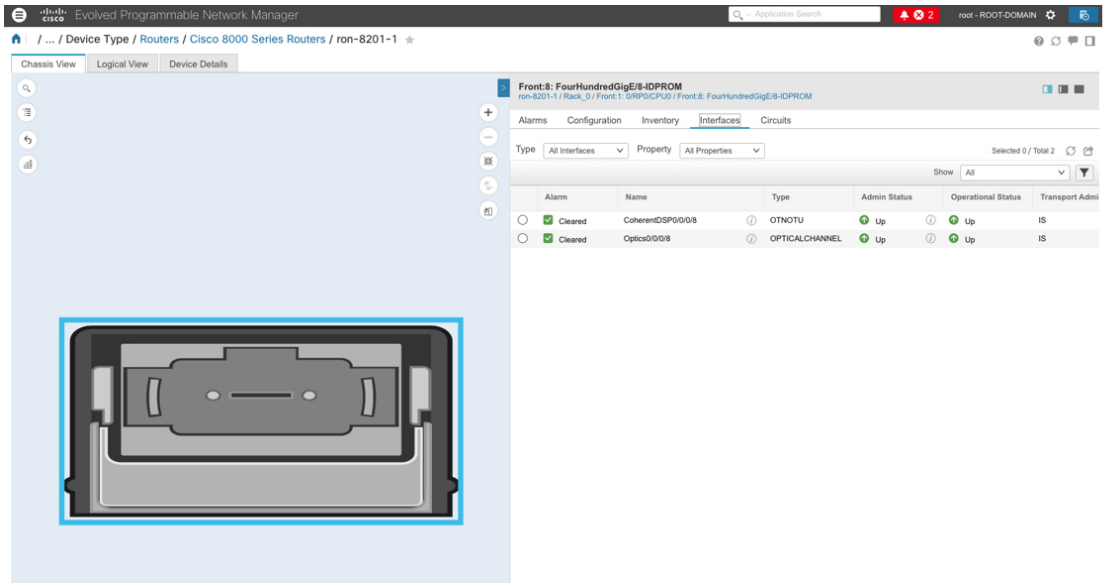

**Step 5** Click the QSFP-DD ZR+ port to view details about that port.

Sample end-to-end configuration




521949

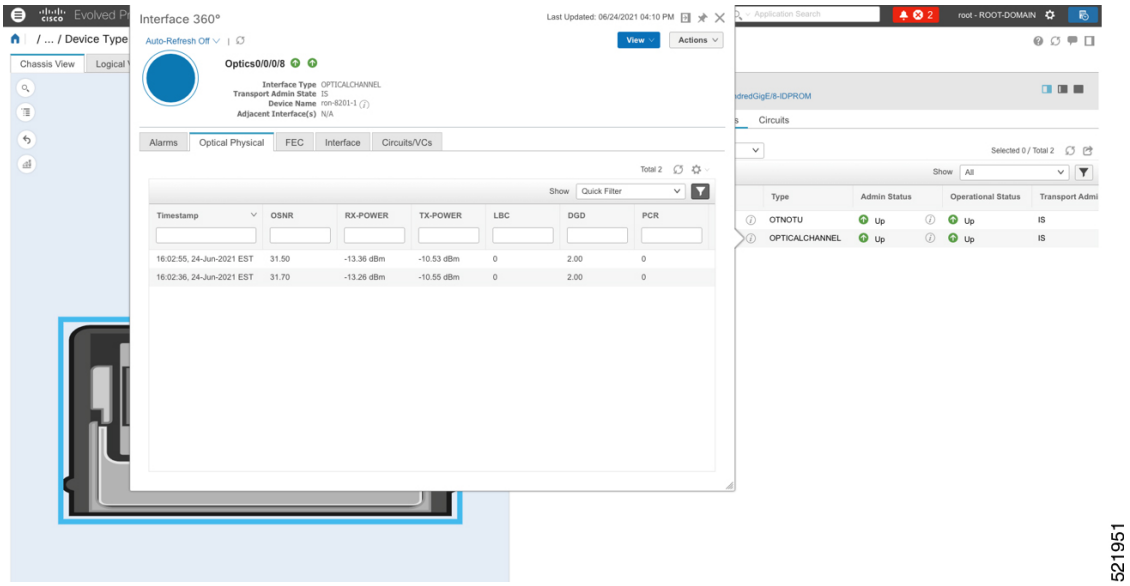
Here, you can view the port, the specific optical channel, and the CoherentDSP entities.



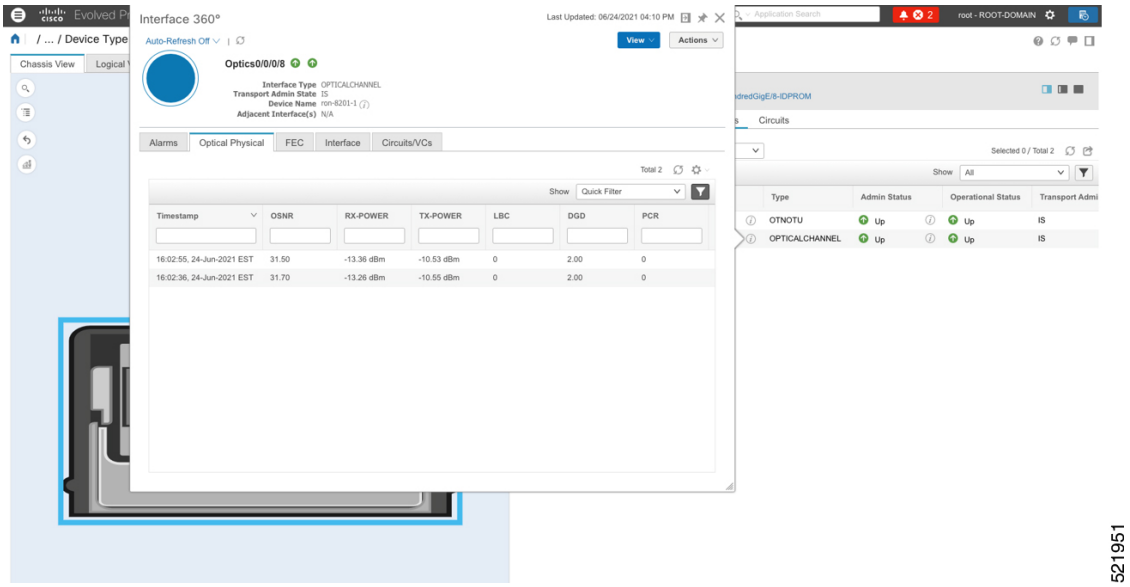

521950

**Step 6** Click the additional information icon for the optical channel. Then select the **Optical Physical** measurement tab to display relevant optical PM values such as **RX/TX signal power** and **OSNR** values.

Sample end-to-end configuration



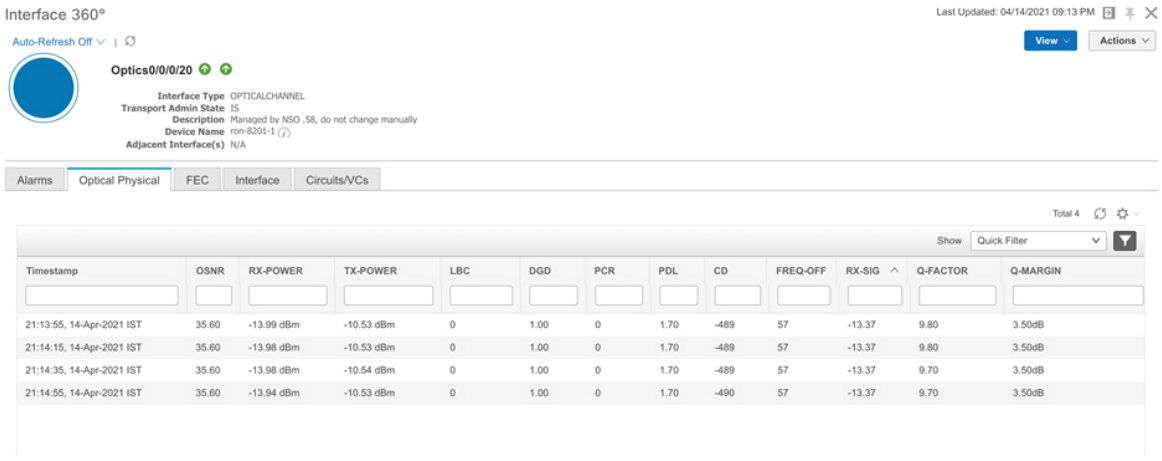

**Step 7** Click the additional information icon for the coherent DSP. Then select the **FEC** measurement tab to display relevant coherent DSP FEC statistics such as **PreFEC Bit Error Rate, Bit Error Rate Count (BIEC),** and **Uncorrected Words (UCW)**. The UCW value must remain 0.




These figures display EPNM monitoring data relevant to ZR or ZR+ optics, including current and historical performance.

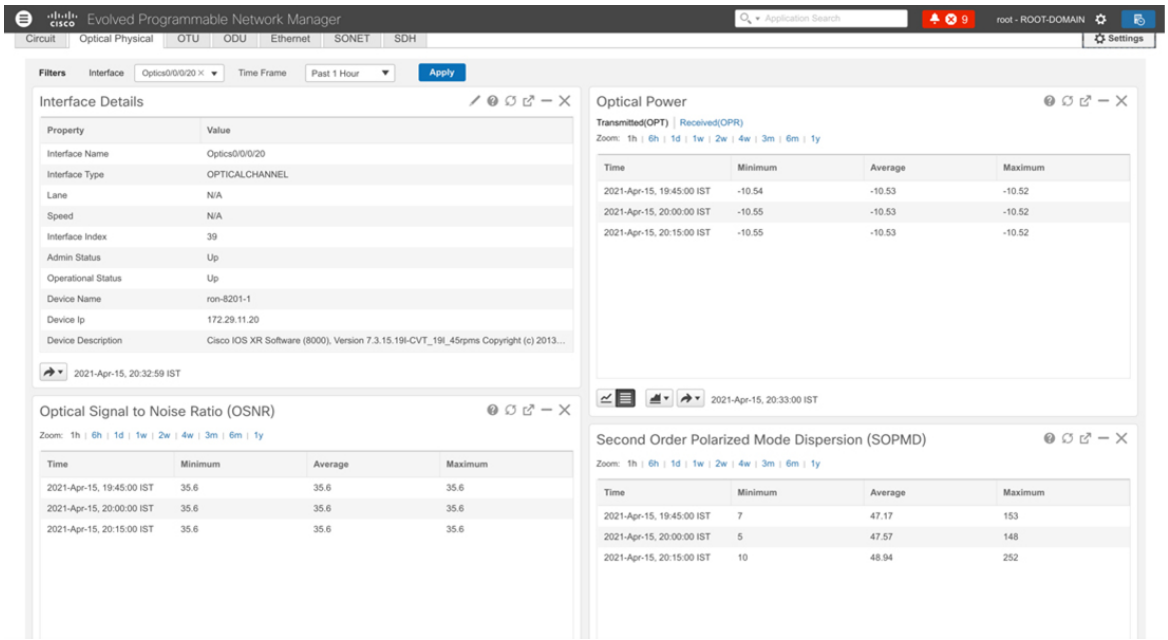
Sample end-to-end configuration

*Figure 34: Optical physical parameters*




521883

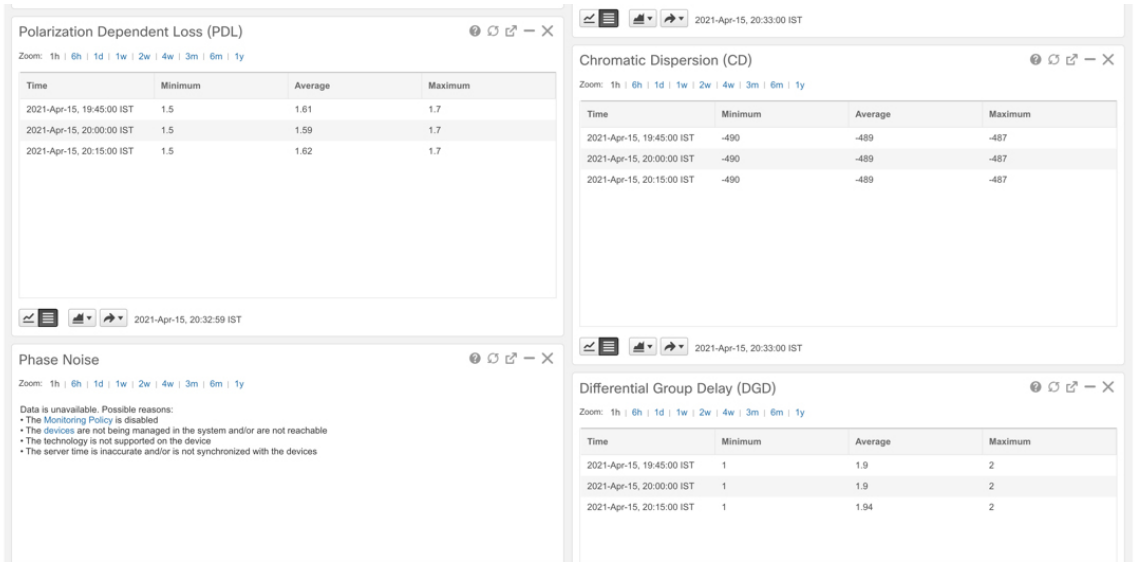
*Figure 35: Historical optical physical parameters*




521884

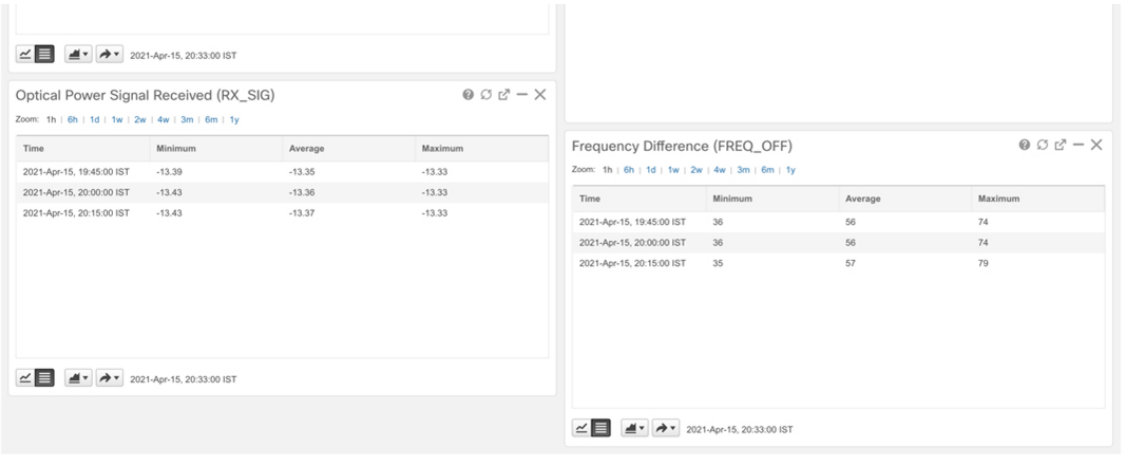
Sample end-to-end configuration

*Figure 36: Historical optical physical parameters*




521885

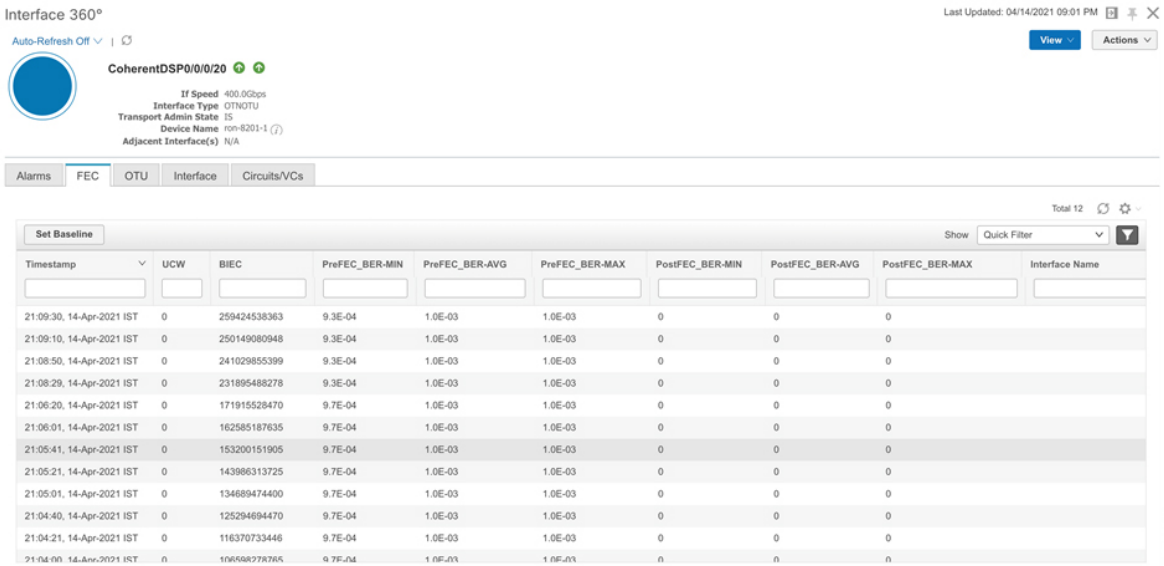
*Figure 37: Historical optical physical parameters*




521888

Sample end-to-end configuration

*Figure 38: FEC parameters*



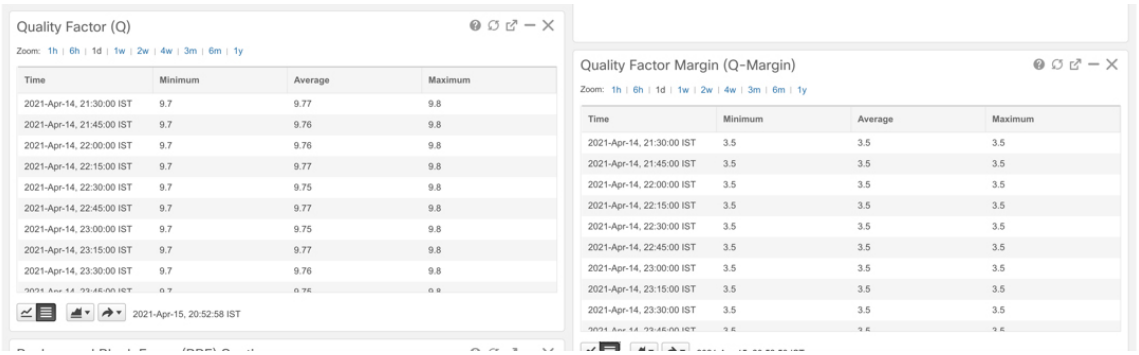

521881

*Figure 39: Historical FEC parameters*


521889

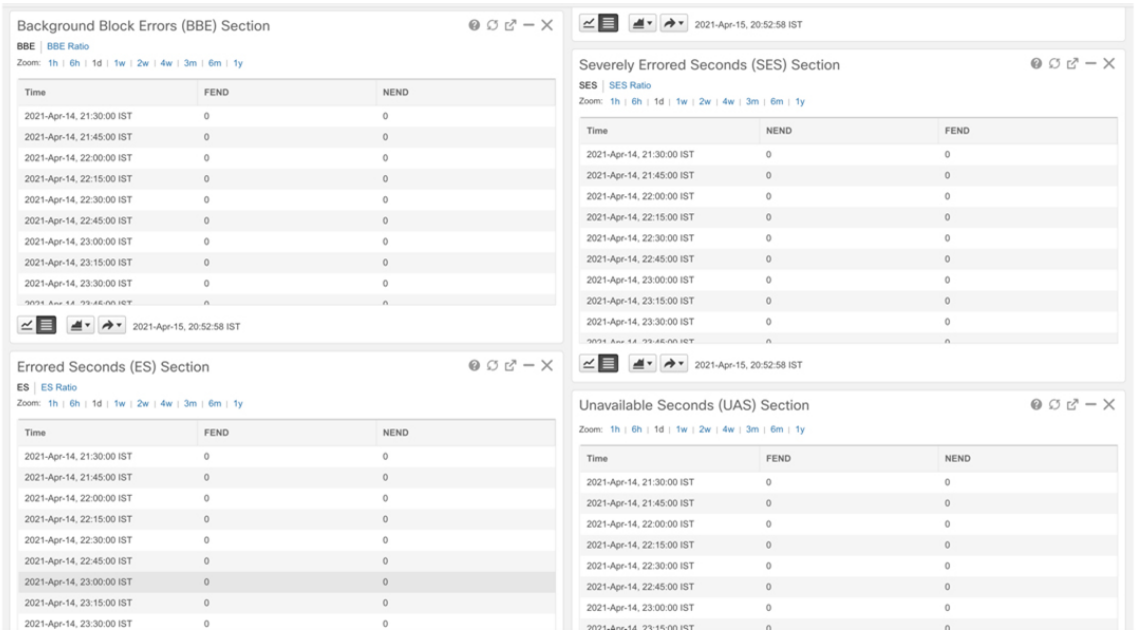
Sample end-to-end configuration

*Figure 40: Historical FEC parameters*



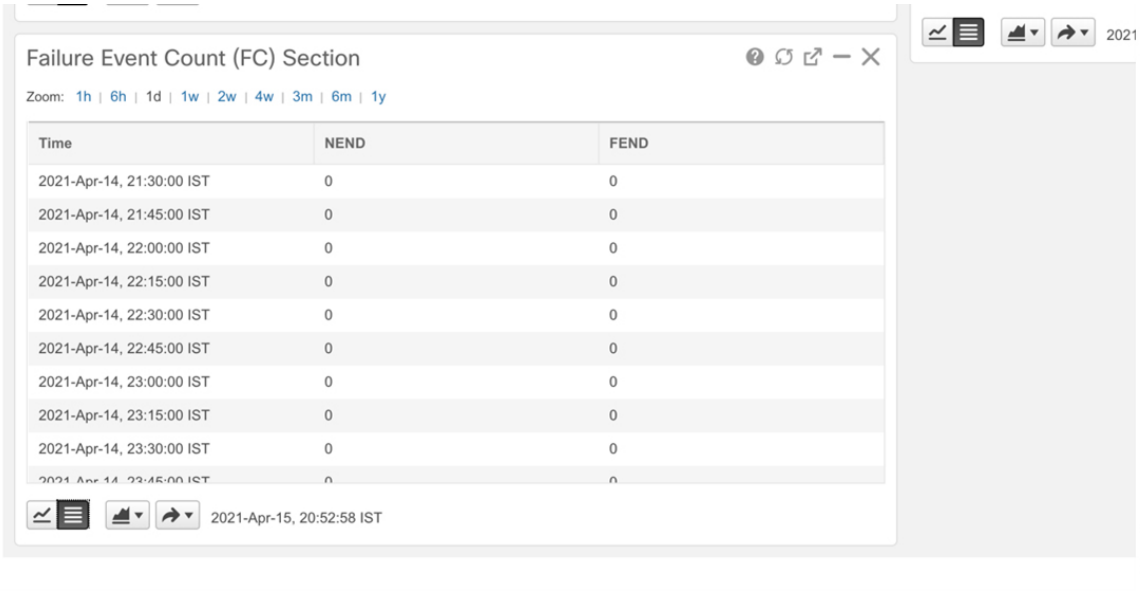

521890

*Figure 41: Historical OTN parameters*




521891

*Figure 42: Historical OTN parameters*



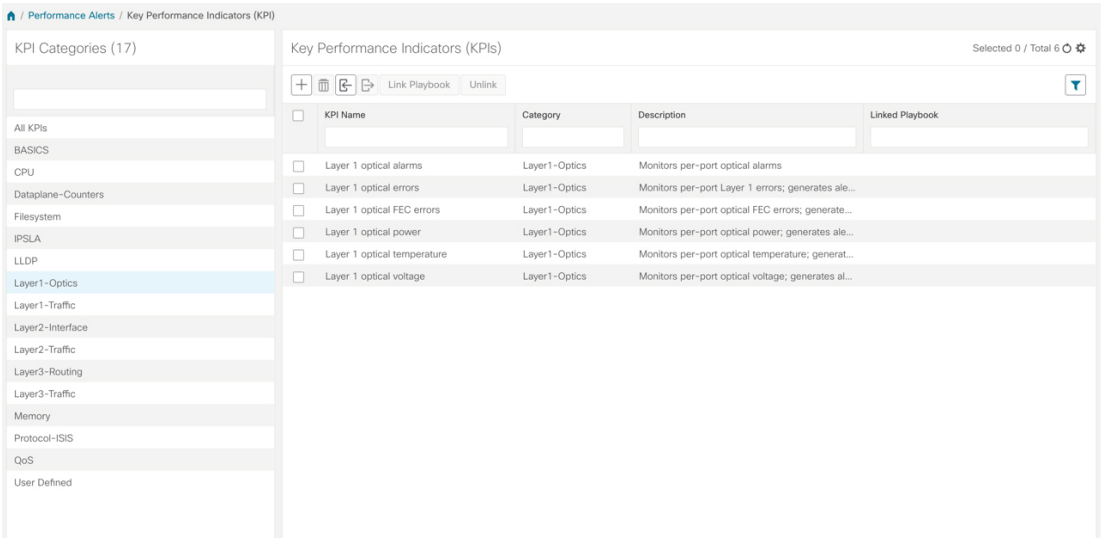

# Monitor ZR or ZR+ optics performance Using KPIs

The purpose of the task is to enable KPI monitoring for ZR or ZR+ optics to track device health using Health Insights.

Use the KPIs supplied by Cisco to monitor specific network optics. Configure and enable KPI profiles on devices to start health monitoring.

Sample end-to-end configuration

**Note** Decide which KPIs supplied by Cisco to use for each device based on its function and the performance characteristics you want to monitor. Review the KPIs supplied by Cisco documented in List of Health Insights KPIs. The image shows the available default L1 optics KPIs.

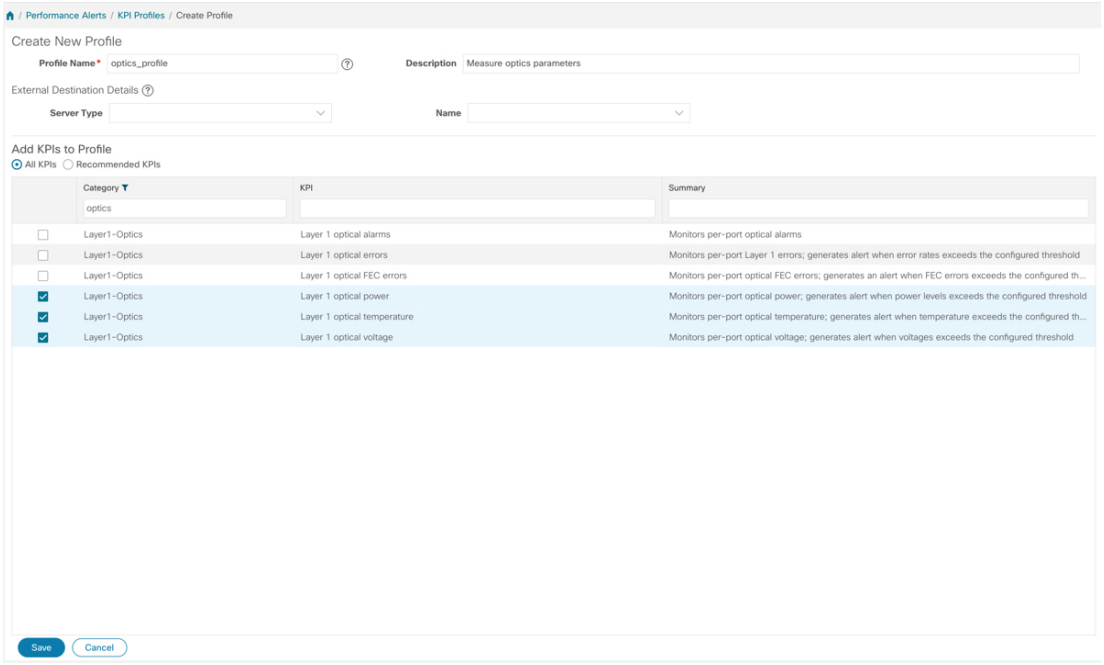



## Procedure

**Step 1** Group the relevant KPIs to create a KPI Profile focused on optics.

A KPI profile can have many different KPIs assigned. In this procedure, add only specific optics KPIs to the **optics_profile** KPI profile.

Sample end-to-end configuration



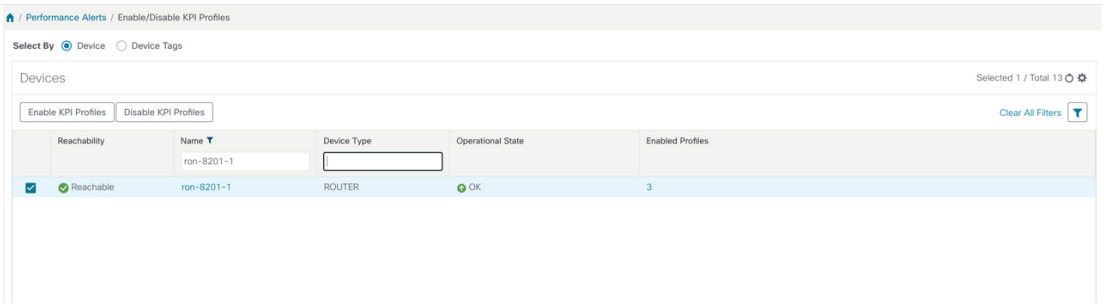
521914

See Create a New KPI Profile.

**Step 2** Enable the appropriate KPI Profile on target devices you want to monitor.

a) From the main menu, choose **Performance Alerts** > **Enable/Disable KPI Profiles**.
b) Check the checkboxes for all nodes where you want to apply the profile.
c) Choose the KPI profile and click **Enable KPI Profiles**.

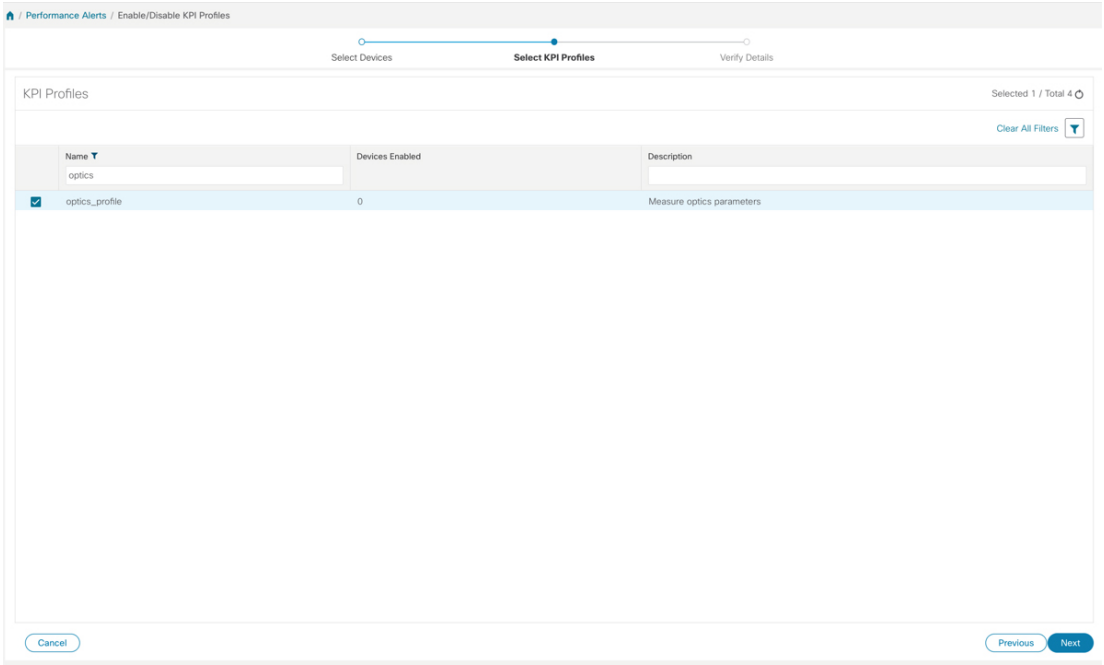
You can select multiple nodes. The image shows the KPI profile being applied to a single node.



521915

**Step 3** Select the optics_profile KPI profile and click **Next** to finalize enabling the KPI for the selected devices.

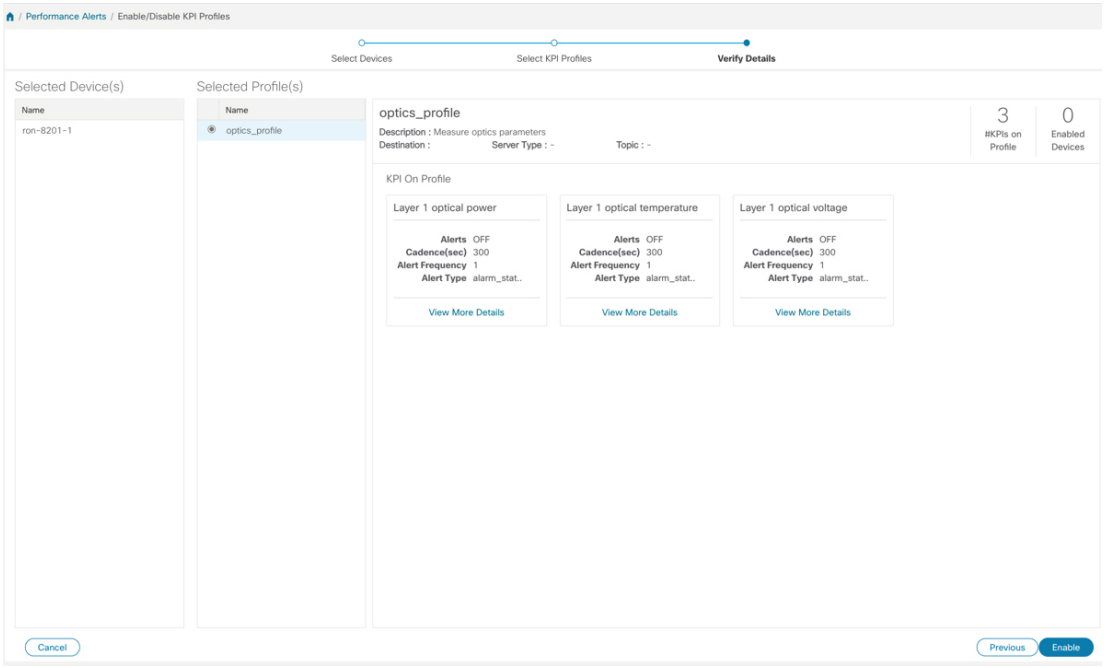
Sample end-to-end configuration




521916

**Step 4** Apply the configuration and click **Enable** to start streaming telemetry sensor data for optics KPIs.

See Enable KPI Profiles on Devices.

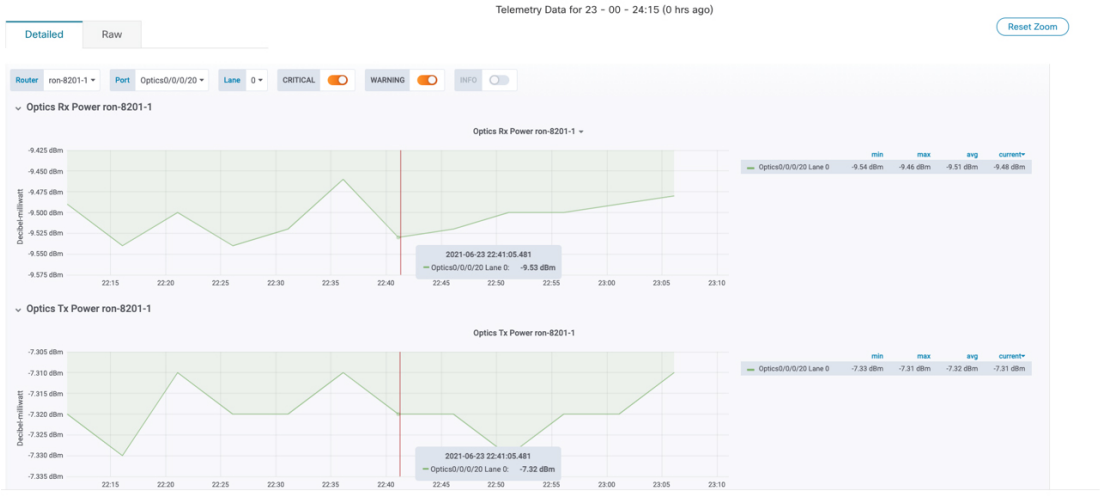



521917

**Step 5** View alerts from network devices as the system begins monitoring.

See View Alerts for Network Devices

This image shows the RX and TX power of the QDD-400G-ZR-S transceiver.




Devices begin streaming telemetry data for selected optics KPIs, and alerts become available in Health Insights.

# Optimization phase

The optimization phase consists of these activities:

1. Return to planning stage.
2. Continue to add or change circuits on the network to match packet demands.