

Sample End-to-end Configuration

This appendix describes an end-to-end provisioning example for a Routed Optical Networking topology.

• Sample Configuration, on page 1

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.

- Network Sizing Requirements, on page 1
- Planning and Design Phase, on page 3
- Implement Phase, on page 4
- Operate Phase, on page 54
- Optimization Phase, on page 66

Network Sizing Requirements

This section details the sizing requirements for a network. For a small lab installation, three servers with 256 GB of RAM is enough to run the Crosswork, Crosswork Network Controller, Cisco Optical Network Controller, NSO, Crosswork Hierarchical Controller, and EPNM in a non-HA deployment. For a production setup, calculate the total resources required using information in the following tables.

Network Profiles

Network profiles are defined based on network size, services, and application features.

Network Entity/Feature	Lab	Production
	(20%)	(100%)
Devices	2000	10000
Total number of interfaces	100000	650000
IGP interfaces	20000	100000

Network Entity/Feature	Lab	Production
	(20%)	(100%)
VPN Services (L2, L3)	40000	200000
Endpoints per VPN service	2 to 10	50
Total LSPs (SR policies and RSVP tunnels)	12000	60000
Number of PCEP sessions	2000	10000

Note

Deployment Size per Network Profile

The following table is the recommended deployment sizing requirement based on the defined network profiles for solution using Cisco Crosswork Network Controller.

Network Profile	Crosswork Cluster	Crosswork Data Gateway	NSO	SR-PCE HA Pairs	Crosswork Hierarchical Controller
Lab	3 VMs	1+1 VM	1+1 VM	1	1+1 VM
Production	5 VMs Essentials package: 3 Hybrid VMs + 1 Worker VM Advantage package: 3 Hybrid VMs + 2 Worker VMs	5+5 VM	1+1 VM	6	1+1 VM

VM Resources

The following table provide the details on CPU, memory, and disk requirements needed for each Crosswork VM and the other VMs in the deployment.

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.

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Crosswork VM	Crosswork Data Gateway	NSO	SR-PCE	Crosswork Hierarchical Controller	EPNM
 CPU: 12 vCPU RAM: 96 GB DISK: 1 TB (SSD) 	• CPU: 20 vCPU • RAM: 112 GB • DISK: 0.5 TB	 Small Network Profile CPU: 8 vCPU RAM: 64 GB DISK: 250 GB Large Network Profile CPU: 24 vCPU RAM: 132 GB DISK: 1TB 	• CPU: 8 vCPU • RAM: 24 GB • DISK: 45 GB	 CPU: 10 cores RAM: 96 GB DISK: 400G SSD (lab), 3TB SSD (production) 	 Professional (Small) CPU: 16 vCPU RAM: 64 GB DISK: 2.8 TB Extended (Medium/Large CPU: 24 vCPU RAM: 12 GB DISK: 4 TB

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Note When Cisco Optical Network Controller is deployed on the same cluster as Crosswork Network Controller, the Crosswork VM must be deployed with 12 cores and 96 GB of RAM.

Cisco Optical Network Controller Scale Support

Cisco Optical Network Controller supports a maximum of 500 nodes and 600 services. Cisco Optical Network Controller can run on the same cluster. Cisco Optical Network Controller adds more resources incrementally at the maximum supported scale. It is captured in Crosswork VM resources in the table above.

Planning and Design Phase

The planning and design phase involves:

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 is used to determine the optical layer feasibility and components that are used to support the network.

Output for a sample configuration:

This topology uses two Cisco 8201 routers, two NCS 2006 terminal nodes with NCS1K-MD-64 add/drop multiplexers, and EDFA-35 bi-directional amplifiers. The span length is 75 kms. Longer spans may require additional ILA nodes for amplification.

2. Automation Software Resource Planning

Server requirements for the Routed Optical Networking software elements

Determine the servers required for the full solution. See Network Sizing Requirements, 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 G of RAM, 32 cores, and two TB SSD.
- b. The solution requires the use of VMware ESX 6.7 or higher.

Installation Requirements for Routed Optical Networking Components

The following list points to the installation requirements for different Routed Optical Networking components.

- Cisco Optical Network Planner
- Cisco WAN Automation Engine 7.5.0
- Cisco NCS 2000 Shelf Virtualization Orchestrator 12.3.x
- · Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications
- Cisco Optical Network Controller 2.0
- Cisco Evolved Programmable Network Manager 6.1
- Cisco Network Services Orchestrator 5.7.6.2
 - Cisco NSO Routed Optical Networking Core Function Pack 1.0
 - Cisco NSO Transport-SDN Function Pack Bundle User Guide 4.1
 - Cisco Network Services Orchestrator DLM Service Pack Installation Guide 4.4.0

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/ZR+ optics. See Deployment Topologies.
 - **d.** SVO 12.2 server or line card based installation to support NCS 2000 nodes. See Install the External Server, and Run the SVO Installation Tool.
 - e. Create SVO instances for all NCS 2000 nodes. See Create an SVO Instance.

2. Installation of the Automation Software Components

- **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 5.0 (for optical planning)
 - Cisco WAN Automation Engine 7.5.0 (for IP planning)
 - Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications (for supporting Crosswork Network Controller)
 - *Cisco Optical Network Controller 2.0* Cisco Optical Network Controller 2.1 (for supporting optical network)
 - Cisco Evolved Programmable Network Manager 6.1.1 (for managing the physical router and the optical network nodes)
 - Cisco Network Services Orchestrator 5.7.6.2 (base installation to support RON FP)
 - Cisco NSO Routed Optical Networking Core Function Pack 1.0 (for RON ML provisioning)
 - Cisco NSO Transport-SDN Function Pack Bundle 3.0 (for Crosswork Network Controller SR and xVPN provisioning)
 - Cisco Network Services Orchestrator DLM Service Pack 4.1.0 (for device synchronization between Crosswork Network Controller and NSO)
 - Cisco Crosswork Hierarchical Controller 5.1 (for provisioning the Routed Optical Networking ML service using the Crosswork Hierarchical Controller)



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Note
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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, NSO, and Routers to Crosswork Network Controller, on page 6.
- c. Add routers to NSO using the IOS-XR CLI NED. See Step 3 in Provision ML Service Using NSO Routed Optical Networking CFP, on page 19.
- d. Add Cisco Optical Network Controller to NSO using the ONF TAPI NED.
- e. Add and configure the following Crosswork Hierarchical Controller adapters. See Add Adapters to Crosswork Hierarchical Controller, on page 12.



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 5.1.
- 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 ML Service Using NSO Routed Optical Networking CFP, on page 19.
 - **b.** Verify that the end-to-end service has been deployed by checking the NSO service deployment status using the check-sync status.
 - Verify the router optics controller state using the CLI or in EPNM. See Troubleshoot Provisioning Issues.
 - 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 Routed Optical Networking ML Service Using Crosswork Hierarchical Controller, on page 39.
 - b. Verify the router optics controller state using the Link Assurance tool in Crosswork Hierarchical Controller. See Step 3 in Provision Routed Optical Networking ML Service Using Crosswork Hierarchical Controller, on page 39.

Add SR-PCE, NSO, and Routers to Crosswork Network Controller

Perform 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.

1. Log in to the Crosswork user interface.

- 2. To create a credential profile, choose Device Management > Credential Profiles from the main menu. 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.

Edit Profile nso							\times
Profile Name * nso							
Add Credential Proto	cols						
Connectivity Type		User Name *	Password *		Confirm Password *		
NETCONF	\sim	nso	*****	۰	•••••	۰	Ē
Connectivity Type		User Name *	Password *		Confirm Password *		
HTTPS	\sim	nso	•••••	۰	•••••	•	Ē
+ Add Another							

Save Cancel

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

Edit Profile SR-PCE						×
Profile Name * SR-PCE						
Add Credential Protocols						
Connectivity Type	User Name*	Password *		Confirm Password *		
HTTP \lor	admin	****	•	*****	۰	Ē
+ Add Another						



c. The router credential profile requires at a minimum, the SNMPv2 or SNMPv3 and SSH connectivity types. NETCONF is optional. GNMi is used when utilizing GNMi to configure streaming telemetry sensors on the node.

Edit Profile routers								×
Profile Name * routers								
Add Credential Protoco	ols							
Connectivity Type		Read Community *		Write Community				
SNMPv2	\sim	*****	۰	•••••	•			Ē
Connectivity Type SSH	\sim	User Name * admin		Password*	۰	Confirm Password *	۰	
Enable Password	\sim							Ē
Connectivity Type		User Name *		Password *		Confirm Password *		
NETCONF	\sim	admin		•••••	•	•••••	۰	Ē
Connectivity Type GNMI	\sim	User Name * admin		Password*	۰	Confirm Password*	۰	
+ Add Another							Save	Cancel

- 3. Add the providers. See About Adding Providers.
 - a. To add the SR-PCE or NSO provider, choose Administration > Manage Provider Access from the main menu. 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 the HOST_NAME or INVENTORY_ID depending on the specific deployment.

The following image demonstrates the connectivity to NSO's RESTCONF API over SSL using port 8888 and NETCONF using the default port of 2022. Since the Routed Optical Networking NSO CFP utilizes the XR NETCONF NED, the Cisco-IOS-XR model is not applicable and may be set to any version.

Provider Name *	nso-58					
Credential Profile*	nso	\sim				
Family*	NSO	\sim				
Device Key*	HOST_NAME	\sim				
Connection Type(s)						
Protocol * II	P Address / Subnet Ma	ask *		Port *	Timeout	
HTTPS 🗸	172.29.11.58		/ 25	8888	60	Ē
HTTP5 V	172.29.11.38		/ 25	0000	00	L.
	172.29.11.58		/ 25	2022	60	
NETCONF V Add Another Provider Properties		Property Value				
NETCONF Add Another Provider Properties Property Key		Property Value				
NETCONF 🗸				2022		
NETCONF ∨ Add Another Provider Properties Property Key forward				2022		
NETCONF Add Another Provider Properties Property Key forward Add Another				2022		

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 the HTTP. In the following 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.

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Edit Provider							\times
Provider Name *	sr-pce-test						
Credential Profile*	SR-PCE	\sim					
Family*	SR_PCE	\sim					
Connection Type(s)							
Protocol * IP	Address / Subnet Ma	sk *			Port *	Timeout	
HTTP \checkmark 1	72.29.11.54		/	25	8080	60	Ē
+ Add Another							
Provider Properties							
Property Key (?)		Property Value	?				
auto-onboard		off					
+ Add Another							
						Save	Cancel

- 4. Validate communications with one or more providers. Check on the provider's reachability using the steps in Get Provider Details.
- 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.

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Administration State*	UP	\sim			UUID				
Reachability Check*	ENABLE	\sim			Serial Number				
Credential Profile*	routers	\sim			Mac Address				
Host Name	ron-8201-1				Capability*	YANG_MDT,	SNMP, GNMI	\sim	
Inventory ID					Tags			\sim	
Software Type					Product Type				
Software Version					Syslog Format			\sim	
Connectivity Details									
Protocol *	IP Address / Subnet Mask *				Port *	Timeout	Encoding Type		
SSH \vee	172.29.11.20			/ 25	22	60		\sim	Ī
SNMP \lor	172.29.11.20			/ 25	161	60		\sim	Ī
GNMI \sim	172.29.11.20		1	/ 25	57333	60	PROTO	\sim	Ī
NETCONF \lor	172.29.11.20			/ 25	830	60		\sim	Ī

Optionally, location information can be entered. Latitude and Longitude information place the node at a specific location on a geographic map.

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

		20		25	161	60		\sim	Ē
\sim	172.29.11	20			57333	60	PROTO	~	Ē
\sim	172.29.11	20			830	60		\sim	Ē
her									
fo									
	config								
Building					Region				
Street					Zip				
City					Latitude				
State					Longitude				
Country					Altitude				
and Access									
mily	\$	Provider Name		Credenti	al		Device Key		
	\sim	nso-58	\sim	nso			ron-8201-1		
her									
1	her fo Telemetry Building Street City State Country and Access mily	 Intervention of the second seco	<pre> T72.29.11.20 her fo Telemetry config Building Street City State Country and Access mily Provider Name</pre>	V 172.29.11.20 her fo Telemetry config Building Street City State Country and Accesss mily Provider Name Nso-58	Interpret Interpret	IT2.29.11.20 25 830 her fo Telemetry config Building Street City City Latitude State Country Altitude and Access mily Provider Name Credential Nso-58 Nso	IT2.29.11.20 / 25 830 60 her fo Telemetry config Building Street City City Latitude State Country Altitude and Access mily Provider Name Credential Nso-58 Nso	V 172.29.11.20 / 25 830 60 her fo Telemetry config Building Region Street Zip City Latitude State Longitude Country Altitude and Access mily Provider Name Credential Device Key ron-8201-1	IT2.29.11.20 / 25 830 60 Image: Construction of the second

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**.

Follow the steps in Attach Devices to Cisco Crosswork Data Gateway.

 Data Gateway 	Metrics Summary									
Operation	al State	Ad	Iministration State		High Availability	Status		Devices		
\frown			\frown		\bigcirc			\sim		
(• Up (1) • Error (0)	(Up (1) Maintenance (0)			votected (0)	(Attached (1		
	Degraded (0) Unknown (0)		Mantenance (0)			d Protection (0) Planned (1)		Available (0	0)	
\sim			\bigcirc							
ata Gateways									Tota	100
ata Gateways									Tota	¢ 0 11
iata Gateways	Operational State	Administration State	High Availability Status	Pool Name	Outage History	⑦ Average Availability	VM ID	Attached Device 6		
	Operational State	Administration State	High Availability Status	Pool Name	Outage History	(?) Average Availability	VMID	Attached Device (T
	Operational State	Administration State	High Availability Status	Pool Name	Outage History	⑦ Average Availability	VM ID cdg-soltest	Attached Device (Count	T
Ime					Outlage History	⑦ Average Availability			Count	Actions

Add Adapters to Crosswork Hierarchical Controller

Prerequisite

When you work with Crosswork Hierarchical Controller adapters you are required to use credentials. These credentials are used for authentication when a device is assigned to an adapter. The same credentials may be shared by multiple adapters. The credentials are added under the **Services > Device Manager > Credentials**

tab in the Crosswork Hierarchical Controller GUI. The adapters needed for the Routed Optical Networking solution are:

Table 1: Routed Optical Networking Adapters

Adapter	Credential Type
Crosswork Network Controller	HTTP (username/password)
Crosswork Network Controller Crosswork Data Gateway	HTTP (username/password)
Cisco Optical Network Controller	HTTP (username/password)
IOS-XR	SSH - User and password

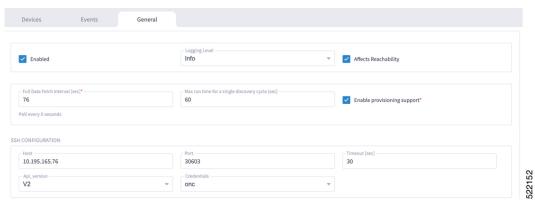


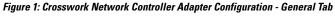
Note If Cisco Optical Network Controller and Crosswork Network Controller are on the same Crosswork cluster, they can use the same credential profile.

To add the adapters, perform the following steps:

- In the applications bar in Crosswork Hierarchical Controller, select Services > Device Manager > Adapters.
- 2. Click Add new adapter.
- **3.** Enter the adapter details:
 - Adapter Type: Select an adapter type from the list of available adapter types currently installed in Crosswork Hierarchical Controller.
 - Adapter Name: Unique user defined name of this adapter type instance (there can be several instances of the same adapter type).
- 4. To configure the adapter, select the adapter in the Adapters pane. Configure the parameters as displayed in the following images.
 - Crosswork Network Controller Adapter:

Note API version for Crosswork Network Controller must be V2.







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

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



NOTIFICATIONS CONFIGURATION		
✓ Enabled	✓ Log_notifications	Log_level DEBUG
Congestion_control_period_sec	Netconf_session_end	Yang_library_update
Termination_point_event	✓ L3_prefix_event	Notification_complete
✓ L3_link_event	Netconf_confirmed_commit	Data_changed_notification
Netconf_config_change	Yang_library_change	Netconf_session_start
Sr_policy_change_event	Replay_complete	✓ L3_node_event
Sr_policy_oper_state_change_event	Netconf_capability_change	
FILE-BRINGERS CONFIGURATION		
Enabled	Remote address with file pattern	Credentials
COLLECTION PARAMETERS		
Enable Topology Collection	Chable L1 IGP IS-IS Collection	Enable L2 IGP IS-IS Collection
IGP IS-IS Priority	 Enable Sr-Policy Collection 	Enable Rsvp-Te Collection

• IOS-XR Adapter

Figure 3: IOS-XR Adapter - Gen	neral Tab
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Enabled		Debug ~	Affects Reachability	
Polling Cycle [sec]* 60 Poll every X seconds		Number of concurrent routers collected 1	Enable provisioning support	
CONFIGURATION PARAMETERS				
Enable Tunnel		Tunnel Host	Tunnel Port	
Tunnel Credentials Key	*	Router Connect timeout 10	Router Command timeout 10	
BRINGER PARAMETERS				
Enable File Bringer		File Server Location	- File Type Dash-and-Pound	•
	*	"[sttp/file]:// <server>:<port>/<absolute path="">" Backup File Server Location (optional)</absolute></port></server>	Backup_server_authentication	¥
Authentication				
Authentication		"[sftp[file]:// <server>:<port>/<absolute path="">"</absolute></port></server>		

Note

The Polling Cycle should not be less than 300s in a production network. Concurrency can be increased. The Logging Level must be set to Info if everything is working correctly.

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

Figure 4: IOS-XR Adapter - General Tab

COLLECTION PARAMETERS		
Enable Topology Collection	Enable IGP IS-IS Collection	Enable IGP OSPF Collection
✓ Enable Interface Stats Collection	Enable VRF Collection	✓ Enable LLDP Collection
Enable MPLS Tunnels Collection	Enable LSP Stats Collection	Enable SNMP Collection
IGP IS-IS Priority	Collect only IGP IS-IS seed routers	✓ Allow to use loopback IP as management IP
✓ Enable RSVP Collection	Enable collection of optics and coherent DSP	Enable Segment Routing Collection

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

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Figure 5: 10	S-XR Adapter	- Devices Tab
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Adapters	Devices	Events	General					
isco-xr	Name	▼ Status	 Status 	✓ Site	 Adapter(s) 	✓ Host	* Port	
nc30			Change 24 hr)	s(Last				
nc-76	16 ITEMS							
nc-poc90-1	172.29.11.26	✓ Ok	0	Monterey	cisco-xr, cnc30	172.29.11.26	22	
10	172.29.11.41	✓ Ok	0	Tucson	cisco-xr, cnc30	172.29.11.41	22	
	172.29.11.23	✓ Ok	2	Las Vegas	cisco-xr, cnc30	172.29.11.23	22	
	172.29.11.40	✓ Ok	0	Monterey	cisco-xr, cnc30	172.29.11.40	22	
	172.29.11.29	🗸 Ok	0	ST. George	cisco-xr, cnc30	172.29.11.29	22	
	172.27.227.11	🗸 Ok	0	Cedar City	cisco-xr, cnc30	172.27.227.11	22	
	172.29.11.120	🗸 Ok	0	Tucson	cisco-xr, cnc30	172.29.11.120	22	
	172.29.11.22	🗸 Ok	0	Mortero Palms	cisco-xr, cnc30	172.29.11.22	22	
	172.29.11.28	✓ Ok	0	Albuquerque	cisco-xr, cnc30	172.29.11.28	22	
	172.29.11.24	🗸 Ok	0	San Diego	cisco-xr, cnc30	172.29.11.24	22	
	172.27.227.10	🗸 Ok	0	Santa Fe	cisco-xr, cnc30	172.27.227.10	22	
	172.29.11.30	✓ Ok	0	ST. George	cisco-xr, cnc30	172.29.11.30	22	
	172.29.11.21	✓ Ok	0	Las Vegas	cisco-xr, cnc30	172.29.11.21	22	
	172.29.11.27	✓ Ok	2	San Luis Obispo	cisco-xr, cnc30	172.29.11.27	22	
	172.29.11.20	✓ Ok	0	Los Angeles	cisco-xr, cnc30	172.29.11.20	22	
	172.29.11.25	✓ Ok	0	Flagstaff	cisco-xr, cnc30	172.29.11.25	22	

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

Figure 6: IOS-XR Adapter -Add New Device - General Tab

72.29.11.40					
General	Adapters	Events			
Name* 172.29.11.40			Network Element Site Monterey	×Q	

It is recommended to use the hostname+hco (ron-8201-1-hco) or the device IP address. The device must be assigned a site for it to be displayed in the Explorer UI.

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

Figure 7: IOS-XR Adapter - Add New Device - Adapters Tab

General Adapters Events		
cisco-xr		 Unassign device from this adapte
Hast*	Port*	
172.29.11.40	22	
	Authentication	
 Direct Connect (avoid tunnel if configured) 	cisco-XR	~
_		
Cnabled*		
cnc30		Unassign device from this adapte

Cisco Optical Network Controller Adapter

Figure 8: 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 the following figure is for the Cisco Optical Network Controller cApp installed on the CW cluster.

Devices Events General		
Z Enabled	Logging Level	✓ Affects Reachability
ADAPTER PROPERTIES		
Polling Cycle [sec]* 120	✓ Provisioning	Max run time for a single discovery cycle [sec] 600
Poll every X seconds Minimal interval between data updates [sec] 0	- Full Data Fetch Interval [sec]	Save persistor request to disk?
CONNECTION PROPERTIES		
Host (including protocol, port and URI prefix) https://10.195.165.76:30603/crosswork/onc-tapi/	Timeout [sec] 1500	Credentials onc
FILE-BRINGERS CONFIGURATION		
Enabled	Remote address with file pattern	Credentials 👻

The optical nodes are discovered automatically from Cisco Optical Network Controller. Nodes must be assigned a site for it to be displayed in the Explorer UI.

Figure 9: Cisco Optical Network Controller Adapter - Devices Tab

Device Manager Adapters Mana	ged Devices Credentials	-			
Adapters ᅙ	Devices Events	General			
cisco-xr cnc30	Name	Status	Status Changes(Last 24 hr)	Site	Adapter(s)
	5 ITEMS				
onc-76	ron-ols-5-roadm	✓ Ok	0	Monterey	onc-76
onc-poc90-1	ron-ols-4-roadm	✓ Ok	0	San Luis Obispo	onc-76
svo	ron-ols-2-roadm	✓ Ok	0	Las Vegas	onc-76
	ron-ols-1-roadm	✓ Ok	0	Los Angeles	onc-76
	ron-ols-3	✓ Ok	0	Barstow	onc-76

Crosswork Network Controller Crosswork Data Gateway Adapter

Crosswork Network Controller Crosswork Data Gateway adapter is used to collect telemetry data via gNMI 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.

rotocol *	IP Address / Subnet Mask *		Port *	Timeout(sec)	Encoding Type	
SSH 🗸	172.29.11.40	/ 25	22	60		\sim
SNMP \vee	172.29.11.40	/ 25	161	60		\sim
Encryption	\sim ?					
NETCONF ~	172.29.11.40	/ 25	830	60		\sim
GNMI V	172.29.11.40	/ 25	57333	60	PROTO	~
Add Another apability*						
apability• YANG MDT □ TL1 🔽	YANG CLI 🗌 YANG EPNM 🗹 SNMP 🚽	GNMI				
apability* YANG MDT □ TL1 ☑ Providers and Access	YANG CLI 🗌 YANG EPNM 🗹 SNMP 🔽	🖌 GNMI				
apability• YANG MDT □ TL1 🔽		✓ GNMI				

Figure 10: 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.

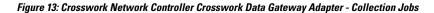
Figure 11: Crosswork Network Controller Crosswork Data Gateway Adapter - General Tab

Adapters 🕞	Devices Events General		
cisco-edg			
cisco-w			
cnc30	Cnabled	Info *	
onc-76			
onc-poc90-1			
540	Collector Cadence [sec] 90	- Status Update Interval [sec] 180	
	Collector sample cadence in seconds	NOTE: You can see missed stats errors if the interval is less than the collector cadence	
	CNC CONFIGURATION		
	/ Most*	Part*	Timeout (sec)
	10.195.165.76	30603	30
	Request Retries	Credentials*	
	3	onc ~	
	GRPC LISTENER CONFIGURATION		
	P Address*	Port*	Destination Name*
	172.29.11.60	65001	netfusion_cdg
	NOTE: Make sure that the address is forwarded (or belonged) to the docker host	KOTE: Make sure that a firewall does not block the docker host port	NOTE: The name should be unique in the crosswork context
	COLLECTION PARAMETERS		
	Missed ports stats error threshold (percentage) 10	Enable Interface Counters	Carable Optics Counters: Instant
	Threshold in percentages per device ports with no stats to report error		
	Enable Optics Counters: 30 Seconds	Enable Optics Counters: 15 Minutes	Enable Optics Counters: 24 Hours
	Zenable OTU Counters: Instant	Enable OTU Counters: 30 Seconds	Enable OTU Counters: 15 Minutes
	Enable OTU Counters: 24 Hours		

 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 setup by Cisco Crosswork Hierarchical Controller and user interaction is not required. 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 12: Crosswork Network Controller Crosswork Data Gateway Adapter - Data Destinations

~ 0	ata Destinations ⑦					
+ /	1 🗊					
	Destination Name		Server Type	Compression Type	Encoding	UUD
	Crosswork_Kafka	٩	Kafka	snappy	gpbkv	c2a8fba8-8363-3d22-b0c2-a9e449693fae
	cdg-astack-pipeline	٩	9RPC	gzip	gpbkv	e9b4c2ec-b2e6-4db0-a942-0402dd347a1d
	netfusion_cdg	٩	gRPC	gzip	gpbkv	0a088f8b-3fea-4694-a744-54c02fbdda5e



Collection Jobs			1/11 01	JOD Details	 nettusion_cdg 	ron-poc-8201-1			
+0			[Last Eval 5 Success OB-DEC-2021 0		Job Configuration Config Details	(6	Collection Type GNMI	O Last Modified On 08-DEC-2021 11:00:39 AM EST
Status	App ID	Context ID	Action			Collection	ns (7)	Distributions (7)	→(②)
Successful	netfusion_cdg	ron-poc-8201-2	Ó			Devices	Data Gatewa	ys	Destinations
Successful	cw.dlminvmgr0	dim/cli-collector/group/	0	Showing - All Col	lections (7) Collection	n Issues (0)			-
 Successful 	cw.dlminvmgr0	dlm/cli-collector/group/	0	Status	Hostname	Device Id	Sensor Data	Topic	Last Reported Time
Successful	cw.optimatraffic	cw.optimatrafficmdt-ctx	0	0.0.00				(cpro	
Successful	cw.dlminvmgr0	dim/snmp-collector/gro	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	(i) at	08-DEC-2021 11:00
Successful	cw.dlminvmgr0	dlm/cli-collector/group/	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	(i) at	08-DEC-2021 11:00
Successful	cw.topo_svc	cw.toposvc.snmp	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	(i) at.	08-DEC-2021 11:00
Successful	netfusion_cdg	ron-poc-8201-1	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	(i) at	08-DEC-2021 11:00
 Successful 	cw.optimatraffic	cw.optimatrafficsnmp-ctx	Ó	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	openconfig-interfac	(i) at.	08-DEC-2021 11:00
Successful	cw.topo-visualization	topo-visualization.colle	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-cont	(i) at	08-DEC-2021 11:00
O Degraded	() cw.topo_svc	cw.toposvc.snmptraps	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-cont	(i) et.	08-DEC-2021 11:00

Provision ML Service Using NSO Routed Optical Networking CFP

Perform the following steps to provision the Routed Optical Networking ML service using the NSO Web UI.

- 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. Click **Confirm**.

				type						
		172.29.11.120								
onc-	-cw-100	172.29.11.100	30666	onf-tapi-nc-1.0:onf-tapi-nc-1.0	3 🔻					
onc	-poc-62	172.29.11.62	30666	onf-tapi-nc-1.0:onf-tapi-nc-1.0	3 🔻					
onc	-soltest-72	172.29.11.72	30666	onf-tapi-nc-1.0:onf-tapi-nc-1.0						
ron-	8201-1	172.29.11.20		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	3 🔻					
ron-	8201-2	172.29.11.21		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	2 🐨					
ron-	8201-3	172.29.11.22		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	Add de	vice		ek-sync		
ron-	8201-4	172.29.11.23		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3		vice		ek-sync		
] ron-	asr9903-1	172.29.11.27		cisco-iosxr-cli-7.33cisco-iosxr-cli-7.3	name	-8202-1		eck-sync		
] ron-	ncs540-1	172.29.11.25		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3				eck-sync		
ron-	ncs57b1-1	172.29.11.26		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	cancel	confirm		eck-sync		
ron-	poc-57b1-1	172.29.11.30		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3		ping	connect	check-sync		
ron-	poc-8201-1	172.29.11.28		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	1 🐨					
ron-	poc-8201-2	172.29.11.29		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	1 🐨					
Xrv9	k-pe-1	172.29.11.24		cisco-losxr-cli-7.33cisco-losxr-cli-7.33						

b. After creating the new device, click the device name to fill required and optional parameters. In this screen, the required parameters are the authgroup and IP address of the device.

Configuration edit	tor			View options v nso v
1. /ncs:devices/device(ron-poc-8202-1)/			Due to the	size of this configuration model, subfolders are not included
See 'ron-poc-8202-1' in Device manager	9282828282828	-8-8-8-8-8-8-8		93939393939 3
name	authgroup	read-timeout	out-of-sync-commit-behaviour	
ron-poc-8202-1	routers	Valid range: 1 4294967	reject	
		And Address of the Owner, where the Party of	And the second second second	
local-user	device-profile	Valid range: 1 4294967	snmp-notification-address	
		Valid range. 1 4254507		
description	connect-timeout	trace		
Cisco 8202 router in PoC lab	Valid range: 1 4294967	pretty - Pretty-printed data	 D-0-0-0-0-0-0-0-0 	
	- HOHOHOHOHOH	HORORORORORO		-2-5-2-2-2-5-5-5-5-5-5-5-5-5-5-5-5-5-5-
trace-output				
file	-0-0-0-0-0-0-0			-2
external				-5-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-
address-choice				
device				
address				
172.29.11.31				
port				
Valid range: 0 65535				
remote-node				
	C* Commit	Configuration A Alarm B Dashboard D	Device C Service	~
	manager	editor A manager D vesinablard D i	manager 🌖 manager	×

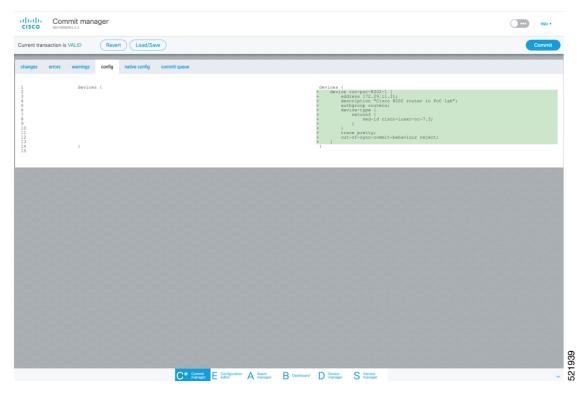
c. Scroll down in the device configuration screen. Click the "device-type" to bring up the device type selection screen. The device-type that is supported in the Routed Optical Networking ML FP is IOS-XR CLI NED.

Configuration editor	🛗 💽 💮 Wew options + 👘 mo +
1 L/ncs:devices/device(ron-poc-8202-1)/device-type	Due to the size of this configuration model, subfolders are not included
See 'ron-poc-8202-1' in Device manager	
ne-type netconf generic cli snmp	
netconf/	
-8	
	E Conference A Army B Denesue D Denes S Strate
C* Correit	E addot A Alarm B Destroard D Device S Service V

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

ahah cisco	Configuration editor				.		View options +	nso •
	devices/device(ron-poc-8202-1)/device-type/netconf/				Due to the size of this conf	iguration mo	del, subfolders are	not included
ned-id* Select Select cisco-ic cisco-ic cisco-ic								
		manager editor A manager	D manager	manager				~

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



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

L

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



b. Specify the end-point-device and the line-port. These are required values. The end-point-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**.

name delxies delxiespic redeploy redeploy <t< th=""><th></th><th>0/8</th><th></th><th></th><th></th></t<>		0/8			
ma-8201-1 0/0/20 0 dedd-sync m-deploy m-deploy m-deploy dynam ma-8201-2 0/0/20 0 dedd-sync m-deploy m-deploy m-deploy dynam ma-8201-2 0/0/20 0 dedd-sync m-deploy m-deploy m-deploy dynam ma-8201-2 0/0/20 0 dedd-sync m-deploy m-deploy dynam ma-8201-2 0/0/20 0 dedd-sync m-deploy m-deploy dynam ma-920-8201-1 0/0/0/22 0 dedd-sync m-deploy m-deploy dynam ma-pac-8201-2 0/0/20 0 m-pac-8201-1 apton m-deploy dynam ma-pac-8201-2 0/0/20 0 m-pac-8201-1 apton m-deploy dynam ma-pac-8201-2 0/0/20 0 m-pac-8201-1 apton m-deploy dynam ma-pac-8201-2 0/0/22 0 m-pac-8201-1 apton m-deploy dynam ma-pac-8201-2 0/0/22 0 m-pac-8201-1 apton m-deploy dynam					
ma-8201-1 0/00/8 0 dedd-sync m-deploy m-deploy rea-8201-2 0/00/20 0 electricitic m-deploy m-deploy rea-8201-2 0/00/20 0 electricitic m-deploy m-deploy rea-8201-1 0/00/20 0 electricitic m-deploy m-deploy rea-920-2 0/00/20 0 electricitic m-deploy m-deploy rea-920-2 0/00/20 0 electricitic electricitic electricitic rea-920-2 0/00/22 0 electricitic electricitic electricitic rea-920-2 0/00/22 0 electricitic electricitic electricitic rea-920-2 0/00/22 0 electricitic electricitic electricitic	name	devices	check-sync	re-deploy	re-deploy dry-run
rm-8201-2 0/0/020 0 check-sync re-deploy re-deploy rm-8201-2 0/0/08 0 check-sync re-deploy rm-poc-8201-1 0/00/22 0 re-deploy re-deploy dry-ran rm-poc-8201-2 0/00/22 0 re-deploy dry-ran re-deploy dry-ran	ron-8201-1 0/0/0/20				
ma-8201-2 0/00/8 0 check-sync m-deploy m-deploy ron-poc-8201-1 0/00/22 0 fold fold ron-poc-8201-2 0/00/22 0 fold fold ron-poc-8201-2 0/00/22 0 fold fold ron-poc-8201-2 0/00/22 0 fold fold ime-port fold fold fold	ron-8201-1 0/0/0/8				
ma-poc-8201-1 0/0/0/20 0 ron-poc-8201-2 0/0/0/22 0 ron-poc-8201-2 0/0/0/22 0 ron-poc-8201-2 0/0/0/22 0	ron-8201-2 0/0/0/20				
ron-poc-8201-1 0/0/0/22 0 Create service estor re-deploy dry-run ron-poc-8201-2 0/0/0/22 0 end-point-device epicy re-deploy dry-run ron-poc-8201-2 0/0/0/22 0 ine-port epicy re-deploy dry-run	ron-8201-2 0/0/0/8				
ron-poc-8201-1 0/0/0/22 or ind-point-device ind-point-device ron-poc-8201-2 0/0/0/22 ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device ind-point-device	ron-poc-8201-1 0/0/0/20			deploy	
ron-poc-8201-2 0/0/0/20 0 end-point-device ron-poc-8201-2 0/0/0/22 0 ine-port ine-port 0/0/22	ron-poc-8201-1 0/0/0/22		Create service	deploy	
ron-poc-8201-2 0/0/0/22 0 dedov medaptov domon	ron-poc-8201-2 0/0/0/20			deploy	
line-port anaza	ron-poc-8201-2 0/0/0/22		ron-poc-8201-1	*	

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 the Optical Network Controller instance to be 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 corresponds with the inventory ID of the physical port on the NCS1K-MD-64-C multiplexer corresponding to a frequency XXXX.YY. Both the RX and TX directions are included as part of the add/drop reference. 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.

Config	unation c -!	lor.
NSO VERSION:S.	uration edi	tor
/cisco-ron-cfp:ron/inte	r-layer-link(ron-	oc-8201
ee 'ron-poc-8201-1 0/0/0	0/20' in Service r	anager
cisco-ron-cfp:ron/int		
/TN /TN /TN /	N. 2010. 20	1.2
end-point-device		Ð
ron-poc-8201-1		
ine-port		•
0/0/0/20		
		_
ite	💼 🤇	•
Los Angeles		. 8
ala domain/		
ols-domain/	KK	83
optical-controller	<u></u>	
onc-poc-62		•
optical-service-interfac		
	e	
d-drop sip		
network-element*		0
ron-poc-ols-1		
optical-add-drop*		0
1/2007/1/25,26		
		S.7.3
		\bigcirc

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 show in TAPI topology.
 - Optical-add-drop specifies the port to be used on the optical network element.

521922

1 L /cisco	o-ron-cfp:ron/inter-layer-link{ron-poc-8201-1 0/0/0/20}/ols-domain/
See 'ron-po	oc-8201-1 0/0/0/20' in Service manager
cisco-ron-c	cfp:ron/inter-layer-link{ron-poc-8201-1 0/0/0/20}/ols-domain/
optical-co	ontroller
onc-poc-9	90 -
optical-se add-drop	sip
network	k-element*
ron-po	pc-ols-1
ontical-	-add-drop*
optical	

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

See 'ron-poc-8201-1 0/0/0/20' in Service	manager
isco-ron-cfp:ron/inter-layer-link{ron-p	oc-8201-1 0/0/0/20}/ols-domain/
optical-controller	
onc-poc-90	• RESERVESSER
add-drop sip	
optical-sip*	
025118e0-1e26-3f0f-b281-4052d48	4954

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

CISCO Commit manager			nso ~
Current transaction (2 - webui-one) is VALID Revert Load/Save			Commit
changes errors warnings config native config commit queue			
Path	Operation	Old value	New value
/cisco-ron-cfp:ron/inter-layer-link(ron-poc-8201-1 0/0/0/20)/ols-domain/optical-add-drop	value_set		1/2007/1/25,26
/cisco-ron-cfp:ron/inter-layer-link(ron-poc-8201-1 0/0/20)/ols-domain/network-element	value_set		ron-poc-ols-1
/cisco-ron-cfp:ron/inter-layer-link(ron-poc-8201-1 0/0/0/20)/ols-domain/optical-controller	value_set		onc-poc-90
/cisco-ron-ofp:ron/inter-layer-link(ron-poc-8201-1 0/0/20)/site	value_set		POC Site A
/cisco-ron-cfp:ron/inter-layer-link(ron-poc-8201-1 0/0/0/20)	created		

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.

diala	Commit manager		() mao ~
Current t	ransaction (3 - webui-one) is VAL	UD Revert Load/Save	Connit
changes	errors warnings config	native config commit queue	
123456789101	ren (<pre>tot { inter-layer-link rom-poo-4281-2 \$/0/0/20 (site "FOC Site D"; oldatis(</pre>

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.



- 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/ZR+ optics. Click **Confirm**.

name	
poc_8201_1_to_poc_8201	_2_20
mode	
transponder	~
bandwidth	
400	

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, we 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.

CISCO Configuration e	ditor			View options • nso •
L/cisco-ron-cfp:ron/ron-mi{poc_circu	uit_195200)()			
See 'poc_circuit_195200' in Service mar	nager			
name poc_circuit_195200	circuit-id This is a demo circuit	dac-rate	0	
mode* transponder	i grid-type ✓ (100mhz-grid)	clear-rollback	0	
bandwidth* 400	frequency	0		
end-point	-010-0-0-0	This list is empt	у	Add list item →
ols-domain/	8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-8-	38888888		3-
service-state (UNLOCKED)	0			
custom-template ()		This list is e	mpty	Add list item →
2020-020	C,	* Commit E Configuration A Alarm B Dash	board D Device S Service	-9

Note

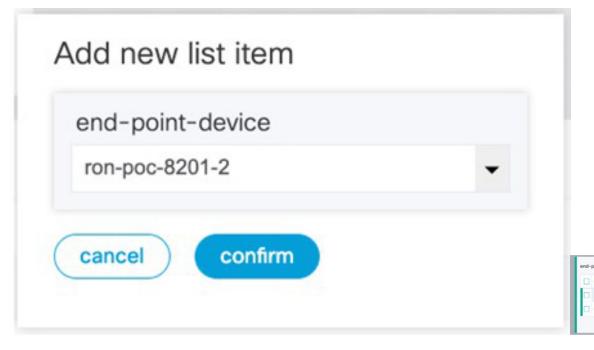
- User configuration global options are frequency and dac-rate
- If OLS provisioning is being performed and OLS can provide the frequency, it is optional, otherwise frequency must be provided.
- Dac-rate controls the TX shaping parameters: 1x1.25 = enabled, 1x1 = disabled. Leaving it blank uses system default of enabled, and can be used in most circumstances
- **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.

Configuration ec	litor				tiew options v nso v
1_/cisco-ron-cfp:ron/ron-mi{poc_circuit	_195200)()				
See 'poc_circuit_195200' in Service mana	•••)				
name poc_circuit_195200	circuit-id This is a demo circuit	dac-rate	0		
mode* transponder	i grid-type (100mhz-grid)	i clear-rollt	ack i		
bandwidth* 400	frequency	0			
end-point ()			This list is empty		Add list item → 🔶
all ols-domain/		<u> </u>	- <u>494949</u>		
service-state (UNLOCKED)	•				
custom-template ()			This list is empty		Add list Item → 🕂
	C*	Commit E Configuration A Alarm	ger B Dashboard D Device	S Service manager	~

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

1 /oisco-ron-ofp:ron/ron-mil/poc_circuit_	195200)			
name poc_circuit_195200	Circuit-Id This is a demo circuit	dac-rate	0	
mode* transponder	grid-type (100mhz-grid)	clear-rollback	0	
bandwidth* 400	frequency	0		
end-point 👔		Add new list item end-point-device ron-poc-8201-1		Add list item +
	0	cancel confirm		
(UNLOCKED)				
custom-template (j				Add list item →

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, this is the same as the line-port specified in the inter-layer-link service for the end-point router.



The transmit-power is an optional parameter for end-to-end provisioning. If it is omitted the optical controller (Cisco Optical Network Controller) will provide the transmit power. Transmit power sets the transmit power, the value is in 100*value in 0.1dBm increments. For example, -100 is -10dBm. If no value is specified the default of -10dBM is used for QDD-400G-ZR-S or QDD-400G-ZRP-S, or 0dBm 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.

L

Configuration editor		H View options • nso •
Cisco-ron-cfp:ron/ron-mi{poc_circuit_195200}/end-poi	int[ron-poc-8201-1]()	
See 'poc_circuit_195200' in Service manager		
end-point-device 1 ron-poc-8201-1		
terminal-device-optical/		
line-port*		
0/0/0/20		
transmit-power		
Valid range: -150 0		
Ols-domain/		
end-point-state		
UNLOCKED ~		
transceiver-capability*		
terminal-device-packet/		
bundle 🚺	This list is empty	Add list item → +
interface 🚺	This list is empty	Add list item → 🕂
custom-template ()	This list is empty	Add list item → 🛨
	C* Commit E Configuration A Alarm B Distributed D Device S Service manager	v

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

Configuration editor		() da View options + nso ∨
1_/cisco-ron-cfp:ron/ron-milpoc_8201_1_to_poc_8201_2_20	J/end-point/ron-poc-8201-1]/terminal-device-packet	
See 'poc_8201_1_to_poc_8201_2_20' in Service manager	8-	
bundle	This list is empty	Add list Item + 😝
Interface	This list is empty	Add list item +
custom-template	This list is empty	Add list item + 💽



• Ethernet/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 bundle to add a bundle, in this case with an identifier of 500. This creates a bundle interface Bundle-Ether 500 on the endpoint router

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

Cisco Sentimentation	View options + nso ~
1_/oisco-ron-ctp:ron/ron-milpoc_8201_1_to_poc_8201_2_20)/end-point/ron-poc-8201-1)/terminal-device-packed	
See 'poc_8201_1_to_poc_8201_2_20' in Service manager	
bundle	
5 00	(■) ⊖ ()
Interface index	
	(Ⅲ) ⊖ 🕄

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

cisco	Configuration editor	
♠ Ĺ/cisc	o-ron-cfp:ron/ron-ml{poc_8201_1_to_poc_8201_2_20}/end-point{ron-poc-8201-1}/terminal-device-packet/bundle{500}/ip-add	dress()
See 'poc_	201_1_to_poc_8201_2_20' in Service manager	-2828
v4		
102.20.	0.20/31	
v6		
	BESESESESESESESESESESESESES	

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



Configuration editor

ee 'poc_8201_1_to_poc_8	201_2_20' in Service manager	0808080	
oundle-id*			
500	•		
node			
active	, D-0		

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 and similarly configure the second endpoint.

Configuration editor			View options + nSo ~
1_/cisco-ron-cfp:ron/ron-mil[poc_8201_1_te	o_poc_8201_2_20)/		
See 'poc_8201_1_to_poc_8201_2_20' in Servi	ice manager	19999999999999999999999	8989898989898989898987 7
name poc_8201_1_to_poc_8201_2_20	circuit-id poc_circuit	dac-rate	
mode* transponder v	grid-type (100mhz-grid)	clear-rollback	
bandwidth* 400	frequency 1952000		
end-point end-point-device ron-poc-8201-1			
ols-domain/			
srig/			

j. Click ols-domain to enable OLS provisioning through Cisco Optical Network Controller.

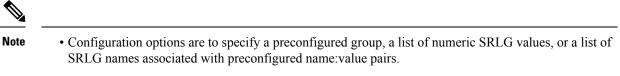


k. Select "Unlocked" under service-state, no additional configuration is necessary as all configuration needed for OLS provisioning is part of the interlayer link and the rest of the ron-ml service.



I. Click SRLG to perform SRLG configuration

Configuration editor		() → View options + n50 ~
1/cisco-ron-cfp:ron/ron-mi[poc_8201_1_to_poc_8201_2_20]/srig		
See 'poc_8201_1_to_poc_8201_2_20' in Service manager	8989898989898989898989898	25252525252525252525
group		
value-list		
ы	value	
10	1000	
20	2000	
name-list	This list is empty	Add list item + 🛟



- 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.
- 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.

altalta cisco	Comm NSO VERSION:	nit mana	ager								 nso 🔻
Current tran	nsaction is V	ALID	Revert	Load/Sav	re						Commit
changes	errors	warnings	config	native config	commit queue						
1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 4 5 6 7 8 9 0 1 1 1 2 3 3 4 5 5 7 8 9 0 1 1 1 2 3 1 2 3 7 8 9 0 1 1 1 2 3 1 2 3 3 1 2 2 2 2 2 2 2 2 2 2		ron {							<pre>* mooo bas * cli * 0) * enc * * * * * * * * * * * * * * * * * * *</pre>	<pre>poc_circuit_192200 { bringsponder; dvich, 400; i= demo circuit*; i=demini { i=omain { ils=port O/O/O/20 ols=demo circuit*; end=point=state UNLOCKED; ins=port 0/O/0/20 ils=port 0/O/0/20 ils=demo circuit*; instate demonstrate UNLOCKED; issand=demonstrate UNLOCKED; issand=demonstratee UNLOCKED; issand=demonstratee UNLOCKED; issa</pre>	
					C* Commit manager	E Configuration	A Alarm manager	B Dashboard	D Device manager	S Service manager	~

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 the following image.

Configuration editor			
1_1_to_p	oc_8201_2_20}/		
See 'poc_8201_1_to_poc_8201_2_20' in Service	manager		
name	bandwidth*	frequency	
poc_8201_1_to_poc_8201_2_20	400	1952000	
plan-location	circuit-id	dac-rate	
/cisco-ron-cfp:ron/cisco-ron-cfp:ron-ml-pl	an[cisco- poc_circuit		
ron-cfp:name='poc_8201_1_to_poc_8201_	_2_20']		
mode*	grid-type	clear-rollback	
transponder	~ (100mhz-grid)	~	

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

on-ml-plan	
name	
582b3df2_30b2_4af2_9438_6dfb7738d0ef	
e2b4907_b08b_4338_8304_a4f2903b3311	
7a00076_d3db_4bd9_9d94_673d4cc462cb	
boc_8201_1_to_poc_8201_2_20	
	(

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

1 /cisco-ron-cfp:ron/ron-mi-plan	(poc_8201_1_to_poc_8201_2_20)/plan/		
2/2 sett	ncsint		ncervedy
3/3 11/11 Optical-Controler	nceint	citor-tar-ta-tars- pia- sevices.confg-	nexready
3/3 ren-poc-8201-1	restrit	erves.comp-	nosready
3/3 ren-poc-8201-2	nes:bit	sendors config-	ncsready
		plan- services:config-	

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.

<pre>RP/0/RP0/CPU0:ron-poc-8201-1#show configuration commit changes last 1 Non Oct 17 09:51:11.625 POT Building configuration 7.7.1 srlg interface Bundle-Ether500 10 value 1000 20 value 1000 20 value 2000 ! ! interface Bundle-Ether500 ipv4 address 102.20.20:20 255.255.255.254 ! controller Optics0/0/20 description poc_circuit transmit-power -100 fec OFEC dwdm-carrier 1000HHZ.grid frequency 1952000 DAC-Rate 1x1.25 ! interface FourHundredGigE0/0/0/20 bundle id 500 mode active ! End</pre>	RP/0/RP0/CPU0:ron-poc-8201-1#show controllers optics 0/0/0/20 Mon Oct 17 09:57:25.475 POT 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 DWOM carrier Info: C BAND, MSA ITU Channel=19, Frequency=195.20THz, Wavelength=1535.822nm Alarm Status: Detected Alarms: None

Provision Routed Optical Networking ML Service Using Crosswork Hierarchical Controller

- 1. To create the router DCO port to the NMC cross-connect:
 - **a.** In the applications bar in the Crosswork Hierarchical Controller, click the **NMC Cross Connections** icon.

Figure 14: NMC Cross Connections

Nam							
	ne		Router Port *	Router Device *	Optical Port *	Optical Device *	
	TEMS						
ron-	-poc-8201-1/Optics0/0/0/22 to Site-A-roadm/1/CHAN 29 (194.000)		Optics0/0/0/22	ron-poc-8201-1	1/CHAN 29 (194.000)	Site-A-roadm	Ō
ron-	-poc-57b1-1/Optics0/0/0/24 to Site-B-roadm/1/CHAN 29 (194.000)		Optics0/0/0/24	ron-poc-57b1-1	1/CHAN 29 (194.000)	Site-B-roadm	Ō
ron-	-8201-1/Optics0/0/0/8 to ron-ols-1-roadm/4/AD-2		Optics0/0/0/8	ron-8201-1	4/AD-2	ron-ols-1-roadm	Ô
ron-	-ncs57c3-1/0ptics0/0/2/2 to ron2_olt6-roadm/0/1/0/29		Optics0/0/2/2	ron-ncs57c3-1	0/1/0/29	ron2_olt6-roadm	Ō
ron-	-8201-3/Optics0/0/0/16 to ron2_olt5-roadm/0/1/0/29	Optics0/0/0/16	ron-8201-3	0/1/0/29	ron2_olt5-roadm	Ō	
ron-	-ncs540-2dd-1/Optics0/0/0/0 to ron-ols-5-roadm/1/CHAN 49 (192	500)	Optics0/0/0/0	ron-ncs540-2dd-1	1/CHAN 49 (192.500)	ron-ols-5-roadm	Ō
ron-	-8201-2/0ptics0/0/0/10 to ron-ols-2-roadm/3/CHAN 49 (192.500)		Optics0/0/0/10	ron-8201-2	3/CHAN 49 (192.500)	ron-ols-2-roadm	Ō
ron-	-8201-3/0ptics0/0/0/20 to ron2_olt4-roadm/0/2/0/25		Optics0/0/0/20	ron-8201-3	0/2/0/25	ron2_olt4-roadm	Ō
ron-	-8201-1/0ptics0/0/0/20 to ron-ols-1-roadm/1/CHAN 7 (195.650)		Optics0/0/0/20	ron-8201-1	1/CHAN 7 (195.650)	ron-ols-1-roadm	Ō
ron-	-8201-1/0ptics0/0/0/18 to ron-ols-1-roadm/4/AD-1		Optics0/0/0/18	ron-8201-1	4/AD-1	ron-ols-1-roadm	Ō
ron-	-ncs57b1-1/Optics0/0/0/24 to ron-ols-5-roadm/1/CHAN 51 (192.35	D)	Optics0/0/0/24	ron-ncs57b1-1	1/CHAN 51 (192.350)	ron-ols-5-roadm	Ō
ron-	-8201-4/0ptics0/0/0/20 to ron-ols-2-roadm/3/CHAN 25 (194.300)		Optics0/0/0/20	ron-8201-4	3/CHAN 25 (194.300)	ron-ols-2-roadm	Ō
ron-	-8201-2/Optics0/0/0/20 to ron-ols-2-roadm/1/CHAN 7 (195.650)		Optics0/0/0/20	ron-8201-2	1/CHAN 7 (195.650)	ron-ols-2-roadm	Ō
			Optics0/0/3/2	ron-ncs57c3-1	0/1/0/25	ron2_olt1-roadm	Ô

The Network Media Channel (NMC) is the service across the optical line system of the network.

b. Click the magnifying glass icon in the Router OCH port field.

The application displays routers and ports with ZR/ZR+ transceivers in the **Advanced** tab in a new window. The description indicates whether it is a ZR or ZR+ transceiver.

c. Select the router ZR/ZR+ optics interface. In this case, select ron-ncs57c3-1 0/0/0/20. Click **OK** after selecting the port. You can filter the selection criteria by clicking on the down arrow in each column.

Figure 15: List of Routers with ZR/ZR+ Transceivers

Router OCH	**		Advanced	3D Explo				
Name 14 ITEMS				PORTS				
ron-poc-8201-1		Device	* Туре	* Capacity	٠	Description *	Admin Status 👻	Ō
ron-poc-57b1-J	12 ITEMS Optics0/0/1/12	ron-asr9903-1	OCH			OCH port of 400G ZR-S QSFPDD M	UP	Ō
ron-8201-1/Opt		ron-asr9903-1	OCH			OCH port of 400G ZRP-S QSFPDD	- 13 C	Ô
ron-ncs57c3-1/		ron-asr9903-1	OCH			OCH port of 400G ZR-S QSFPDD M		Ō
ron-8201-3/Opt		ron-poc-8201-2	OCH			OCH port of Cisco QSFPDD 400G		Ō
ron-ncs540-2dd		ron-ncs5504-1	OCH			OCH port of Cisco QSFPDD 400G	UP	Ô
ron-8201-2/Opt		ron-poc-8201-1	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-8201-3/Opt		ron-ncs57c3-1	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-8201-1/Opt	And the second	ron-8201-1	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-8201-1/Opt		ron-8201-1	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-ncs57b1-1/		cst-pe4	OCH			OCH port of 400G ZR-S QSFPDD M	UP	Ō
ron-8201-4/Opt		ron-8201-2	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-8201-2/Opt		ron-8201-3	OCH			OCH port of Cisco QSFPDD 400G	UP	Ō
ron-ncs57c3-1/								Ō
							Cancel OK	

d. Click the magnifying glass icon in the Optical NMC port field.

The app displays optical devices and ports. Due to the potentially long list of ports, it is best to filter the selection criteria.

ron-ncs57c3-1 - Optics0/0/2/0 × Q	Optical NMC port	S + Add			
ame	* Router Port	* Router Device	Optical Port	Optical Device *	
4 ITEMS					
on-poc-8201-1/Optics0/0/0/22 to Site-A-roadm/1/CHAN 29 (194.000)	Optics0/0/0/22	ron-poc-8201-1	1/CHAN 29 (194.000)	Site-A-roadm	Ô
on-poc-57b1-1/Optics0/0/0/24 to Site-B-roadm/1/CHAN 29 (194.000)	Optics0/0/0/24	ron-poc-57b1-1	1/CHAN 29 (194.000)	Site-B-roadm	Ō
on-8201-1/Optics0/0/0/8 to ron-ols-1-roadm/4/AD-2	Optics0/0/0/8	ron-8201-1	4/AD-2	ron-ols-1-roadm	Ō
on-ncs57c3-1/Optics0/0/2/2 to ron2_olt6-roadm/0/1/0/29	Optics0/0/2/2	ron-ncs57c3-1	0/1/0/29	ron2_olt6-roadm	Ō
on-8201-3/Optics0/0/0/16 to ron2_olt5-roadm/0/1/0/29	Optics0/0/0/16	ron-8201-3	0/1/0/29	ron2_olt5-roadm	Ō
on-ncs540-2dd-1/Optics0/0/0/0 to ron-ols-5-roadm/1/CHAN 49 (192.500)	Optics0/0/0/0	ron-ncs540-2dd-1	1/CHAN 49 (192.500)	ron-ols-5-roadm	Ō
on-8201-2/Optics0/0/0/10 to ron-ols-2-roadm/3/CHAN 49 (192.500)	Optics0/0/0/10	ron-8201-2	3/CHAN 49 (192.500)	ron-ols-2-roadm	Ô
on-8201-3/Optics0/0/0/20 to ron2_olt4-roadm/0/2/0/25	Optics0/0/0/20	ron-8201-3	0/2/0/25	ron2_olt4-roadm	Ō
on-8201-1/Optics0/0/0/20 to ron-ols-1-roadm/1/CHAN 7 (195.650)	Optics0/0/0/20	ron-8201-1	1/CHAN 7 (195.650)	ron-ols-1-roadm	Ô
on-8201-1/Optics0/0/0/18 to ron-ols-1-roadm/4/AD-1	Optics0/0/0/18	ron-8201-1	4/AD-1	ron-ols-1-roadm	Ō
on-ncs57b1-1/Optics0/0/0/24 to ron-ols-5-roadm/1/CHAN 51 (192.350)	Optics0/0/0/24	ron-ncs57b1-1	1/CHAN 51 (192.350)	ron-ols-5-roadm	Ō
on-8201-4/Optics0/0/0/20 to ron-ols-2-roadm/3/CHAN 25 (194.300)	Optics0/0/0/20	ron-8201-4	3/CHAN 25 (194.300)	ron-ols-2-roadm	Ō
on-8201-2/Optics0/0/0/20 to ron-ols-2-roadm/1/CHAN 7 (195.650)	Optics0/0/0/20	ron-8201-2	1/CHAN 7 (195.650)	ron-ols-2-roadm	Ō
on-ncs57c3-1/Optics0/0/3/2 to ron2_olt1-roadm/0/1/0/25	Optics0/0/3/2	ron-ncs57c3-1	0/1/0/25	ron2_olt1-roadm	Ō

Figure 16: Optical Add/drop Ports

Select the optical add/drop port. In this case, select 0/1/0/6 port on ron2_olt1 and click OK.

Figure 17: Optical Add/drop Ports

Router OCH p ron-ncs57c			Advanced	30	Explorer		
Name				PORTS			
14 ITEMS ron-poc-8201-	Name -	Device •	Туре	* Capacity	* Description	✓ Admin Status ✓	Ō
ron-poc-57b1-		Filter ×	NMC			UP	Ō
ron-8201-1/Op	1/3/[EXP 17-20]-2		NMC			UP	Ô
ron-ncs57c3-1,	1/CHAN 4 (195.875)	Cancel Apply	NMC			UP	Ô
ron-8201-3/Op	1/CHAN 32 (193.775)	Site-A-roadm	NMC			UP	Ō
ron-ncs540-2d	1/CHAN 33 (193.700)	Site-B-roadm	NMC			UP	Ō
ron-8201-2/Op	1/CHAN 58 (191.825)	Site-B-roadm	NMC			UP	Ō
ron-8201-3/Op	1/CHAN 27 (194.150)	Site-B-roadm	NMC			UP	Ō
ron-8201-1/Op	1/CHAN 20 (194.675)	Site-B-roadm	NMC			UP	Ô
ron-8201-1/0p	1/CHAN 19 (194.750)	Site-A-roadm	NMC			UP	Ō
ron-ncs57b1-1	1/CHAN 28 (194.075)	Site-B-roadm	NMC			UP	Ō
ron-8201-4/Op	T/CHMM II (192.320)	Site-A-roadm	NMC			UP	Ô
ron-8201-2/Op	1/CHAN 52 (192.275)	Site-B-roadm	NMC			UP	Ō
ron-ncs57c3-1	1/CHAN 22 (194.525)	Site-B-roadm	NMC			UP	Ō
	1/CHAN 10 (195.425)	Site-B-roadm	NMC			UP	
	1/CHAN 25 (194.300)	Site-A-roadm	NMC			UP	
	1/FMAN 10/104 0161	Cite B madm	NMC			UP	
						Cancel OK	

Figure 18: Optical Add/drop Ports

	Router OCH po					-	_						
		* *			Advanced		8	3D Explorer					
	ame 4 ITEMS					POR	ITS					- 10	
	on-poc-8201-1	Name	Device	۲	Туре	-	Capacity	-	Description	✓ Admi	n Status		Ō
	on-poc-57b1-1	1 ITEM MATCHING FILTERS 0/1/0/6	ron2_olt1-roadm		NMC					UP			Ō
	on-8201-1/Opt	0/1/0/6	ronz_ott1-roadm										Ô
	on-ncs57c3-1/												Ō
2	on-8201-3/Opt												ō
	on-ncs540-2de												Ō
	on-8201-2/Opt											- 10	0
3 3	on-8201-3/Opt												Ō
	on-8201-3/0pt												Ô
	on-8201-1/0p												
	on-a201-1/0p												Ō
												- 10	
	on-8201-4/Opt											- 10	Ō
	on-8201-2/0pt												Ō
n	on-ncs57c3-1/											- 10	Ō
												- 10	
												- 10	
												_	
											Cancel	ык	

e. After the router and optical interfaces are selected, click Add to add the NMC cross-connect.

Figure 19: NMC Cross Connection Creation

Router OCH port ron-ncs57c3-1 - Optics0/0/2/0		NMC port olt1-roadm - 0/1/0/6	x 🔍 🛛 + 48	5		
Name		* Router Port	* Router Device	* Optical Port	Optical Device *	
14 ITEMS						
ron-poc-8201-1/Optics0/0/0/22 to Site-A-roadm/1/CHAN 2	29 (194.000)	Optics0/0/0/22	ron-poc-8201-1	1/CHAN 29 (194.000)	Site-A-roadm	Ô
ron-poc-57b1-1/Optics0/0/0/24 to Site-B-roadm/1/CHAN	29 (194.000)	Optics0/0/0/24	ron-poc-57b1-1	1/CHAN 29 (194.000)	Site-B-roadm	Ō
ron-8201-1/Optics0/0/0/8 to ron-ols-1-roadm/4/AD-2		Optics0/0/0/8	ron-8201-1	4/AD-2	ron-ols-1-roadm	Ō
ron-ncs57c3-1/0ptics0/0/2/2 to ron2_olt6-roadm/0/1/0/2	9	Optics0/0/2/2	ron-ncs57c3-1	0/1/0/29	ron2_olt6-roadm	Ō
ron-8201-3/Optics0/0/0/16 to ron2_olt5-roadm/0/1/0/29		Optics0/0/0/16	ron-8201-3	0/1/0/29	ron2_olt5-roadm	Ô
ron-ncs540-2dd-1/Optics0/0/0/0 to ron-ols-5-roadm/1/Ci-	IAN 49 (192.500)	Optics0/0/0/0	ron-ncs540-2dd-1	1/CHAN 49 (192.500)	ron-ols-5-roadm	Ô
ron-8201-2/Optics0/0/0/10 to ron-ols-2-roadm/3/CHAN 45	(192.500)	Optics0/0/0/10	ron-8201-2	3/CHAN 49 (192.500)	ron-ols-2-roadm	Ô
ron-8201-3/Optics0/0/0/20 to ron2_olt4-roadm/0/2/0/25		Optics0/0/0/20	ron-8201-3	0/2/0/25	ron2_olt4-roadm	Ō
ron-8201-1/Optics0/0/0/20 to ron-ols-1-roadm/1/CHAN 7	(195.650)	Optics0/0/0/20	ron-8201-1	1/CHAN 7 (195.650)	ron-ols-1-roadm	Ō
ron-8201-1/Optics0/0/0/18 to ron-ols-1-roadm/4/AD-1		Optics0/0/0/18	ron-8201-1	4/AD-1	ron-ols-1-roadm	Ō
ron-ncs57b1-1/Optics0/0/0/24 to ron-ols-5-roadm/1/CHAI	N 51 (192.350)	Optics0/0/0/24	ron-ncs57b1-1	1/CHAN 51 (192.350)	ron-ols-5-roadm	Ō
ron-8201-4/Optics0/0/0/20 to ron-ols-2-roadm/3/CHAN 25	6 (194.300)	Optics0/0/0/20	ron-8201-4	3/CHAN 25 (194.300)	ron-ols-2-roadm	Ō
ron-8201-2/Optics0/0/0/20 to ron-ols-2-roadm/1/CHAN 7	(195.650)	Optics0/0/0/20	ron-8201-2	1/CHAN 7 (195.650)	ron-ols-2-roadm	Ō
ron-ncs57c3-1/Optics0/0/3/2 to ron2_olt1-roadm/0/1/0/2	5	Optics0/0/3/2	ron-ncs57c3-1	0/1/0/25	ron2_olt1-roadm	Ō

f. Select and add second router port, ron-5504-1 0/0/0/0 and OLS add/drop port, ron2_olt2 0/3/0/6.
 Figure 20: Second Router Port and OLS Port

ron-ncs5504-1 - Optics0/0/0/0 ×	ron2_olt2-roadr	n - 0/3/0/6	× < + Add			
Name		Router Port	* Router Device *	Optical Port	* Optical Device *	
15 ITEMS						
ron-poc-8201-1/Optics0/0/0/22 to Site-A-roadm/1/CHAN 29 (194.	000}	Optics0/0/0/22	ron-poc-8201-1	1/CHAN 29 (194.000)	Site-A-roadm	Ô
ron-poc-57b1-1/Optics0/0/0/24 to Site-B-roadm/1/CHAN 29 (194	.000}	Optics0/0/0/24	ron-poc-57b1-1	1/CHAN 29 (194.000)	Site-B-roadm	Ō
ron-8201-1/Optics0/0/0/8 to ron-ols-1-roadm/4/AD-2		Optics0/0/0/8	ron-8201-1	4/AD-2	ron-ols-1-roadm	Ō
ron-ncs57c3-1/0ptics0/0/2/2 to ron2_olt6-roadm/0/1/0/29		Optics0/0/2/2	ron-ncs57c3-1	0/1/0/29	ron2_olt6-roadm	Ô
ron-8201-3/Optics0/0/0/16 to ron2_olt5-roadm/0/1/0/29		Optics0/0/0/16	ron-8201-3	0/1/0/29	ron2_olt5-roadm	Ō
ron-ncs540-2dd-1/Optics0/0/0/0 to ron-ols-5-roadm/1/CHAN 49	Optics0/0/0/0	ron-ncs540-2dd-1	1/CHAN 49 (192.500)	ron-ols-5-roadm	Ō	
ron-8201-2/Optics0/0/0/10 to ron-ols-2-roadm/3/CHAN 49 (192.5	Optics0/0/0/10	ron-8201-2	3/CHAN 49 (192.500)	ron-ols-2-roadm	Ô	
ron-ncs57c3-1/Optics0/0/2/0 to ron2_olt1-roadm/0/1/0/6		Optics0/0/2/0	ron-ncs57c3-1	0/1/0/6	ron2_olt1-roadm	Ō
ron-8201-3/Optics0/0/0/20 to ron2_olt4-roadm/0/2/0/25		Optics0/0/0/20	ron-8201-3	0/2/0/25	ron2_olt4-roadm	Ō
ron-8201-1/Optics0/0/0/20 to ron-ols-1-roadm/1/CHAN 7 (195.65	0)	Optics0/0/0/20	ron-8201-1	1/CHAN 7 (195.650)	ron-ols-1-roadm	Ō
ron-8201-1/Optics0/0/0/18 to ron-ols-1-roadm/4/AD-1		Optics0/0/0/18	ron-8201-1	4/AD-1	ron-ols-1-roadm	Ō
ron-ncs57b1-1/Optics0/0/0/24 to ron-ols-5-roadm/1/CHAN 51 (19	2.350)	Optics0/0/0/24	ron-ncs57b1-1	1/CHAN 51 (192.350)	ron-ols-5-roadm	Ō
ron-8201-4/Optics0/0/0/20 to ron-ols-2-roadm/3/CHAN 25 (194.3	00)	Optics0/0/0/20	ron-8201-4	3/CHAN 25 (194.300)	ron-ols-2-roadm	Ō
ron-8201-2/Optics0/0/0/20 to ron-ols-2-roadm/1/CHAN 7 (195.65	0)	Optics0/0/0/20	ron-8201-2	1/CHAN 7 (195.650)	ron-ols-2-roadm	Ō
ron-ncs57c3-1/Optics0/0/3/2 to ron2_olt1-roadm/0/1/0/25		Optics0/0/3/2	ron-ncs57c3-1	0/1/0/25	ron2_olt1-roadm	Ō

- 2. To provision the Routed Optical Networking IP link, perform these steps:
 - a. In the applications bar in the Crosswork Hierarchical Controller, click the Services Manager icon.

Figure 21: Services Manager



b. Select the **Point to Point** tab and click **IP Link** from the **Create New P2P** drop-down list to start the provisioning process.

Figure 22: Create IP Link

Create New P2P	•									
IP Link	•	P2P Type *	Configurat ® State	+ Creation Date +	Endpoint A 👻	Endpoint B *	Speed *	Operation: * State	Last 24h * Operation:	Last Operation
OCH Link	TCHING FILTE	RS							optionent	
OCH-NC Link	3-0L\$4	IP Link	INSTALLED	29-09-2022 10:42:24 UTC	ron-asr9903-1 - Optics0/	ron-8201-4 - Optics0/0/0		Up	1	Create IP Link: ✓ Done
OTN-Line	4-RON	IP Link	INSTALLED	29-09-2022 10:06:30 UTC	ron-8201-1 - Optics0/0/0	ron-asr9903-1 - Optics0/		Up	1	Create IP Link: ✓ Done
Circuit E-Line	202-2809	IP Link	INSTALLED	28-09-2022 08:19:38 UTC	ron-poc-8201-1 - Optics0	ron-poc-8201-2 - Optics0		Up	1	Create IP Link: ✓ Done
Packet E-Line										

The IP Link Creation wizard appears.

Figure 23: IP Link Creation Wizard

۲	Services Manager	Tunnels	Point to Poin	it Muli	ti Point									Operations	Settings
SHOP	Create New P2P					IP Link C	reation								
	Name *	Р2Р Туре 🔻	Configurat State	+ Creatio						•	Speed *	Operation: * State	Last 24h * Operation:	Last Operation	-
	3 OUT OF 213 ITEMS MATCHING FILTE	ERS			1	2 ENOPOINTS	3	4 SUMMANY	- 1						
	RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20	GENERAL				3			Up	1	Create IP Link: ✓ Done	
0	RON-8201-1-OLS1-OLS4-RON	IP Link	INSTALLED	29-09-20	Name							Up	1	Create IP Link: ✓ Done	
0	ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	1							Up	1	Create IP Link: ✓ Done	
					Description										
0 @															
					Link Rate Mode	r			-						
C.					Router Confi	guration Only									
\bigcirc									- 1						
									- 1						
									- 1						
									- 1						
									- 1						
									- 1						
									- 1						
0									. 1						
					× Cancel			Back > Net	xt						
\$									_						
Θ															
cisco															

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

Figure 24: IP Link Creation Wizard - General

۲	Services Manager	Tunnels	Point to Poir	t Mult	Point					Operations Settings
\odot	Create New P2P									
SHOL	Create New P2P				IP Link Creation					
1000	Name +	Р2Р Туре 🔹	Configurat State	Creation	(1) 2 3	4	* Speed *	Operation: * State	Last 24h * Operation:	Last Operation *
	3 OUT OF 213 ITEMS MATCHING FILTE	RS			GENERAL ENDPOINTS PATH	SUAMARY				
	RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20	GENERAL LINE OFFICE		J	Up	1	Create IP Link: 🗸 Done
0	RON-8201-1-OL51-OL54-RON	IP Link	INSTALLED	29-09-20	Name* ron-57c3-1-olt1-olt2-ron-5504-1		·	Up	1	Create IP Link: ✓ Done
\odot	ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	Description)	Up	1	Create IP Link: ✓ Done
and the second se					ron_57c3_1_to_ron_5504_1					
					Link Rate Mode* 100G - 1x100G					
0 () () ()					200G - Bundle					
					200G - 2x100G					
					300G - Bundle					
					300G - 3x100G					
					400G - 4x100G 400G - 1x400G					
					4000 - 1x4000					
0										
*					× Cancel	Back > Next				
10.50										
Θ										
alaile cisco										

(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.

Figure 25: IP Link Creation Wizard - General

۲	Services Manager	Tunnels	Point to Point	t Multi	Point						Operations	Settings
	Create New P2P											
SHOL	Enderstation of the local sector				IP Link Creati	on						
and the second se			Configurat State	+ Creatio	1 2 3	3 4	* \$	peed *	Operation: * State	Last 24h * Operation:	Last Operation	•
0	3 OUT OF 213 ITEMS MATCHING FILTE	RS				TH SUMMARY						
	RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20	areas and a second s		J		Up	1	Create IP Link: ✓ Done	
0	RON-8201-1-OL51-OL54-RON	IP Link	INSTALLED	29-09-20	Name" ron-57c3-1-olt1-olt2-ron-5504-1		·		Up	1	Create IP Link: ✓ Done	
	ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	1011-51-1-011-011-1011-5501-1		J		Up	1	Create IP Link: ✓ Done	
0					Description ron_57c3_1_to_ron_5504_1							
0					Link Rate Mode*							
					400G - 1x400G	*						
					Router Configuration Only							
\odot					4							
0												
					× Cancel	C Back > Next						
\$				1								
Θ												
aliadia cisco												
cisco												

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 TX power is used if no value is provided.

Figure 26: IP Link Creation Wizard - Router Endpoints

Create New P2P				IP Link Creation					
Name +	P2P Type *	Configurat State	+ Creatio			* Speed	d * Operation: * State	Last 24h * Operation:	Last Operation
3 OUT OF 213 ITEMS MATCHING FILTE	ERS			1 2 3 GENERAL ENDPOINTS PATH	4 SUMMARY				
RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20	ENDPOINTS PATH		1,	Up	1	Create IP Link: ✓ Done
RON-8201-1-OL51-OL54-RON	IP Link	INSTALLED	29-09-20			·	Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	ENDPOINT A)	Up	1	Create IP Link: ✓ Done
				Site A					
				De de de					
				Port A*					
				Transmit Power (dBm)					
				ENDPOINT B					
				Site B					
				Port B*					
				Transmit Power [dBm]					
				× Cancel	< Back > Next				

e. Click the magnifying glass icon to select the site. The site can be selected either by selecting from the list or by using the 3D Explorer.

Figure 27: IP Link Creation Wizard - Site Selection

۲			int to Point Multi Point		Operations Settings
\odot	Create	*			_
(IDH2)	Name		Advanced	3D Explorer	
		Name 1 ITEM MATCHING FILTERS	🛞 Latitude		
0	RON-82	MAL	36.7213	-4.4213	✓ Done ✓ Done
\odot	ron-poc				ď Done
0000					
0					
0					×
					Cancel
albah					

f. Click the magnifying glass icon to select the router port.

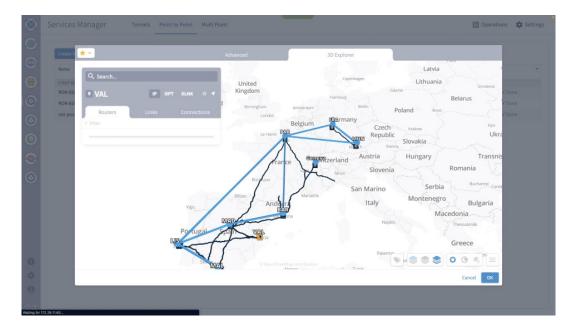
The ports are displayed based on the following criteria:

- Is a ZR/ZR+ interface
- Has no existing optics configuration
- Has a proper NMC cross-connect configured

Figure 28: IP Link Creation Wizard - Port Selection

Create N	**	-		Advanced	_		3D Explorer	_	-	-	
	<u> </u>			Auvanceo			30 Explorer				
Name					OCHI	2002000					
30010	Name 1 ITEM	•	Device	Туре	•	Capacity		Description *	Admin Status		
RON-820	Optics0/0/0/0		ron-ncs5504-1	осн				OCH port of Cisco QSFPDD 400G	UP		
RON-820											
ron-poo											
									Can	el OK	
		-									

g. Select the second site using the 3D Explorer. VAL is the site of the other endpoint router and port.
 Figure 29: IP Link Creation Wizard - Site Selection Using 3D Explorer



h. Select the second router port.

Figure 30: IP Link Creation Wizard - Router Port Selection

	*		Advanced	30			
Name				OCH PORTS			
	lame	* Device	* Туре		* Description *	Admin Status	
RON-820	ITEMS Optics0/0/2/0	ron-ncs57c3-1	осн		OCH port of Cisco QSFPDD 400G	UP	/ Done
RON-826	optics0/0/2/0	ron-ncs57c3-1	OCH		OCH port of Cisco QSFPDD 400G		/ Done
ron-poc	optics0/0/2/2	ron-ncs57c3-1	OCH		OCH port of Cisco QSFPDD 400G		/ Done
	decision of othe	101-1630163-1					
						Cancel Olg	

Both the router ports are selected.

Create New P2P										
				IP Link Crea						
Name *	Р2Р Туре 🔻	Configurat State	+ Creatio			-	Speed *	Operation: * State	Last 24h * Operation:	Last Operation
3 OUT OF 213 ITEMS MATCHING FILTE	RS			1 2 GENERAL ENDPOINTS	3 4 рати зиммалу	- 100				
RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20	ENDPOINTS		J		Up	1	Create IP Link: ✓ Done
RON-8201-1-OLS1-OLS4-RON	IP Link	INSTALLED	29-09-20			·		Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	ENDPOINT A		J		Up	1	Create IP Link: ✓ Done
				Site A MAL	×Q					
				Port A*						
				ron-ncs5504-1 - Optics0/0/0/0	× Q					
				Transmit Power [dBm]						
				*						
				ENDPOINT B						
				Site B						
				VAL	×Q					
				Port B*	×					
				Port B* ron-ncs57c3-1 - Optics0/0/2/0	×Q					
					×Q					
				ron-ncs57c3-1 - Optics0/0/2/0	x Q					
				ron-ncs57c3-1 - Optics0/0/2/0	× Q					

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

Figure 31: IP Link Creation Wizard - IP Addresses

Create New P2P	3			IP Link Creation					
Name	▼ Р2Р Туре ▼	Configurat State	+ Creatio		-	Speed *	Operation: * State	Last 24h * Operation:	Last Operation
3 OUT OF 213 ITEMS	AATCHING FILTERS			1 (2) 3 4 GENERAL ENDPOINTS PATH SUMMARY					
RON-8201-4-OLS2-0	LS3-OLS4 IP Link	INSTALLED	29-09-20	ACHORAGE ENDI-DINTS PATH SUBBOOK	J		Up	1	Create IP Link: ✓ Done
RON-8201-1-OLS1-0	LS4-RON IP Link	INSTALLED	29-09-20	Transmit Power (dBm)	·		Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201	-8202-2809 IP Link	INSTALLED	28-09-20		J		Up	1	Create IP Link: 🗸 Done
				(ron-ncs7rc31-0ptics0)0/2/0 X Q Transmit Power [dBm] LINK #1 (P ADDRESSES (P Address A (CDR)) 10.42.41.0731 (P Address B (CDR)) 10.42.41.1/31					
				× Cancel < Back > Next					

j. In the optical path configuration, optical node exclusion can be configured. The frequency can be manually set in this step. In router only configuration, the frequency is mandatory. If OLS provisioning is performed, Cisco Optical Network Controller returns the proper frequency to be configured on the router endpoints; hence, the frequency may be omitted. In this case, the manual frequency is set to the same value returned by Cisco Optical Network Controller.

Figure 32: IP Link Creation Wizard - Path

۲	Services Manager	Tunnels	Point to Poir	nt Multi	Point							Operations	🗘 Settings
.	Create New P2P				IP Link (reation							
and the second se	Name *	Р2Р Туре 🔻	Configurat State	+ Creatio				-	Speed *	Operation: * State	Last 24h * Operation:	Last Operation	•
	3 OUT OF 213 ITEMS MATCHING FILTE	ERS			1 2 GENERAL ENOPOINTS	3	4 SUMMATY						
	RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20		PATH		J		Up	1	Create IP Link: ✓ Done	
0	RON-8201-1-OLS1-OLS4-RON	IP Link	INSTALLED	29-09-20	Select Node or Link			·		Up	1	Create IP Link: ✓ Done	
\odot	ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	(No	items)		J		Up	1	Create IP Link: ✓ Done	
					▼ Disjoint From Links								
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO													
					(No	items)							
					FREQUENCY								
					L Band								
					C Band								
					Frequency THz 195.2								
							~						
0													
\$					× Cancel	<	Back						
Θ													
-ilinilin cisco													

k. Click **Next** to review the final configuration. Click **Finish** to start provisioning, or click **Save** to save for later provisioning.

Figure 33: IP Link Creation Wizard - Summary

Create New P2P									
				IP Link Creation					
	P2P Type *	Configurat ** State	+ Creatio	1 2 3 4	-	Speed *	Operation: * State	Last 24h * Operation:	Last Operation
3 OUT OF 213 ITEMS MATCHING FILTE				GENERAL ENOPOINTS PATH SUMMARY	- 64				
RON-8201-4-OLS2-OLS3-OLS4	IP Link	INSTALLED	29-09-20		J		Up	1	Create IP Link: ✓ Done
RON-8201-1-OLS1-OLS4-RON	IP Link	INSTALLED	29-09-20	Description: ron_57c3_1_to_ron_5504_1	·		Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-20	▼ Endpoint A	J		Up	1	Create IP Link: ✓ Done
				Port: ron-ncs57c3-1 - Optics0/0/2/0					
				Transmit Power: None dBus Transmit Power: None dBus Link Rate Mode: 400G - 1x400G Frequency: 195.2 THz Path Criteria: Latency Optical Societa Latency Disjoint From Links: V IP Addresses:					
				Transmit Power: None dBm Link Rate Mode: 400G - 1x400G Frequency: 195.2 THz Path Critical Latency Optical Excluded List: - Included List: - Disjoint From Links: -					
				Transmit Power: None dBm Link Rate Mode: 400G - 1x400G Frequency: 195.2 THz Path Criteria: Latency Optical Exclude List: - Included List: - Disjoint From Links: - V IP Addresses: 1042.41.031	e				

1. The progress of provisioning is shown in the Services Manager.

I

Name		Р2Р Туре 🔹	Configurat 🕤 State	♦ Creation Date	Endpoint A *	Endpoint B *	Speed	• Operation: • State	Last 24h * Operation:	Last Operation
4 OUT OF 214 ITEMS M										
ron-57c3-1-olt1-olt2		IP Link	IN PROG	06-10-2022 00:59:49 UTC	ron-ncs5504-1 - Optics0	ron-ncs57c3-1 - Optics0			1	Create IP Link: Pro
RON-8201-4-OLS2-0	LS3-OLS4	IP Link	INSTALLED	29-09-2022 10:42:24 UTC	ron-asr9903-1 - Optics0/	ron-8201-4 - Optics0/0/0		Up	1	Create IP Link: ✓ Don
RON-8201-1-OLS1-0	LS4-RON	IP Link	INSTALLED	29-09-2022 10:06:30 UTC	ron-asr9903-1 - Optics0/	ron-8201-1 - Optics0/0/0		Up	1	Create IP Link: ✓ Dor
ron-poc-direct-8201-	8202-2809	IP Link	INSTALLED	28-09-2022 08:19:38 UTC	ron-poc-8201-1 - Optics0	ran-pac-8201-2 - Optics0		Up	1	Create IP Link: ✓ Dor
ron-57c3-1-olt										
ron-57c3-1-olt	1-olt2-ror Endpoint		nderlay Path	Operations	Events Actions					
Summary				Operations cycle State		ion Date		✓ Last Upp	fate	
Summary			ě Life	cycle State	Events Actions	ion Date -2022 00:59:43 UTC			fate 022 01:00:32 UT	rc
Summary Action 1.ITEM			ě Life		Events Actions					rc

Figure 34: Provisioning Progress - Services Manager

m. Click the Operations > Logs tab to view the provisioning API calls used and responses.
 Figure 35: Provisioning Progress - Logs

Create New P2P									
Name *	Р2Р Туре 🔹	Configurat State	+ Creation Date +	Endpoint A *	Endpoint B	 Speed 	Operation: * State	Last 24h * Operation:	Last Operation
4 OUT OF 214 ITEMS MATCHING FILT	RS								
ron-57c3-1-olt1-olt2-ron-5504-1	IP Link	IN PROG	06-10-2022 00:59:49 UTC	ron-ncs5504-1 - Optics0	ron-ncs57c3-1 - Optics0			1	Create IP Link: Discov
RON-8201-4-0LS2-0LS3-0LS4	IP Link	INSTALLED	29-09-2022 10:42:24 UTC	ron-8201-4 - Optics0/0/0	ron-asr9903-1 - Optics0/		Up	1	Create IP Link: ✓ Done
RON-8201-1-0LS1-0LS4-RON	IP Link	INSTALLED	29-09-2022 10:06:30 UTC	ron-8201-1 - Optics0/0/0	ron-asr9903-1 - Optics0/		Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-2022 08:19:38 UTC	ron-poc-8201-2 - Optics0	ron-poc-8201-1 - Optics0.		Up	1	Create IP Link: ✓ Done
ron-57c3-1-olt1-olt2-roc Summary Endpoir	its Ur	nderlay Path	Operations	Events Actions		11111 PV	_	LOPE	TROOPE
Summary Endpoin					@ SI	IMMARY		LOGS	ERRORS
Summary Endpoir	ts Ur Lifecycle State			Events Actions	▼ Normal	Flow		LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	its Ur		Creation Date	Events Actions	▼ Normal ▼ Ada	Flow pter #1: onc-5	0√	LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	▼ Normal ▼ Ada ▶ •	Flow pter #1: onc-5 create service	0 √	LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	rc ▼ Normal ▼ Ada ▶ d	Flow pter #1: onc-5 create service preate service	0 √ response	LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	rc ▼ Normal ▼ Ada ▶ d	Flow pter #1: onc-5 create service	0 √ response	LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	rc ▼ Normal ▼ Ada ▶ d	Flow pter #1: onc-5 create service preate service	0 √ response	LOGS	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	rc ▼ Normal ▼ Ada ▶ d	Flow pter #1: onc-5 create service preate service	0 √ response	1005	ERRORS
Summary Endpoin Action + 1 ITEM	ts Ur Lifecycle State		Creation Date	Events Actions	rc ▼ Normal ▼ Ada ▶ d	Flow pter #1: onc-5 create service preate service	0 √ response	1.065	ERRORS

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

Figure 36: Successful Provisioning

Services Manager	Tunnels	Point to Point	Muta Point						Operations
Create New P2P									
Name *	P2P Type 🔹	Configuration 💿 State	+ Creation Date *	Endpoint A *	Endpoint B *	Speed *	Operation * State	Last 24h * Operation	Last Operation
4 OUT OF 214 ITEMS MATCHING FILTER	85								
ron-57c3-1-olt1-olt2-ron-5504-1	IP Link	INSTALLED	06-10-2022.00:59:49 UTC	ron-ncs57c3-1 - Optics0	ron-ncs5504-1 - Optics		Up	1	Create IP Link: ✓ Done
RON-8201-4-0LS2-0LS3-0LS4	IP Link	INSTALLED	29-09-2022 10:42:24 UTC	ron-asr9903-1 - Optics0/	ron-8201-4 - Optics0/0/		Up	1	Create IP Link: ✓ Done
RON-8201-1-OLS1-OLS4-RON	IP Link	INSTALLED	29-09-2022 10:06:30 UTC	ron-8201-1 - Optics0/0/	ron-asr9903-1 - Optics0/		Up	1	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-2809	IP Link	INSTALLED	28-09-2022 08:19:38 UTC	ron-poc-8201-2 - Optics	ron-poc-8201-1 - Optics		Up	1	Create IP Link: ✓ Done
Summary Endpoints	s Ui	nderlay Path		Events Actions					
Action	s Ui	nderlay Path • Lifecycl		Events Actions	Date		▼ Last Upda	ate	
	s U		le State	- Creation	1 Date 022 00:59:43 UTC			ate 122 01:02:12 UT(:
Action 1.ITEM	s U	▼ Lifecycl	le State	- Creation					
Action 1.ITEM	s Ur	▼ Lifecycl	le State	- Creation					
Action 1.ITEM	s U	▼ Lifecycl	le State	- Creation					5

o. Click the **Summary** tab to see the new service link and click the square to show the new link in the 3D Explorer view.

Figure 37: Provisioned Service Link

Create New P2P									
Name	• P2P Type	Configuration State	+ Creation Date +	Endpoint A +	Endpoint B *	Speed *	Operation * State	Last 24h * Operation	Last Operation
4 OUT OF 214 ITEMS MATCHING	LTERS								
ron-57c3-1-olt1-olt2-ron-550-	1 IP Link	INSTALLED	06-10-2022 00:59:49 UTC	ron-ncs57c3-1 - Optics0	ron-ncs5504-1 - Optics		Up	1	Create IP Link: ✓ Done
RON-8201-4-OL52-OL53-OL54	IP Link	INSTALLED	29-09-2022 10:42:24 UTC	ron-asr9903-1 - Optics0/	ron-8201-4 - Optics0/0/		Up	1	Create IP Link: ✓ Done
RON-8201-1-OLS1-OLS4-RON-	. IP Link	INSTALLED	29-09-2022 10:06:30 UTC	ron-8201-1 - Optics0/0/	ron-asr9903-1 - Optics0/		Up	1	Create IP Link: ✓ Done
								12	Create IP Link: ✓ Done
ron-poc-direct-8201-8202-280 ron-57c3-1-olt1-olt2 Summary End GUID: SI/ddf3d71768fd4 Name: ron-57c3-1-olt1-	ron-5504-1 oints I 6a9539b070ad It2-ron-5504-1	Jnderlay Path Je158b0	28-09-2022 08:19:38 UTC Operations	ron-poc-8201-2 - Optics	ron-poc-8201-1 - Optics		Up	1	Greate in Link, Y Done
Con-57c3-1-olt1-olt2 Summary End GUID: Sl/ddf3d71768fd4 Name: con-57c3-1-olt1- Creation Time: 06-10-20 Last Changed: 06-10-20	ron-5504-1 oints 1 16a9539b070ac lt2-ron-5504-1 22 00:59:49 UTC 2 00:59:49 UTC	L Jnderlay Path Je158b0 C			ron-poc-8201-1 - Optics		Up	1	
ron-57c3-1-olt1-olt2 Summary End GUID: Sl/ddf3d71768fd4 Name: ron 57c3-olt1- Creation Time: 06-10-20 Template Name: defaul * Service Links:	ron-5504-1 oints I 669539b070ad It2-ron-5504-1 22 00:59:49 UTO 2 00:59:49 UTO template	L Jnderlay Path Je158b0 C			ron-poc-8201-1 - Optics		Up	1	
Con-57c3-1-olt1-olt2 Summary End Guide: Styldrifar17rs6rid Name: con-57c3-olt1- Creation Time: 06-10-20 Template Name: cfeduu * Service Links: [10:42:41:0 to 10:42:41. Br Address Assignment Is Bundle? No	ron-5504-1 oints 1 669539b070ad 122 ron-5504-1 22 00:59:49 UTC template * @ Policy: User All	L Jinderlay Path Je158b0 C			ron-poc-8201-1 - Optics		Up	1	
ron-57c3-1-olt1-olt2 Summary End GUID: SI/ddf3d71768fd4 Name: ron 57c3-1-olt1- Creation Time: ro6:10-21 List Changed: 06:10-22 Template Name: defaul & Service Links: [04241016104241] IP Address Assignment	ron-5504-1 oints 1 669539b070ad 122 ron-5504-1 22 00:59:49 UTC template * @ Policy: User All	L Jinderlay Path Je158b0 C			ron-poc-8201-1 - Optics		Up	1	
ron-57c3-1-olt1-olt2 Summary End GUID: SI/ddf3d71768fd4 Name: ron:57c3-1-olt1- Creation Time: o6:10:21 Last Changed: 06:10:22 Template Name: defaul v Enderse Assignment B Address Assignment Chanel Config: 12 400	ron-5504-1 oints 1 669539b070ad 122 ron-5504-1 22 00:59:49 UTC template * @ Policy: User All	L Jnderlay Path Je158b0 C			ron-poc-8201-1 - Optics		Up	1	

p. 3D Explorer view highlights the new logical router link along with the underlying optical path that is shown in Green.

Figure 38: Provisioned Link in 3D Explorer



q. Click Path to show the full multilayer path including each optical line system segment.*Figure 39: Multilayer Path View in 3D Explorer*



3. The Link Assurance app can be used to inspect the end-to-end link path.

elect Links For In-Depth Analysis	10.42.4	0.1 to 10.4	2.40.0 L3 Logical Link			
Define Valid Links For Inspection By:			MAL	MAD	VAL	
 Specific link(s) / underlay link(s) Tags 	LOG					•
Device(s) in 1 of the endpoints	РНУ	•				•
O Device(s) in both endpoints	ETH					•
	ZRC	ron-ncs5504-1				ron-ncs57c3-1
Q Add Link	ZRM					
ron-ncs57c3-1/Optics0/0/2/0 to ron2_olt1-roadm/0/1/0/6	ОСН -					
	NMC					
	MC		-		-	
	мс		ron2_olt2-roa		oron2_olt1-roa	
	OMS				-	
	оть			ron2_ila1		
Name • Type • Status •						
ITEMS						
10.42.40.1 to 10.42.40.0 L3 Log UP						
Optics0/0/0/0 to Optics0 OCH UP						

Figure 40: Link Assurance Tool

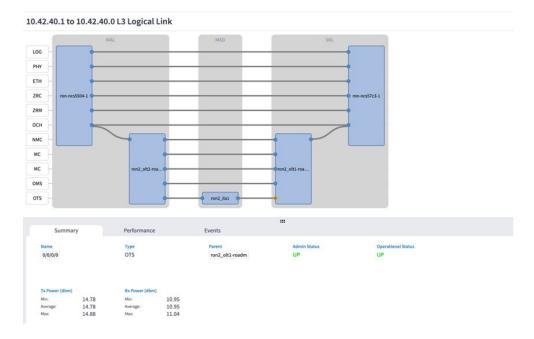
Select a specific layer to show PM data (ZRM, OCH, and OTS layers only).

Figure 41: Link Assurance Tool



Select a specific port to show PM data for the port.

Figure 42: Link Assurance Tool



Operate Phase

To monitor the ZR/Z+ optics:

- Use either CLI commands or EPNM to monitor router ZR/ZR+ optics for proper operation. See Monitor ZR or ZR+ Optics Using EPNM, on page 54.
- 2. (Optional) Setup router ZR/ZR+ optics data collection in CW Health Insights. See Monitor Performance of ZR/ZR+ Optics Using KPIs, on page 63.

Monitor ZR or ZR+ Optics Using EPNM

This section adds the 8201 router to EPNM for monitoring the PM parameters on the ZR or ZR+ optics.

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

ice Groups		roups / Device Type / 8000 Series Ro								Selected 0 / Total 4 🖉 🖄
· · · · · · · · · · · · · · · · · · ·	+ •	Ad	min State 🔻 Sync	Groups & Sites 🔻	Export Device Revoke C	oAM Co			Show	Quick Filter
Search All		Reachability	Admin Status	Device Name	▲ IP Address		DNS Name	Device Type	Last Inventory Collection Statu	us Last Successful Colle
NI Devices (j) Device Type (j)										
Optical Networking (j)			Managed	ron-8201-1	172.29.11.20	II ()	172.29.11.20	Cisco 8201 Router	Completed	2021-Jun-24 12:37:07
Routers (j)		v	Managed	ron-8201-2	172.29.11.21		172.29.11.21	Cisco 8201 Router	Completed with Warning	0
Cisco 8000 Series Routers		\checkmark	Managed	ron-8201-3	172.29.11.22	II ()	172.29.11.22	Cisco 8201 Router	Completed	(j) 2021-Jun-24 12:36:29
scation () ser Defined ()		v	Managed	ron-8201-4	172.29.11.23	11 Ø	172.29.11.23	Cisco 8201 Router	Synchronizing	0
ser Denned (1)										

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

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Cancel

Device Groups	Device Groups / Device Typ Cisco 8000 Series R							Sai	cted 0 / Total 4 🖉 🖻 🔅
<'"≡ +		dmin State V Sync	Groups & Sites 🔻		icate OAM Co			Show Qu	
Q Search All All Devices ()	Add Device Bulk Import	Admin Status	Device Name	IP Address		DNS Name	Device Type	Last Inventory Collection Status	Last Successful Coll
Device Type ① Optical Networking ②		Managed	ron-8201-1	172.29.11.20	11 ()	172.29.11.20	Cisco 8201 Router	Completed	 2021-Jun-24 12:37:07
* Routers (j)		Managed	ron-8201-2	172.29.11.21	11 (1)	172.29.11.21	Cisco 8201 Router	Completed with Warning	(i)
Cisco 8000 Series Routers (j)		Managed	ron-8201-3	172.29.11.22	II ()	172.29.11.22	Cisco 8201 Router	Completed	(i) 2021-Jun-24 12:36:29
Location User Defined		Managed	ron-8201-4	172.29.11.23	II ()	172.29.11.23	Cisco 8201 Router	Synchronizing	0
User Defined ()									

3. Configure the General, SNMP, and SSH parameters as seen in that following figures. Click **Verify Credentials** to validate that Cisco EPN Manager can reach the device. Click **Add** to add the device to EPNM.

	* General Parameters		
* General 🗸	IP Address	172.29.11.28	
101110	O DNS Name		
SNMP (Optional if TL1 is configured)	License Level	Full	• @
Telnet/SSH .	Device Role	Select	• 0
•	Add to Group	Select	• Ø
HTTP/HTTPS	Credential Profile	Select	• 0
TL1			
Civic Location			

Verify Credentials

Add

	Telnet/SSH Parameters			
* General 🗸	Protocol	SSH2	•	
		* Port	22	
SNMP (Optional if TL1 is configured)		• Timeout	60	(secs)
Telnet/SSH 🗸	• Username	admin		
Telleuson V	e Password			
HTTP/HTTPS	e Confirm Password			
	Enable Password			0
TL1	Confirm Enable Password			
		Add	Verify Credentials	s Cancel
d Device	* SNMP Parameters	Add	Verify Credential	s Cancel
d Device • General 🗸	* SNMP Parameters Version	Add V v2c	Verify Credentials	
• General 🗸				
• General 🗸	Version	v2c	2	
• General • SNMP • SNMP Optional if TL1 is configured)		v2c * SNMP Retries	▼ 2 10	;
• General 🗸	e •	v2c * SNMP Retries * SNMP Timeout	▼ 2 10	;
• General • SNMP • Optional if TL1 is configured)	Version • Read Community • Confirm Read Community	v2c * SNMP Retries * SNMP Timeout * SNMP Port 	▼ 2 10) (secs)) @
• General • SNMP • SNMP • Optional if TL1 is configured) Telnet/SSH	Version Read Community Confirm Read Community Write Community	v2c * SNMP Retries * SNMP Timeout * SNMP Port 	▼ 2 10] (secs)
• General • SNMP Optional if TL1 is configured) Telnet/SSH	Version • Read Community • Confirm Read Community	v2c * SNMP Retries * SNMP Timeout * SNMP Port	▼ 2 10) (secs)) @
* SNMP V Optional if TL1 is configured) Telnet/SSH V HTTP/HTTPS	Version Read Community Confirm Read Community Write Community	v2c SNMP Retries SNMP Timeout SNMP Port	▼ 2 10) (secs)) @

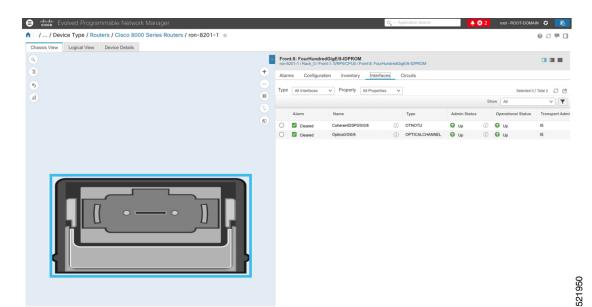
4. To open the chassis view from the Network devices table, click the device name link. The following figure displays the chassis view of the 8201 router.

/ Device Type / Routers / Cisco 8000 Series Routers / ron-8201-1 *					00
s View Logical View Device Details					
	> ron-8201-1 💟 🔤 🕢				
			rfaces Circuits Image		
	Alarms Configuratio	ion Inventory Inter	faces Circuits Image	Configuration Archive	2021-Jun-24 16:07:38 EST
		6	0 4 0	0 0	
	×		2 4 0		
	\$	All	Critical Major Minor	Warning Information	
	Export			Show Qu	uick Filter V
	Severity Co	Condition	Timestamp ~	Affected Objects	Alarm ID
	V isis	sisAdjacencyChangeDown	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509938
	V RO	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509937
	V RO	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/8	11509939
	O LM	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20-mpis la	11509935
		LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20	11509936
	V cel	cefcPowerStatusChange	2021-Jun-23 00:05:47 EST	0/PM0	11509854
I . It lie te lie te lie te lie te les te lie te	AIR \$10 AIR \$10 AIR \$10 AIR \$10				

5. Click the QSFP-DD ZR+ port to see specific data about that port.

	>	ron-8201-1	0			
	+	Alarms Confi	guration Inventory Int	erfaces Circuits Im	ge Configuration Archive	
FourHundredGigE0/0/0/8-IDPROM Hardware Version ES03			6 All		0 0 0 0 0 Information	: 2021-Jun-24 16:07:38 EST
Part Number QDD-400G-ZRP-S		Export			Show C	Quick Filter V
Serial Number ACA2501003X		Severity	Condition	Timestamp	V Affected Objects	Alarm ID
CLEI Code No Data Available						
Equipment Type		Δ.	isisAdjacencyChangeDown	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509938
Module		V	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509937
No Data Available		V	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/8	11509939
Location FourHundredGigE0/0/0/8-IDPROM		0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20-mpls la	
Product ID		0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20	11509936
 QDD-400G-ZRP-S		•	cefcPowerStatusChange	2021-Jun-23 00:05:47 EST	0/PM0	11509854
Show Details	A					

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



6. Clicking the additional information icon for the optical channel and then the **Optical Physical** measurement tab displays the relevant optical PM values such as **RX/TX signal power** and **OSNR** values.

thight Evolved Pr / Device Type	Interface 360° Auto-Refresh Off V Ø			Last Updated: 06/2	4/2021 04:10 PM ⊡ ★ × View ∨ Actions ∨	D, ~ A	pplication Search		3 2	root - ROOT-DOMA	s ≎ 5 ⊡ = 2 9
Chassis View Logical Y	Transport Admin S	ype OPTICALCHANNEL tate IS ame ron-8201-1					igE/8-IDPROM				
6	Alarms Optical Physical FEC	Interface Circuits/V	Cs			~				Selected 0 /	Total 2 💭 🖻
(al)					Total 2 💭 🎝 🗸				Shi	All	▼
				Show Quick Fil	ter V		Туре	Admin Status		Operational Status	Transport Admi
	Timestamp V OSNR	RX-POWER	X-POWER LBC	DGD	PCR	()	OTNOTU	🕢 Up	()	🚱 Up	IS
						>0	OPTICALCHANNEL	🕜 Up	<i>(i)</i>	🚱 Up	IS
	16:02:55, 24-Jun-2021 EST 31.50 16:02:36, 24-Jun-2021 EST 31.70		10.53 dBm 0	2.00	0						
Į						8					

7. Clicking the additional information icon for the coherent DSP and then the **FEC** measurement tab displays the 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.

		Interface Transport Admin	Name ron-8201-1 (i)			vdre S		E/8-IDPROM				
	Alarms FEC	OTU Inter	face Circuits/VCs				×				Selected 0	/ Total 2 💭
					Total 4	Ø¢.				St	All	 Y
	Set Baseline				Show Quick Filter	Y		Туре	Admin Status		Operational Status	Transport A
	Timestamp	UCW	BIEC	PreFEC_BER-MIN	ProFEC_BER-AVG		<i>i</i>	OTNOTU	O Up	()	O Up	IS
							1	OPTICALCHANNEL	🕜 Up	<i>(i)</i>	🚱 Up	IS
	16:04:14, 24-Jun-2021	EST 0	493733542753	1.3E-03	1.4E-03							
	16:04:34, 24-Jun-2021	EST 0	507114399500	1.3E-03	1.4E-03							
	16:04:54, 24-Jun-2021	EST 0	520413161689	1.3E-03	1.4E-03							
	16:05:14, 24-Jun-2021	EST 0	533591199474	1.3E-03	1.4E-03							
l												

The following figures display the current and historical performance monitoring data in EPNM that is specific to the ZR or ZR+ optics.

Figure 43: Optical Physical Parameters

erface 360°											Last 0	pdated: 04/14/2021 0	9:13 PM 🔄 🕂
to-Refresh Off $\vee + \mathcal{O}$												View	Actions
Optics0/0/0	/20 📀 📀												
Transport A	erface Type OP dmin State IS Description Ma evice Name rom nterface(s) N/	naged by NSO .58, d 1-8201-1 (j)	o not change manually										
			uits/VCs										
arms Optical Physical	FEC Ir	terface Circ	unarvea									т	otal 4 💭 🛱 V
optical Physical	FEC II	terface Circ	ditor V CS								Show	Quick Filter	otal 4
Timestamp	FEC In	RX-POWER	TX-POWER	LBC	DGD	PCR	PDL	CD	FREQ-OFF	RX-SIG /		Quick Filter	Y
				LBC	DGD	PCR	PDL	CD	FREQ-OFF	RX-SIG		Quick Filter	Y
				LBC	DGD 1.00	PCR 0	PDL	CD 	FREQ-OFF	RX-SIG /		Quick Filter	Y
Timestamp	OSNR	RX-POWER	TX-POWER								Q-FACTOR	Quick Filter	Y
Timestamp 21:13:55, 14-Apr-2021 IST	OSNR 35.60	RX-POWER	TX-POWER	0	1.00	0	1.70	-489	57	-13.37	Q-FACTOR 9.80	Quick Filter Q-MARGIN 3.50dB	Y

Figure 44: Historical Optical Physical Parameters	
---	--

nterface Details							
			/ @ Ø & – X				0 0 C – X
Property	Value			Transmitted(OPT) Received(0 Zoom: 1h 6h 1d 1w 2v			
Interface Name	Optics0/0/0/20			-			
Interface Type	OPTICALCHAN	INEL		Time	Minimum	Average	Maximum
Lane	N/A			2021-Apr-15, 19:45:00 IST	-10.54	-10.53	-10.52
Speed	N/A			2021-Apr-15, 20:00:00 IST	-10.55	-10.53	-10.52
Interface Index	39			2021-Apr-15, 20:15:00 IST	-10.55	-10.53	-10.52
Admin Status	Up						
Operational Status	Up						
Device Name	ron-8201-1						
Device Ip	172.29.11.20						
Device Description	Cisco IOS XR S	oftware (8000), Version 7.3.15.	19I-CVT_19I_45rpms Copyright (c) 2013				
★ 2021-Apr-15, 20:32:56	IST						
Row rough roy Rouserou							
					21-Apr-15, 20:33:00 IST		
Optical Signal to No	oise Ratio (OSNR)	0 I E – X				
		:)	0 0 C – X	Second Order Polar	ized Mode Disp	ersion (SOPMD)	© ∅ ♂ ♂ − ×
ioom: 1h 6h 1d 1w 2		!) Average	@ ∅ ピ – × Maximum			ersion (SOPMD)	0 S 2 - X
ioom: 1h 6h 1d 1w 2	tw 4w 3m 6m 1y			Second Order Polar		ersion (SOPMD)	@ ♡ ピ ⁿ — X Maximum
loom: 1h 6h 1d 1w 2 Time 2021-Apr-15, 19:45:00 IST	2w 4w 3m 6m 1y Minimum	Average	Maximum	Second Order Polar Zoom: 1h 6h 1d 1w 2w Time	w 4w 3m 6m 1y Minimum	Average	Maximum
Dptical Signal to No com: th 6h 1d 1w 2 Time 2021-Apr-15, 19:45:00 IST 2021-Apr-15, 20:00:00 IST 2021-Apr-15, 20:15:00 IST	w 4w 3m 6m 1y Minimum 35.6	Average 35.6	Maximum 35.6	Second Order Polar Zoom: 1h 6h 1d 1w 2v	w 4w 3m 6m 1y		 Ø ∅ ℓ³ − X Maximum 153 148

Figure 45: Historical Optical Physical Parameters

Zoom: 1h 6h 1d 1w 2	w 4w 3m 6m 1y			Chromatic Dispersio	on (CD)		0 C Z ->
Time	Minimum	Average	Maximum	Zoom: 1h 6h 1d 1w 2v	v 4w 3m 6m 1y		
2021-Apr-15, 19:45:00 IST	1.5	1.61	1.7	Time	Minimum	Average	Maximum
2021-Apr-15, 20:00:00 IST	1.5	1.59	1.7	2021-Apr-15, 19:45:00 IST	-490	-489	-487
2021-Apr-15, 20:15:00 IST	1.5	1.62	1.7	2021-Apr-15, 20:00:00 IST	-490	-489	-487
	21-Apr-15, 20:32:59 IST		0 0 c² – X	201	21-Apr-15, 20:33:00 IST		
	w 4w 3m 6m 1y sasons: ted		@ Ø & – X	Differential Group D Zoom: th 6h 1d 1w 2v	elay (DGD)		@ S & - >
hase Noise om: 1h 6h 1d 1w 2 ata is unavailable. Possible n The Monitoring Policy is disat The devices are not being m The technology is not support	w 4w 3m 6m 1y sasons: led intaged in the system and/or an led on the device		@ Ø & – X	Differential Group D	elay (DGD)	Average	ම රැ ලී — X Maximum
hase Noise thase Noise the Monitoring Policy is disat The Monitoring Policy is disat The devices are not being m The technology is not support	w 4w 3m 6m 1y easons: Jed inaged in the system and/or an		ම	Differential Group D	elay (DGD) v 4w 3m 6m 1y	Average 1.9	
Phase Noise pom: 1h 6h 1d 1w 2 hata is unavailable. Possible m The Monitoring Policy is disat The devices are not being m The technology is not support	w 4w 3m 6m 1y sasons: led intaged in the system and/or an led on the device		@ 0 d' - X	Differential Group D Zoom: 1h 6h 1d 1w 2v Time	elay (DGD) x 4w 3m 6m 1y Minimum		Maximum

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Figure 46: Historical Optical Physical Parameters

optical Power Sign			© ∽ ∟" – ×				
Time	Minimum	Average	Maximum	Frequency Difference	e (FREQ_OFF)		@ Ø 🖉 —
2021-Apr-15, 19:45:00 IST	-13.39	-13.35	-13.33	Zoom: 1h 6h 1d 1w 2h	w 4w 3m 6m 1y		
2021-Apr-15, 20:00:00 IST	-13.43	-13.36	-13.33	Time	Minimum	Average	Maximum
2021-Apr-15, 20:15:00 IST	-13.43	-13.37	-13.33	2021-Apr-15, 19:45:00 IST	36	56	74
				2021-Apr-15, 20:00:00 IST	36	56	74
				2021-Apr-15, 20:15:00 IST	35	57	79

Figure 47: FEC Parameters

Т	erentDSP0 If Interface	Name ron-8201-1 (j)						Last Updated:	04/14/2021 09:01 PM 🗹 🐥 🗍 View 🗸 🕹 Actions 🗸
Narms FEC (TU Inte	rface Circuits/VCs	i						
									Total 12 💭 🎝 🗸
Set Baseline								Show Quick	Filter V
Timestamp	∨ UCW	BIEC	PreFEC_BER-MIN	PreFEC_BER-AVG	PreFEC_BER-MAX	PostFEC_BER-MIN	PostFEC_BER-AVG	PostFEC_BER-MAX	Interface Name
21:09:30, 14-Apr-2021 I	то	259424538363	9.3E-04	1.0E-03	1.0E-03	0	0	0	
21:09:10, 14-Apr-2021 I	6T 0	250149080948	9.3E-04	1.0E-03	1.0E-03	0	0	0	
21:08:50, 14-Apr-2021 I	T 0	241029855399	9.3E-04	1.0E-03	1.0E-03	0	0	0	
21:08:29, 14-Apr-2021 I	T 0	231895488278	9.3E-04	1.0E-03	1.0E-03	0	0	0	
21:06:20, 14-Apr-2021 I	T 0	171915528470	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:06:01, 14-Apr-2021 I	T 0	162585187635	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:05:41, 14-Apr-2021 I	T 0	153200151905	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:05:21, 14-Apr-2021 I	T 0	143986313725	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:05:01, 14-Apr-2021 I	T 0	134689474400	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:04:40, 14-Apr-2021 I	T 0	125294694470	9.7E-04	1.0E-03	1.0E-03	0	0	0	
21:04:21, 14-Apr-2021 I	T 0	116370733446	9.7E-04	1.0E-03	1.0E-03	0	0	0	
	T 0	108598278785	9.7F-04	1.0F-03	1.0E-03				

Figure 48: Historical FEC Parameters

orward Error Corre	table Words Pre-FEC BE	ER Post-FEC BER	0 C C — X
Time	Minimum	Average	Maximum
2021-Apr-14, 21:30:00 IST	0.00092	0.00099	0.001
2021-Apr-14, 21:45:00 IST	0.00091	0.00097	0.001
2021-Apr-14, 22:00:00 IST	0.00077	0.00099	0.001
2021-Apr-14, 22:15:00 IST	0.00077	0.001	0.001
2021-Apr-14, 22:30:00 IST	0.00094	0.001	0.001
2021-Apr-14, 22:45:00 IST	0.00093	0.001	0.001
2021-Apr-14, 23:00:00 IST	0.00095	0.001	0.001
2021-Apr-14, 23:15:00 IST	0.00093	0.00099	0.001
2021-Apr-14, 23:30:00 IST	0.00091	0.00098	0.001
2021 Apr 14 22-45-00 IST	0 00003	0.00008	0.001

Figure 49: Historical FEC Parameters

om: 1h 6h 1d 1w 2	w 4w 3m 6m 1v						
Time	Minimum	Average	Maximum	Quality Factor Marg			- 5 C @
2021-Apr-14, 21:30:00 IST	9.7	9.77	9.8		w i ww i sin i oni i ry		
2021-Apr-14, 21:45:00 IST	9.7	9.76	9.8	Time	Minimum	Average	Maximum
2021-Apr-14, 22:00:00 IST	9.7	9.76	9.8	2021-Apr-14, 21:30:00 IST	3.5	3.5	3.5
021-Apr-14, 22:15:00 IST	9.7	9.77	9.8	2021-Apr-14, 21:45:00 IST	3.5	3.5	3.5
2021-Apr-14, 22:30:00 IST	9.7	9.75	9.8	2021-Apr-14, 22:00:00 IST	3.5	3.5	3.5
021-Apr-14, 22:45:00 IST	9.7	9.77	9.8	2021-Apr-14, 22:15:00 IST	3.5	3.5	3.5
021-Apr-14, 23:00:00 IST	9.7	9.75	9.8	2021-Apr-14, 22:30:00 IST	3.5	3.5	3.5
021-Apr-14, 23:15:00 IST	9.7	9.77	9.8	2021-Apr-14, 22:45:00 IST	3.5	3.5	3.5
021-Apr-14, 23:30:00 IST	9.7	9.76	9.8	2021-Apr-14, 23:00:00 IST	3.5	3.5	3.5
1021 Apr 14 22-45-00 IQT	0.7	0.75	0.9	2021-Apr-14, 23:15:00 IST	3.5	3.5	3.5
20	21-Apr-15, 20:52:58 IST			2021-Apr-14, 23:30:00 IST	3.5	3.5	3.5
				2021 Apr 14 22-45-00 IST	2.5	2.5	3 5

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Figure 50: Historical OTN Parameters

Zoom: 1h 6h 1d 1w 2w 4	w 3m 6m 1y		Sever	ely Errored Seco	nds (SES) Section		@ Ø ♂ - >
Time	FEND	NEND	SES S	ESRatio h 6h 1d 1w 2w 4	1		
2021-Apr-14, 21:30:00 IST	0	0			w shi shi iy		
2021-Apr-14, 21:45:00 IST	0	0	Time		NEND	FEND	
2021-Apr-14, 22:00:00 IST	0	0	2021-A	pr-14, 21:30:00 IST	0	0	
2021-Apr-14, 22:15:00 IST	0	0	2021-A	pr-14, 21:45:00 IST	0	0	
2021-Apr-14, 22:30:00 IST	0	0	2021-A	pr-14, 22:00:00 IST	0	0	
2021-Apr-14, 22:45:00 IST	0	0	2021-A	pr-14, 22:15:00 IST	0	0	
2021-Apr-14, 23:00:00 IST	0	0	2021-A	pr-14, 22:30:00 IST	0	0	
2021-Apr-14, 23:15:00 IST	0	0	2021-A	pr-14, 22:45:00 IST	0	0	
2021-Apr-14, 23:30:00 IST	0	0	2021-A	pr-14, 23:00:00 IST	0	0	
2021 Avr 14 22-45-00 IQT	0	0	2021-A	pr-14, 23:15:00 IST	0	0	
2021-Ac	v-15 20-52-58 IST		2021-A	pr-14, 23:30:00 IST	0	0	
				TPI 00-84-00	^	n	
Errored Seconds (ES) S is ES Ratio icom: 1h 6h 1d 1w 2w 4	Section w 3m 6m 1y	NEND	@ ∅ ピ – X	ar 14 22:45:00 IST 2021-Ar ailable Seconds (I h 6h 1d 1w 2w 4	UAS) Section	0	@ ග ස් – >
Errored Seconds (ES) S	Section	NEND 0	@ ∅ ピ – X	ailable Seconds (UAS) Section	NEND	@ Ø e ² – >
Errored Seconds (ES) S s Es Ratio com: 1h 6h 1d 1w 2w 4 Time 2021-Apr-14, 21:30:00 IST	Section w 3m 6m 1y FEND			2021-A	UAS) Section file 3m 6m 1y FEND		@ Ø & -)
Errored Seconds (ES) S S ES Ratio com: th 6h 1d 1w 2w 4 Time 2021-Apr-14, 21:30:00 IST 2021-Apr-14, 21:45:00 IST	Section w 3m 6m 1y FEND 0	0	⊕ ∅ ℓ ² − × □	2021-A	UAS) Section tw 3m 6m 1y FEND 0	0	@ Ø & - >
Errored Seconds (ES) S IS ES Ratio com: 1h 6h 1d 1w 2w 4 Time	Section w 3m 6m 1y FEND 0 0 0	0		Image: Seconds (I 021-A) ailable Seconds (I 0 pr-14, 21:30:00 IST pr-14, 21:45:00 IST	UAS) Section w 3m 6m 1y FEND 0 0	0	@ Ø 2ª -)
Import Import<	Section w 3m 6m 1y FEND 0 0 0 0 0	0		Image: Seconds (I) ailable Seconds (I) pr-14, 21:30:00 IST pr-14, 21:45:00 IST pr-14, 21:45:00 IST	UAS) Section (w 3m 6m 1y FEND 0 0 0	0 0	@ Ø & – >
Errored Seconds (ES) S \$ ES Ratio com: th fh fd fw 2w 4 Time 2021-Age: 14, 2130:00 IST 2021-Age: 14, 2215:00 IST	Section w 3m 6m 1y PEND 0 0 0 0 0	0 0 0 0 0 0	⊕ ∅ ℓ ² − × ↓	Image: Constraint of the seconds (Image: Constraint of the seconds (Image: Constraint of the seconds (Image: Constraint of the second seconds (Image: Constraint of the second	UAS) Section Wr 3m 6m 1y FEND 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0	0 0 c² - >
Errored Seconds (ES) S S ES Ratio com: th dh tw 2w 4 Time 2021-Apr-14, 21:30:00 IST 2021-Apr-14, 22:100 IST 2021-Apr-14, 22:000 IST 2021-Apr-14, 22:000 IST 2021-Apr-14, 22:000 IST 2021-Apr-14, 22:3000 IST 2021-Apr-14, 22:000 IST 2021-Apr-14, 22:3000 IST 2021-Apr-14, 22:000 IST	Section w 3m 6m 1y PEND 0 0 0 0 0 0 0 0 0	0 0 0 0 0	⊕ ∅ ℓ ² − × ↓	2021-A iilable Seconds (I pr-14, 21:30:00 IST pr-14, 21:30:00 IST pr-14, 22:15:00 IST pr-14, 22:00 IST pr-14, 22:00 IST	UAS) Section We 3m 6m 1y FEND 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0	@ C Ľ –)
Errored Seconds (ES) S (S) [S Raio com: 1h 6h 1d 1w 2w 4 Time 2021-Apr-14, 21:30:00 IST 2021-Apr-14, 21:45:00 IST 2021-Apr-14, 22:00:00 IST	Section w 3m 6m 1y FEND 0 0 0 0 0 0 0 0 0 0 0 0 0			Image: Constraint of the seconds (Image: Constraint of the seconds (Image: Constraint of the seconds (Image: Constraint of the second seconds (Image: Constraint of the second	UAS) Section Wr 3m 6m 1y FEND 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0	@ Ø Ľ –)

Figure 51: Historical OTN Parameters

om: 1h 6h 1d 1w 2w 4	w 3m 6m 1y			
Time	NEND	FEND		
2021-Apr-14, 21:30:00 IST	0	0		
2021-Apr-14, 21:45:00 IST	0	0		
2021-Apr-14, 22:00:00 IST	0	0		
2021-Apr-14, 22:15:00 IST	0	0		
2021-Apr-14, 22:30:00 IST	0	0		
2021-Apr-14, 22:45:00 IST	0	0		
2021-Apr-14, 23:00:00 IST	0	0		
2021-Apr-14, 23:15:00 IST	0	0		
2021-Apr-14, 23:30:00 IST	0	0		
2021 Apr 14 22:45:00 IST	0	0		

Monitor Performance of ZR/ZR+ Optics Using KPIs

Perform the following steps to create KPI Profiles in Health Insights and enable them on the devices to monitor network health.

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Note

Plan which Cisco-supplied KPIs you want to begin using, based on each device's function and the device performance characteristics you want to monitor. Review the Cisco-supplied KPIs documented in List of Health Insights KPIs. In the following image, you see the available default L1 optics KPIs.

↑ Performance Alerts / Key Performance Indicators (KPI)						
KPI Categories (17)	Key	Performance Indicators (KPIs)				Selected 0 / Total 6 🔿 🌣
	+	Interpretation				T
		KPI Name	Category	Description	Linked Playbook	
All KPIs						
BASICS						
CPU		Layer 1 optical alarms	Layer1-Optics	Monitors per-port optical alarms		
Dataplane-Counters		Layer 1 optical errors	Layer1-Optics	Monitors per-port Layer 1 errors; generates ale		
Filesystem		Layer 1 optical FEC errors	Layer1-Optics	Monitors per-port optical FEC errors; generate		
IPSLA		Layer 1 optical power	Layer1-Optics	Monitors per-port optical power; generates ale		
LLDP		Layer 1 optical temperature	Layer1-Optics	Monitors per-port optical temperature; generat		
Layer1-Optics		Layer 1 optical voltage	Layer1-Optics	Monitors per-port optical voltage; generates al		
Layer1-Traffic						
Layer2-Interface						
Layer2-Traffic						
Layer3-Routing						
Layer3-Traffic						
Memory						
Protocol-ISIS						
QoS						
User Defined						

1. Group the relevant KPIs to form a KPI Profile. A KPI profile can have many different KPIs assigned. In this case, the focus is only on some specific optics KPIs to add to the **optics_profile** KPI profile.

ate New Profile						
Profile Name* optics_profile		Description Measure optics parameters				
rnal Destination Details (0	0				
	D ~			\sim		
Server Type	~	Name		×		
KPIs to Profile						
II KPIs O Recommended k	(PIs					
Category T	KPI			Summary		
optics						
Layer1-Optics	Layer	optical alarms		Monitors per-port optical alarms		
Layer1-Optics	Layer	optical errors		Monitors per-port Layer 1 errors; generates alert when error rates exceeds the configured thresho		
Layer1-Optics	Layer	optical FEC errors		Monitors per-port optical FEC errors; generates an alert when FEC errors exceeds the configured		
Layer1-Optics	Layer	optical power		Monitors per-port optical power; generates alert when power levels exceeds the configured three		
Layer1-Optics	Layer	optical temperature		Monitors per-port optical temperature; generates alert when temperature exceeds the configured t		
Layer1-Optics	Layer	optical voltage		Monitors per-port optical voltage; generates alert when voltages exceeds the configured threshold		
		option rotage		universible, but shreet, terreffel flatereres eret turen terreffes enesses ere serviller og eres		

See Create a New KPI Profile.

 Enable the appropriate KPI Profiles on the devices you want to monitor. From the main menu, choose Performance Alerts > Enable/Disable KPI Profiles. Check the checkboxes of all the nodes to which the profile must be applied to, and click Enable KPI Profiles.

Multiple nodes may be selected. In the following figure, we are applying the KPI profile to a single node.

A / Perf	ormance Alerts / Enable,	/Disable KPI Profiles				
Select	By 💿 Device 🔿 Dev	rice Tags				
Dev	ices					Selected 1 / Total 13 🔿 🌣
Ena	ble KPI Profiles Disab	le KPI Profiles				Clear All Filters
	Reachability	Name T ron-8201-1	Device Type	Operational State	Enabled Profiles	
	Reachable	ron-8201-1	ROUTER	OK OK	3	

3. Select the optics_profile KPI profile that was created in the previous step and click next to finalize enabling the KPI for the selected device.

/ Perfor	mance Alerts / Enable/Disable KPI Profiles				
		O-Select Devices	Select KPI Profiles	O Verify Details	
KPI P	Profiles				Selected 1 / Total 4 🔿
					Clear All Filters
	Name T optics	Devices Enabled	D	escription	
	optics_profile	0	M	feasure optics parameters	
<u> </u>	ncel				Previous Next
La	incer				Previous

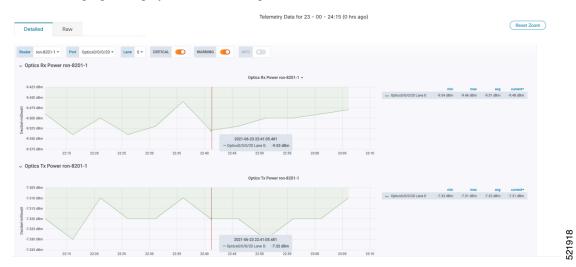
4. The following image displays the final page before enabling the KPI profile for the router. After you click **Enable**, the appropriate configuration is applied to the router to begin streaming the telemetry sensors data for the selected optical KPIs.

		Select Devices	Select Ki	PI Profiles	Verify Details		
elected Device(s)	Selected Profile(s)						
lame	Name	optics_profile				3	0
ron-8201-1	optics_profile	Description : Measure o Destination :	ptics parameters Server Type : -	Topic : -		#KPIs on Profile	Enabled Devices
		KPI On Profile	KPI On Profile				
		Layer 1 optical po	ower	Layer 1 optical temperature	Layer 1 optical voltage		
		Alerts C Cadence(sec) 3 Alert Frequency 1 Alert Type a	800	Alerts OFF Cadence(sec) 300 Alert Frequency 1 Alert Type alarm_stat.	Alerts OFF Cadence(sec) 300 Alert Frequency 1 Alert Type alarm_stat.		
		View More	Details	View More Details	View More Details		

See Enable KPI Profiles on Devices.

5. To view alerts from network devices, see View Alerts for Network Devices.

The following figure displays the RX and TX power of the QDD-400G-ZR-S transceiver.



Optimization Phase

The optimization phase involves:

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