

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 4
- Implement Phase, on page 5
- Operate Phase, on page 70
- Optimization Phase, on page 82

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 for solution using Cisco Crosswork Network Controller.

Package	Contents	Crosswork Data Gateway Deployment	Recommended number of cluster VMs
Cisco Crosswork	Cisco Crosswork Optimization Engine	On-Premise Standard (default): Collectors only.	When Essentials package is installed
Network Controller Essentials	Cisco Crosswork Active Topology	On-Premise Standard (default): Collectors only.	Management Functions:
	Element Management Functions	On-Premise Standard (default): Collectors only.	• 3 Hybrid nodes
			When Essentials package is installed WITH Element Management Functions:
			• 3 Hybrid nodes + 1 Worker node
Cisco Crosswork Network Controller Advantage	Cisco Crosswork Service Health	On-Premise Extended : Collectors and offload services.	3 Hybrid nodes + 2 Worker nodes

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.

Package	Contents	Crosswork Data Gateway Deployment	Recommended number of cluster VMs
Add-on Package	Cisco Crosswork Change Automation	On-Premise Extended : Collectors and offload services.	3 Hybrid nodes + 2 Worker nodes
	Cisco Crosswork Health Insights	On-Premise Extended : Collectors and offload services.	
	Cisco Crosswork Zero Touch Provisioning	On-Premise Standard (default): Collectors only.	

Note

For non-production lab installations without HA, you can use 1 Hybrid node.

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.

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: 128 GB DISK: 4 TB



Note In Routed Optical Networking 2.1, Cisco Optical Network Controller and Crosswork Network Controller require different Crosswork Infrastructure versions. The Crosswork Infrastructure Cluster for Cisco Optical Network Controller must have:

- 3 VM
- CPU: 12 vCPU
- RAM: 96 GB
- DISK: 1TB SSD

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 5.2

- Cisco WAN Automation Engine 7.6.x
- Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications
- Cisco Optical Network Controller 3.1
- Cisco Evolved Programmable Network Manager 7.1.2
- Cisco Network Services Orchestrator 6.1.9
 - Cisco NSO Routed Optical Networking Core Function Pack 3.0.0
 - Cisco NSO Transport-SDN Function Pack Bundle 6.0
 - Cisco Network Services Orchestrator DLM Service Pack 6.0
- Cisco Crosswork Hierarchical Controller 8.0
- Cisco Crosswork Network Controller 6.0

Implement Phase

The implement phase involves:

- 1. Installation of hardware components
 - a. Hardware staging or installation and initial base configuration required for management connectivity.
 - **b.** All onboard software updates must be completed to the required revision.
 - c. All associated base wiring must be completed to support the network. This includes connections between the optical elements and connections between routers and optical add/drop end-points to support Routed Optical Networking circuits using ZR/ZR+ optics. See Deployment Topologies.
 - d. Install Cisco Optical Site Manager to support NCS 1010 nodes. See Install Cisco Optical Site Manager

2. Installation of 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 5.2 (for optical planning)
 - Cisco WAN Automation Engine 7.6.x (for IP planning)
 - Cisco Crosswork Cluster, Crosswork Data Gateway, and Crosswork Applications (for supporting Crosswork Network Controller)
 - Cisco Optical Network Controller 3.1 (for supporting optical network)
 - Cisco Evolved Programmable Network Manager 7.1.4 (for managing the physical router and the optical network nodes)
 - Cisco Network Services Orchestrator 6.1.9 (base installation to support RON FP)
 - Cisco NSO Routed Optical Networking Core Function Pack 3.0 (for RON ML provisioning)

- Cisco NSO Transport-SDN Function Pack Bundle 6.0 (for Crosswork Network Controller SR and xVPN provisioning)
- Cisco Network Services Orchestrator DLM Service Pack 6.0 (for device synchronization between Crosswork Network Controller and NSO)
- Cisco Crosswork Hierarchical Controller 8.0 (for provisioning the Routed Optical Networking ML service using the Crosswork Hierarchical Controller)

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

3. Onboarding of Devices

- **a.** Add devices to Cisco Optical Network Controller. See Onboard Devices to Cisco Optical Network Controller.
- **b.** Add NSO, SR-PCE, and devices to Crosswork Network Controller. See Add SR-PCE, NSO, and Routers to Crosswork Network Controller, on page 7.
- c. Add routers to NSO using the IOS-XR CLI NED. See Step 3 in Provision ML Service Using NSO Routed Optical Networking CFP, on page 30.
- **d.** Add and configure the following Crosswork Hierarchical Controller adapters. See Configure Adapters for Crosswork Hierarchical Controller, on page 13.



- **Note** This step is required only if the Routed Optical Networking ML service is provisioned via the Crosswork Hierarchical Controller GUI.
 - Add and configure the Crosswork Network Controller adapter.
 - Create or import sites in Crosswork Hierarchical Controller. See the sections, "Add Sites" and "Export and Import Sites" in the Cisco Crosswork Hierarchical Controller Administration Guide 8.0.
 - Add and configure the IOS-XR adapter. Create router devices in Crosswork Hierarchical Controller using the IOS-XR adapter type. After the routers are created, add the Crosswork Network Controller adapter to the router device.
 - Add and configure the Cisco Optical Network Controller adapter.

4. Provisioning of Services

- **a.** Ensure all device interconnections are complete.
- **b.** To provision the Routed Optical Networking ML service, use either one of the procedures:
 - 1. Using the NSO GUI:
 - a. Utilize the Routed Optical Networking FP ML services to provision and end-to-end service. See Provision ML Service Using NSO Routed Optical Networking CFP, on page 30.

- **b.** Verify that the end-to-end service has been deployed by checking the NSO service deployment status using the check-sync status.
- c. Verify the router optics controller state using the CLI or in EPNM. See Troubleshoot Provisioning Issues.
- 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 44.
 - b. Verify the router optics controller state using the Link Assurance tool in Crosswork Hierarchical Controller. See Step 4 in Provision Routed Optical Networking ML Service Using Crosswork Hierarchical Controller, on page 44.

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.
- 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							>
Profile Name * nso	ls						
Connectivity Type NETCONF	~	User Name * nso	Password *	٥	Confirm Password *	٠	Ē
Connectivity Type HTTPS	~	User Name * nso	Password *	۰	Confirm Password*	۰	Ô
+ Add Another							

Cancel

Save

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 Credentia	al Protocols						
Connectivity Ty	/pe	User Name *	Password *		Confirm Password *		
HTTP	\sim	admin	*****	۰	•••••	۰	Ē
+ Add Another							

Save Cancel 906125

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.

L

Edit Profile routers								×
Profile Name * routers								
Add Credential Protoco	ols							
Connectivity Type		Read Community *		Write Community				
SNMPv2	\sim	•••••	۰	•••••	•			
Connectivity Type		User Name *		Password *		Confirm Password *		
SSH	\sim	admin		•••••	۰	*****	۰	
Enable Password								
	\sim							
Connectivity Type		Lisor Namo *		Password *		Confirm Password		
NETCONF	\sim	admin		*****	•	•••••	•	Ē
								ш
Connectivity Type		User Name *		Password *		Confirm Password*		
GNMI	\sim	admin		•••••	۰	•••••	۰	Ē
+ Add Apother								
+ 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 CLI NED, the Cisco-IOS-XR model is not applicable and may be set to any version.

Edit Provider								\times
Provider Name *	nso-58							
Credential Profile*	nso	\sim						
Family*	NSO	\sim						
Device Key*	HOST_NAME	\sim						
Connection Type(s)								
Protocol * IF	P Address / Subnet Mas	sk *				Port *	Timeout	
HTTPS \checkmark 1	172.29.11.58			/	25	8888	60	Ē
NETCONF \checkmark	172.29.11.58			/	25	2022	60	Ē
+ Add Another								
Provider Properties								
Property Key		Property Value	9					
forward		true			Ē			
+ Add Another								
Model Prefix Info								
Model *		Version *						
Cisco-IOS-XR	\vee	7.3.1			Ē			
						s	ave C	ancel

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.

Edit Provider						\times
Provider Name *	sr-pce-test					
Credential Profile*	SR-PCE	~				
Family*	SR_PCE	\sim				
Connection Type(s)	Address / Subnet Ma	sek *		Port *	Timeout	
HTTP V 17	2.29.11.54		/ 25	8080	60	
+ Add Another Provider Properties						
Property Key ?		Property Value ?				
auto-onboard		off	Ō	Ī		

- 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.

Administration State*	UP 🗸		UUID				
	ENADIE		0				
Reachability Check*	ENABLE		Serial Number				
Credential Profile*	routers \lor		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	
Protocol *	IP Address / Subnet Mask *		Port *	Timeout	Encoding Type		
SSH \lor	172.29.11.20	/ 25	22	60		\sim	Ē
SNMP \checkmark	172.29.11.20	/ 25	161	60		\sim	Ē
GNMI 🗸	172.29.11.20	/ 25	57333	60	PROTO	\sim	Ē
NETCONF \checkmark	172.29.11.20	/ 25	830	60		\sim	Ē
+ Add Apothor							

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.

Ac	d New Device									>
	SNMP \checkmark	172.29.11.	20		/ 25	161	60		\sim	Ē
	GNMI 🗸	172.29.11.	20		/ 25	57333	60	PROTO	\sim	Ē
	NETCONF \lor	172.29.11.	20		/ 25	830	60		\sim	Ē
	+ Add Another									
>	Routing Info									
>	Streaming Telemetry	config								
\vee	Location									
	Building					Region				
	Street					Zip				
	City					Latitude				
	State									
	Country			Altitude						
\sim	Providers and Access	2								
	Provider Family	-	Provider Name		Credenti	al		Device Key		
	NSO	\sim	nso-58	\sim	nso			ron-8201-1		
	Ô									
	+ Add Another									
									Save	(Cancel

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.

	Pools Virtual M:	achines							
Data Gatewa	y Metrics Summary								
Operation	nal State	Adr	ministration State		High Availabil	lity Status		Devices	
\mathbb{C}	Up (1) Error (0) Oegraded (0) Unknown (0)	(Up (1) Maintenance (0)		\bigcirc	Protected (0) Not Protected (0) Limited Protection (0) None Planned (1)	(Attached (13) Available (0)	
a Gateways									Total 1 🔿 🗘
									٣
	Operational State	Administration State	High Availability Status	Pool Name	Outage History	② Average Availability	VM ID	Attached Device Count	Actions
0									
•									
pool-1-1 ④	O Up	O Up	None Planned	cdg-pool-1			cdg-soltest	13 🛈	Ξ
pool-1-1 (j)	O Up	O Up	None Planned	cdg-pool-1			cdg-soltest	13 🚯	Attach Devices
pool-1-1 (j)	G Up	O Up	None Planned	cdg-pool-1			cdg-soltest	13	Attach Devices Detach Devices

Configure Adapters for 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:

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.

Figure 2: Crosswork Network Controller Notifications

NOTIFICATIONS CONFIGURATION			
C Enabled	✓ Log_notifications	INFO -	
Congestion control period [sec]	Maximum notification flood time [sec] 30	Vpn_service	
How long to wait after a notification for more notifications, before triggering discovery	Maximum time between the first notification and triggering discovery. This limits 'Maximum notification flood time'		

Figure 3: Crosswork Network Controller Collection and Provisioning

IGP domain Name cnc-default-domain	Pable L1 IGP IS-IS Collection
only alphanumeric, dash, and underscore characters allowed _ IGP IS-IS Priority1	✓ Enable 5+Policy Collection
Enable L3VPN Collection	Enable L2VPN Collection (multipoint and elines)
Requires topology to be enabled	Requires topology to be enabled
Cnc_nso_conn_ned CLI_NED	
HyperLinker Rules Interval Checking [sec] 120	
	by Bornain Kame cnc.default.domain only alphanumeric, dash, and underscore characters allowed by Br Is is Priority 1 balance LSVPM Collection Requires topology to be enabled clc.nso.come_ned cll_NED

IOS-XR Adapter

Figure 4: IOS-XR Adapter - General Tab

Devices Events	General			
Z Enabled		Logging Level		
Polling Cycle [sec]* 300 Poll every X seconds		Number of concurrent routers collected 8	Timeout for data persisting [sec] 300	
SSH CONFIGURATION PARAMETERS				
Enable Tunnel		Tunnel Host	Tunnel Port	
Tunnel Credentials Key	•	Router Connect timeout 30	Router Command timeout 90	
Router Command retries				

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 5: IOS-XR Adapter - General Tab

COLLECTION PARAMETERS		
Enable Topology Collection	Enable IGP IS-IS Collection	Enable IGP 05PF 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
Enable collection of optics and coherent DSP Statistics	Use host_name.domain_name device ID format	
	Used under specific circumstances, see documentation	

Note

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

Figure 6: IOS-XR Adapter - General Tab

COLLECTION PARAMETERS		
 Enable Topology Collection 	Enable IGP IS-IS Collection	Enable IGP OSPF Collection
Enable Interface Stats Collection	Enable VRF Collection	Carable 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
Enable collection of optics and coherent DSP Statistics	Use host_name.domain_name device ID format	
	Used under specific circumstances, see documentation	

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

Figure 7: IOS-XR Adapter - Devices Tab

pters	😇 Devices	Events (ieneral					
+xr	Name	▼ Status	• Status	Site	 Adapter(s) 	✓ Host	* Port	
0			Changes(Last 24 hr)					
76	16 ITEMS							
poc90-1	172.29.11.26	✓ Ok	0	Monterey	cisco-xr, cnc30	172.29.11.26	22	
	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 20 11 25	-2 OK	0	Elaestaff	cisco yr cardlo	172 20 11 25	22	

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

Figure 8: IOS-XR Adapter -Add New Device - General Tab

172	2.29.11.40					
	General	Adapters	Events			
	Name* 172.29.11.40			Network Element Site Monterey	×Q	522157

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 9: IOS-XR Adapter -Add New Device - Adapters Tab

cisco-xr Host	Port*	Unassign device from this ada
172.29.11.40 Image: Connect (avoid tunnel if configured)	22 Authentication cisco-XR	~
Cnabled*		

Cisco Optical Network Controller Adapter

Figure 10: Cisco Optical Network Controller Adapter - General Tab

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

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

Devices Events General								
Carbled	Logging Lovel							
ADAPTER PROFERIES								
Polling Cycle [sec]* 240	Provisioning	Connection Timeout [sec] 600	Minimal interval time between data updates [sec] 0					
Poll every X seconds								
Number of provisioning retries in case of Timeout	Interval time between provisioning retries [sec] 60	Save persistor request to disk?						
CONNECTION PROPERTIES								
Host (including protocol, port and URI preflu) https://172.29.11.81:8443/onc-nbi-service/	Credentials onc31							
URI prefix: /crosswork/onc-tapi/ or /nbiservice/ or /onc-nbi-service/								
FILE-BRINGERS CONFIGURATION								
Enabled	Remote address with file pattern	Credentials 👻						
NOTIFICATIONS CONFIGURATION								
C Enabled	URL Sub-part CONC_NETCONF							
	NETCONF or CONC_NETCONF							
STATS COLLECTION CONFIGURATION								
✓ Enabled	Stats Interval Polling [sec] 600							
HYPERLINKER RULES CONFIGURATION								
Z Enabled	HyperLinker Rules Interval Checking [sec] 600							

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 11: Cisco Optical Network Controller Adapter - Devices Tab

Device Manager Adap	oters Managed Devices Credentia	als				
Adapters	Devices	Events	General			
cisco-xr	Name	•	Status •	Status Changes(Last 24 hr)	Site -	Adapter(s)
onc-76	5 ITEMS ron-ols-5-roadm		✓ Ok	0	Monterey	onc-76
onc-poc90-1	ron-ols-4-roadm		✓ Ok	0	San Luis Obispo	onc-76
5V0	ron-ols-2-roadm		✓ Ok	0	Las Vegas 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.

Protocol *	IP Address / Subnet Mask *		Port *	Timeout(sec)	Encoding Type	
SSH	∨ 172.29.11.40	/ 25	22	60		\sim
SNMP	∨ 172.29.11.40	/ 25	161	60		\sim
Encryption	\sim ?					
NETCONF	∨ 172.29.11.40	/ 25	830	60		\sim
GNMI Add Another	✓ 172.29.11.40	/ 25	57333	60	PROTO	~
GNMI Add Another apability* 2 YANG MDTTL1 Providers and Acce	V 172.29.11.40	7 25 SNMP GNMI	57333	60	PROTO	~
Add Another apability• 2 YANG MDTTL1 Providers and Acce Routing Info	V 172.29.11.40 VANG CLI VANG EPNM	/ 25 SNMP ☑ GNMI	57333	60	PROTO	×
Add Another apability• 2 YANG MDT □ TL1 Providers and Acce Routing Info Streaming Telemett	V 172.29.11.40 VANG CLI VANG EPNM V VSS Vy config	/ 25 SNMP ☑ GNMI	57333	60	PROTO	v

Figure 12: Crosswork Network Controller Crosswork Data Gateway Adapter

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

Figure 13: Crosswork Network Controller Crosswork Data Gateway Adapter - General Tab

Devices Events General		
Carabled	Logging Level	
Collector Cadence (sec) 300 Collector sample cadence in seconds	Status Update Interval [sec] 300 NOTE: You can see missed stats errors if the interval is less than the	
	collector cadence	
CNC CONFIGURATION		
Host* 172.29.11.75	Port* 30603	Timeout [sec]
cnc-6-75		
GRPC LISTENER CONFIGURATION		
Public IP Address for GRPC listen port 65001*	Destination Name*	
NOTE: Make sure that the address is forwarded (or belonged) to the docker host	NOTE: The name should be unique in the crosswork context	un-t wessages besug Logging
COLLECTION PARAMETERS		
Missed ports stats error threshold (percentage)	C Enable Interface Counters	C Enable 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
Enable OTU Counters: Instant	Enable OTU Counters: 30 Seconds	Chable 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 14: Crosswork Network Controller Crosswork Data Gateway Adapter - Data Destinations

\sim c	Data Destinations ③					
+ ,						
	Destination Name		Server Type	Compression Type	Encoding	UUID
	Crosswork_Kafka	G) Kafka	snappy	gpbkv	c2a8fba8-8363-3d22-b0c2-a9e449693fae
	cdg-astack-pipeline	G	gRPC	gzip	gpbkv	e9b4c2ec-b2e6-4db0-a942-0402dd347a1d
	netfusion_cdg	đ	gRPC	gzip	gpbkv	0a088f8b-3fea-4694-a744-54c02fbdda5e



Administration / Collecti	ion Jobs										
Collection Jobs			1/11 0	> Job Details	- netfusion_cdg	ron-poc-8201-1					
+0				Last Eval S	itatus () sful	Job Configuration Config Details		Collection GNMI	а Туре	C Last M 08-DE	odified On C-2021 11:00:39 AM EST
Status	App ID	Context ID	Action	00-060-20210	CASAS PREST O	Collectio	ns (7)	Die	tributions (7)	→()	
Successful	netfusion_cdg	ron-poc-8201-2	0			Devices	Data Gater	ways		Destinations	
Successful	cw.dlminvmgr0	dim/cli-collector/group/	0	Showing - All Coll	lections (7) Collectio	n Issues (0)					T 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								
Successful	cw.dlminvmgr0	dim/snmp-collector/gro	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	() al.			08-DEC-2021 11:00:40 A
Successful	cw.dlminvmgr0	dlm/cli-collector/group/	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	(D) at			08-DEC-2021 11:00:40 A
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 11:00:40 A
Successful	netfusion_cdg	ron-poc-8201-1	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-pme	at.			08-DEC-2021 11:00:40 A
 Successful 	cw.optimatraffic	cw.optimatrafficsnmp-ctx	Ó	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	openconfig-interfac	() at			08-DEC-2021 11:00:40 A
 Successful 	cw.topo-visualization	topo-visualization.colle	0	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR-cont	a D			08-DEC-2021 11:00:41 A
Degraded	(i) cw:topo_svc	cw.toposvc.snmptraps	Ó	Successful	ron-poc-8201-1	3dd19b98-be21-4c72-ab	Cisco-IOS-XR+cont	(i) at			08-DEC-2021 11:00:41 A

NSO Adapter In Hierarchical Controller

In Hierarchical Controller 8.0 there is an embedded NSO installed when Hierarchical Controller 8.0 is installed. The NSO adapter can use the internal NSO or point to an external NSO instance. Provisioning using the NSO adapter requires adding the NSO adapter to the devices you want to provision.

Use the NSO adapter when you use the Automation Starter Solution.



• If using the internal NSO, the Routed Optical Networking 3.0 Core Function Pack must be installed on the NSO instance.

• If using the internal NSO, devices must be added to that NSO, adding them to Hierarchical Controller does not automatically onboard them into the internal NSO.

Figure 16: NSO Adapter - General Tab

device-manager-srv Adapters	Managed Devices Credentials	G
Adapters 😇	Devices Events General	
cnc		
cdg	← Logging Level	
cisco-xr	Enabled Debug	
onc		
onc-50		
nso	Use internal nso	
	Connect to an aiready-exiting local noo instance (you may leave Server Configuration parameters empty) SERVER CONFIGURATION	
	Host Timeout(sec) Cordentials	
	PROVISIONING PARAMETERS	

Start configuration with NSO and XR adapters.

cisco-xr		Ĉ	Unassign device from this adapte
Host 172.29.11.120	22		
	- Authen	cation	
Direct Connect (avoid tunnel if config	rred) cisco-	(r 👻	
—			
Enabled			
nso			Unassign device from this adapt
nso r/CE CONFIGURATION		C	Unassign device from this adapt
nso //CE CONFIGURATION		C	Unassign device from this adapt
nso n/CE CONFIGURATION		C	Unassign device from this adapt
nso vice configuration		C	Unassign device from this adapt
nso nice configuration		C	Unassign device from this adapt

Configure SSO in Crosswork Hierarchical Controller

This section describes how to configure SSO in Crosswork Hierarchical Controller with Crosswork Network Controller as Identity Provider. You can use the same SSO configuration to set up SSO for Cisco Optical Network Controller Release 3.1.

1. Configure Crosswork Hierarchical Controller

a. ClickSettings > Security > SAML Configuration

Enter the necessary information:

- Login URL: https://<CNC_IP>:<port>/crosswork/sso/idp/profile/SAML2/Redirect/SSO
- Entity ID: https://<CNC_IP>/idp
- Certificate: Copy from Crosswork Network Controller metadata frm https://<CNC_IP>:<port>crosswork/sso/idp/metadata
- Use Groups Attribute Name authenticationMethod

Figure 17: Crosswork Hierarchical Controller Provider Configuration Sample

	SYSTEM INFO		
		SAML SSO	
	Versions		
	SECURITY	Enabled	
	Local Users	Login URL	
	LDAP	https://172.29.11.75:30603/crosswork/sso/idp/profile/SAML2/Redired	ct/SSO
	SAML SSO	Entity ID	
۱	Permission Mapping	https://172.29.11.75/idp	
		Base URL	
W		https://172.29.11.83:8443	Use Current
\otimes		Signing Certificate	
0		MIIDEjCCAfqgAwlBAglVAMMMGZNUyo1rFyvLoSkqGlZxhdADMA0GCS CwUAMBcxFTATBgNVBAMMDDE3Mi4yOS4xMS43NTAeFw0yNDAxME NDAxMDgxMTA1NTFaMBcxFTATBgNVBAMMDDE3Mi4yOS4xMS43NT hycNAOCFBQADAgeFPADCCAOcGagFBANcway7BWr1ukFc2HswKur4	qGSlb3DQEB 9gxMTA1NTFaFw00 CCASIwDQYJKoZI 1xwm27.1c3\/rfb
		qpiwesEGOw83DbJcPZEdqR58HpeiQGwTCoCwFiC0UcLWii/0/j8eAqvl 7LXgb9YI/mp9ly+hBISGv1R+OZXunkFenfSwiD3+RV64Yk/Ol4u7vounzz qFiZ0YSuUr0ka7rcUcedX3U33HYRnxR7Ad7Wvg/OTx7z34ntbEWVnwA	J3/4PDabF Qp4rhN J9KPR08Ha
		POSUMtNGViVI7LX46CirrVvgUoiEBStZNv8+BbQ9wPle841b9919LlhqM cpDI8WDzRixS/Tp4NpOaZ2rSs+MloGbLQ9UUGQdmsw1xMlrVg1cCAw HQYDVR00BBYEFGYgIp+LtWLZmLQC/tf4CDB3qns8MDIGA1UdEQQrM QS4MS42NV72MTovLifE1EvLia12Ucc0472Vb72CEQTANBackabkiCo	q97SgtU /EAAaNVMFMw CmCDDE3Mi4y
SHOL		Groups Attribute Name	
		authenticationMethod	
(D)		Relo	bad Save

b. Click Settings > Security > Permission Mapping

L

	SYSTEM INFO Versions	Permission Mapping
	SECURITY	No permission mappings defined
SHOP	Local Users	Reload Add
	LDAP	
	SAML SSO	
	Permission Mapping	

Figure 18: Crosswork Hierarchical Controller Permission Mapping Sample

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

	SYSTEM INFO Versions	
(F) (SHOL)	SECURITY	Mapping Type*
	LDAP	Match* QueryDatabaseAuthenticationHandler
0	SAML SSO	Access Permissions*
		permission/hco/device-manager-srv:ro permission/hco/link-assurance-app:rw permission/hco/logs:ro
 ⊗ 		permission/hco/static permission/hco/service-manager-app:rw permission/hco/cisco-onc-adpt:rw
		permission/hco/dashboard-app:rw permission/hco/service-manager-internal-api permission/hco/hyperlinker:rw
		Save

Figure 19: Crosswork Hierarchical Controller Permission Mapping Sample

2. Copy Crosswork Hierarchical Controller SAML metadata to a file, metadata is located at https://<HCO IP>:<port>/sso/metadata. The following is a sample.

- 3. Configure Crosswork Network Controller
 - a. Login to Crosswork Network Controller, click Administration > AAA > SSO

Figure 20: Crosswork Network Controller AAA

cisco Crosswo	ork Network Controller		ር ତ ହ
Dasbboard	AAA		
្លឺំំំំំំំំ Topology	Servers SSO	Identity Provider ③ Entity ID* Inter (177:28:11.7%/etp	
Network Automation	Settings	Service Name Evaluation Order	Selected 0 / Total 0 🖶
Performance Alerts			

b. Click +

- Add a name
- Add a unique evaluation order number
- Upload HCO's Metadata file in XML format

Figure 21: Crosswork Network Controller Add new Service Provider

Identity Provider (?)	
Entity ID * https://172.29.11.75//dp	
+⊘ ₪	
Service Name	Evaluation Order
	Service Provider
	Name* ©
	Evaluation Order * ①
	Metadata () Browse
	Add Cancel

c. Click Save

Figure 22: Crosswork Network Controller AAA

	Identity Pro	ovider (?)						
I	Entity ID*							
l	+01	1						
		Service Name		E	valuation Order		 	J
								,
			Service Provider					
			Name * ①					
			Evaluation Order * 🛈					
			Metadata 🛈			Browse		
					Add	Cancel		

4. Login to

Figure 23: Crosswork Network Controller AAA



Troubleshooting Cisco Crosswork Hierarchical Controller SSO

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

Examples of Cross Launch

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

- · Cross Launch from IGP Link SRC/DST Router in Hierarchical Controller to Crosswork Network Controller
- 1. Click on Links > IGP
- 2. Hover over either Source Device or Destination Device, click the ellipsis and click IGP device at Crosswork Network Controller

Figure 24: Network Inventory

۲	Network Inve	ntory							_						
	Filter inventory by:	Regions/Sites/D	levices												
<u></u>	Devices	Sites	Links	Conne	ctions		Services	More	Informatio	on:			Powe	r Supplies	
۲	FIBER OTS	OMS ZR	MEDIA ZR CHANN	EL L3 PHYS	ICAL	L3 AGGREG	ATE LI	⊠ IGP	device at CN	с		- 1		Apply	y Invent
	Name			▼ So	urce Port	•	Source De					n 5	at 🕶	Operatic 🕶 State	Protect
	22 ITEMS											- 1			
	ron-8201-1 100.1.1.14	to ron-asr9903-1 10	00.1.1.15	10	0.1.1 ron-82	201-1 ☆〔	2 🔺 … 🕨					I		UP	SINGL
	ron-8201-1 100.1.1.20	to ron-ncs55a2-1 10	00.1.1.21	10	0.1.1.20/31		ron-8201							UP	SINGL
9	ron-ncs540-1 100.1.4.	1 to ron-poc-8201-1	100.1.4.0	10	0.1.4.1/31		ron-ncs5					- 1		UP	SINGL
	ron-8201-2 100.1.2.2 t	o ron-8201-4 100.1.	2.3	10	0.1.2.2/31		ron-8201							UP	SINGL
>	ron-8201-1 67.67.67.0	to ron-ncs5504-1 6	7.67.67.1	67	.67.67.0/31		ron-8201					- 1		UP	SINGL
	ron-ncs57b1-1 139.1.1	1.2 to ron-ncs57c3-1	139.1.1.1	13	9.1.1.2/30		ron-ncs5					- 1		UP	SINGL
	ron-8201-1 100.1.1.16	to ron-ncs540-1 100	0.1.1.17	10	0.1.1.16/31		ron-8201-1		10	100.1.1.17/31	ron-ncs540-1	10		UP	SINGL

This operation launches the router traffic engineering information in Crosswork Network Controller.



Figure 25: Traffic Engineering

- · Hierarchical Controller SR Policy to Crosswork Network Controller
- 1. Click on Connections > SR Policy
- 2. Hover over policy and click on ellipses to open cross launch.

Figure 26: Network Inventory

۲	Network Inve	ntory				_	_					(9 C
⊕	Filter inventory by:	Regions/Sites	s/Devices										
SHOL	Devices	Sites	Links	Connections	Services	Cards	Ports	Transce	ivers	Power Supplies	Fans	5	Shelves
۲	NMC OCH	ETHERNET	SR POLICY	MC						Apply Inventory Filter	On Connecti	ons 👤	Export Table
	Name			•	Source Device *	Destination Device	 Operation * State 	Protectec *	IGP Hops * Count	Tags	*	Color 👻	Preferenc 🔻
	39 ITEMS												
	100.0.0.20 to 100.0.0.	3, color 1000			ron-ncs57b1-1	ron-8201-32FH-3	UP	SINGLE	3			1000	200
	100.0.0.50 to 100.0.0.	52, color 101	More Inform:	ation		-1	UP	SINGLE	3			101	100
	100.0.0.50 to 100.0.0.	52, color 1000	More morma	ation.		-1	UP	SINGLE	3			1000	200
S	100.0.0.50 to 100.0.0.	52, color 705	SR Policy at C	<u>NC</u>		-1	UP	SINGLE	3			705	200
8	100.0.0.50 to 100.0.0.	52, color 103				-1	UP	SINGLE	3			103	200
	100.0.0.50 to 100.0.0.	27, color 705				3-1	UP	SINGLE	3			705	200
	0.0.0.52, color 10000 🟠	☑ ◀ … ◀				-1	UP	SINGLE	3			10000	200
	100.0.0.50 to 100.0.0.	52, color 102				-1	UP	SINGLE	3			102	100
1	100.0.1.1 to 100.0.1.3	color 9010				b1-1	UP	SINGLE	1			9010	100
	100.0.1.1 to 100.0.0.2	7, color 9009				8-1	UP	SINGLE	3			9009	100
	100.0.0.52 to 100.0.1.	8, color 1000				b1-1	UP	SINGLE	3			1000	100
	100.0.0.52 to 100.0.0.	27, color 5227				3-1	UP	SINGLE	3			5227	100
	100.0.0.52 to 100.0.0.	50, color 4000			ron-ncs540-1	cloud-ncs540-1	UP	SINGLE	3			4000	200

This operation launches detailed policy information in Crosswork Network Controller.

Figure 27: Traffic Engineering



- Hierarchical Controller Optical Node to Cisco Optical Site Manager
- 1. Click on **Devices** > **ONS**
- 2. Hover over a device, click ellipsis and click Optical Node at COSM.

Figure 28: Network Inventory

٢	Network Inventory					_						
⊕	Filter inventory by: Regions	/Sites/Devices		٩	1							
SHOL	Devi More Inform	nation:			Services	Cards	Ports	Trans	ceivers	Power	Supplies	
٢		e at COSM									Apply Inven	tor
	Name 14 ITEMS				•	OS Version	 Serial Number 	*	Site	•	Reachabilit 👻	T,
	₹ 🛛 ┥ …) <								VAL		REACHABLE	
	OLT1-roadi OLT5 R C-								LIS		REACHABLE	
\odot	OLT6-roadi								Geneva		REACHABLE	
<i>></i>									BAR		REACHABLE	
	ILA1	172.27.227.101	Cisco	ola	J				COR		REACHABLE	
	ron-poc-ols-1-roadm	172.29.11.73	Cisco	roadm					FRA		REACHABLE	

- · Hierarchical Controller Optical Port to Cisco Optical Site Manager
- 1. Click on **Ports** > **OTS**
- 2. Hover over a port, click ellipsis and click Optical Port at COSM.

Figure 29: Network Inventory

۲	Network Inve	entory										
⊕	Filter inventory by:	Regions/Sites/Devices		٩								
SHOL	Devices	More Information:			Services	Cards		Ports	Trans	ceivers	Powe	er Supplies
٢	OTS Z	Port at Component View (COSM)										Apply Invent
	Name					Device Vendor	Spa ♥ Los	Site	•	Operationa * Status	Admin Status	 Supported Links
9	24 ITEMS											
	lt6/1/0/LINE ☆ 🗹 ◀				dm	Cisco		Geneva		UP	UP	1 Link
	ron_ncs1010_01				dm	Cisco		VAL		UP	UP	▶ 1 Link
	ron_ncs1010_olt				3-roadm	Cisco		MAL		UP	UP	1 Link
	ron_ncs1010_ila					Cisco		COR		UP	UP	▶ 1 Link
	ron_ncs1010_olt				dm	Cisco		LIS		UP	UP	1 Link
	ron_ncs1010_ila					Cisco		COR		UP	UP	▶ 1 Link
W	ron_ncs1010_ila2-r-c	/1/0 Port: 1/0/LINE-2, Physical	PORT-1/0/LINE-2	ILA2	-	Cisco		BAR		UP	UP	1 Link
	ron_ncs1010_olt2/8/	0/LINE Port: 8/0/LINE, Physical D	PORT-8/0/LINE	OLT2 O	LT3-roadm	Cisco		MAL		UP	UP	1 Link

- Hierarchical Controller Link Assurance Node to Cisco Optical Site Manager or SVO
- 1. Click Link Assurance > Inspect links
- 2. Hover over a node, click ellipsis and click Optical Node at COSM.



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

			ron-poc-ols-1				I 🔊 🔊 💿
🟶 J. Fault Menitoring							
• Rack 1 +							•
	Alarms Conditions	History Profile	15				
	Alarm Summary		Critical Maju	or Minor Ward	0 ing Indetermin	ate Auto Delete Cleared , Show Transient Alarn	Alarms or and a second se
	\$ @				Fet	:hed at :03/27/2024, 18:4	49:41 Displaying : 15 of 15
	Rack	UID	Device Name	Severity	Service Affe	Condition	Timestamp ↓
•	T	T	T	T	T	T	T
•	1/1	1	ron-poc-ols-1	Warning	NSA	SSM-ST3	08/12/2001, 05:11:32
	1/1	1	ron-poc-ols-1	Warning	NSA	FRNGSYNC	08/12/2001, 05:11:37
	1/1	1	ron-poc-ols-1	A Minor	NSA	EQPT-MISS	08/12/2001, 05:12:04

- Hierarchical Controller Link Assurance Port to Cisco Optical Site Manager
- 1. Click Link Assurance > Inspect links
- 2. Hover over a port, click ellipsis and click Optical Port at COSM.

Figure 31: Link Assurance



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**.

	/ 15											
name	address	port	type	services	ping	connect	check-sync	sync-from	sync-to	compare-config	alarm	
cloud-ncs540-1	172.29.11.120		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3									
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	A dal da	u de e		teck-sync					
ron-8201-4	172.29.11.23		cisco-iosxr-nc-7.3:cisco-iosxr-nc-7.3	Add de	evice		eck-sync					
ron-asr9903-1	172.29.11.27		cisco-iosxr-cli-7.33cisco-iosxr-cli-7.3	name	c-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. w								
xrv9k-pe-1	172.29.11.24		cisco-iosxr-cli-7.33cisco-iosxr-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.

CISCO Configuration edit	or		time O ···· View options + nso	•
1_/ncs:devices/device(ron-poc-8202-1)/			Due to the size of this configuration model, subfolders are not incl	luded
See 'ron-poc-8202-1' in Device manager	8-8-8-8-8-8-8	-8-8-8-8-8-8-8		
name	authgroup	read-timeout	out-of-sync-commit-behaviour	
ron-poc-8202-1	routers	▼ Valid range: 1 4294967	(reject ~	
local-user	device-profile	write-timeout	snmp-notification-address	
	_	Valid range: 1 4294967		
description	connect-timeout	trace		
Cisco 8202 router in PoC lab	Valid range: 1 4294967	pretty - Pretty-printed data		
trace-output				
🗌 file	180808080808			
external				
address-choice				
device				
address				
172.29.11.31				
port				
Valid range: 0 65535				
remote-node				
	C* Commit manager	Configuration A Alarm B Dashboard D	Device S service 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	ti View options + nso +
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	888888888888888888888
ne-type netcort generic cli snmp	
netconf/	
C* commit E Configuration A Aism B Destboard	D Device S Service ~

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.

CISCO Configuration editor			View options v nso v
1 /ncs:devices/device(ron-poc-8202-1)/device-type/netconf/]		Due to the size of this configuration model, subfolders are not included
See ton: pos-6323-1' in Device manager			
	C* Commit E Configuration A Alarm manager	B Dashiboard D Device S Service manager	~

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





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.



- 2. 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_820	1_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 NO VERIONS.4.2	200)()			
See 'poc_circuit_195200' in Service manager		858585858	-585858585859	
name i	circuit-id This is a demo circuit	dac-rate	0	
mode* itansponder ~	grid-type (100mhz-grid)	clear-rollback	0	
bandwidth*	frequency			
end-point		This list is empty	080808080808080	Add list item →
) () ols-domain/ service-state () (UNLOCKED) ~				
custom-template ()		This list is empty		Add list item →
custom-template 🚺		This list is en	npty	Add list iter

Note

- User configuration global options are frequency and dac-rate
- 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
- Modulation of 16 QAM is available for 2x100G muxponder mode.
- **c.** After the ols-domain is added, you must add end-points to the circuit. Two end-points are always required. The end-points are the routers with ZR/ZR+ optics.
| Configuration ed | ditor | | | View options v nso v |
|------------------------------------------|---------------------------------------|------------------------------------|------------------------------------|----------------------|
| 1_/cisco-ron-cfp:ron/ron-mi{poc_circuit | t_195200){ | | | |
| See 'poc_circuit_195200' in Service mana | xxv) | | | 19282828282828282 |
| 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 🚺 | | This list is em | pty | Add list item → 😯 |
| all ols-domain/ | | | | 3666666666666666666 |
| service-state
(UNLOCKED) | • | | | |
| custom-template 🚺 | | This list is | empty | Add list item → 🛟 |
| | | | | |
| | | | | |
| | | | | 3888888888 |
| | | | | 19-9-9-9-9-9-9-9-9- |
| | C* | Commit E Configuration A Alarm B D | shboard D Device S Service manager | · · |

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

ter 'per, strout, 19520' is Service manager name
name pc_chcut_195200 mode* transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate mode/ transponder de-rate
mode"
andwidth*
Add new list item end-point-device ron-poc-8201-1 end/contain/ cancel contrm
) ols-domain/ service-state
(UNLOCKED)
ustom-template () This list is empty

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-ml(poc_circuit_195200)/end-poin	tfron-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		
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 Dashboard D Device S Service manager	~

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

Configuration editor		View options + nso ~
1/cisco-ron-cfp:ron/ron-mi(poc_8201_1_to_poc_8201_2_20)/end-p	xxint[ron-poc-8201-1]/terminal-device-packet	
See 'poc_8201_1_to_poc_8201_2_20' in Service manager		
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.

alialia cisco	Configuration editor) di	View options + nso -	~
	-ron-clpuxa/ton-milpoc_8201_1_to_poc_8201_2_20)/end-point/ron-poc-8201-1)/terminal-dev/ce-packet/			
See 'poc_8	201_1_to_poc_6201_2_20' in Service manager			
bundle				
Ш Ю				
500				
1.1				0
interface				
inde	x			
•				
				0

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

cisco	Configuration ec	litor				
♠ Ĺ/cisc	co-ron-cfp:ron/ron-ml{poc_82	01_1_to_poc_8201_2_20}	/end-point{ron-poc-82	01-1}/terminal-device-p	acket/bundle{500}/ip	-address
See 'poc_	_8201_1_to_poc_8201_2_20'	in Service manager				8-8-9
v4		- 1888 1888				
102.20.	.20.20/31					
v6		1-9-9-9-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2-				
ROKE		70202				
\times						

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

See 'poc_8201_1_to_poc_8	201_2_20' in Service manager	
oundle-id*		
500	• 59898	
mode		
active	• D-0-0-	

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.

t kisco-ron-cfo:ron/ron-millooc 8201 1 to	poc 8201 2 201		
Exercision changes with a feet of a			
iee 'poc_8201_1_to_poc_8201_2_20' in Servic	ce manager		
iame	circuit-id	dac-rate	
00c_8201_1_to_poc_8201_2_20	poc_circuit		
node*	grid-type	clear-rollback	
transponder ~	(100mhz-grid)	~	
bandwidth*	frequency		
400	1952000		
nd-point			
end-point-device			
ron-poc-8201-1			
ron-poc-8201-2			
als demain/			

j. Click SRLG to perform SRLG configuration

1 //cisco-ron-cfp:ron/ron-milpoc_8201_1_to_poc_8201_2_3	20)/srig/	
See 'poc_8201_1_to_poc_8201_2_20' in Service manager		
group		
		HOROROROROROROROR
value-list		
□ id	value	
10	1000	
	2000	
20	Read and a second s	
20		•

Note

- Configuration options are to specify a preconfigured group, a list of numeric SRLG values, or a list of SRLG names associated with preconfigured name:value pairs.
- Each type can be populated in the same configuration.
- In this example we specify a list of explicit numeric values. An index is used along with the numeric value.
- **3.** 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.



4. 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.

CISCO Configuration editor			
12/cisco-ron-cfp:ron/ron-ml{poc_8201_1_to_poc_8201_2_21	D)/		
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-plan[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

	ron-mi-plan	
L	Dame	
L	682b3df2_30b2_44f2_9438_6dfb7738d0ef	
L	6e2b4907_b08b_4338_8304_s4f2903b3311	
L	17a00076_d3db_4bd9_sd94_673d4cc462cb	
L	poc_8201_1_to_poc_8201_2_20	
L		

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

1 Lisco-ron-cfp:ron/ron-mi-plan	(poc_8201_1_to_poc_8201_2_20)/plan/		
2/2	nestre		e ncs.ready
3/3 11/11 Oprical-Controller	nosinit	cite-ma- par- par-	nostready
3/3		•	•
ron-poc-8201-1	ncsinit	ctsco-ron-ctp-nano- pian- services.contg-	ncaready
3/3 —		•	•
ron-poc-8201-2	nesinit	cisco-ron-otp-nano- pian- services.conto-	ncs.ready

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 Mon Oct 17 09:51:11.625 POT Building configuration !! IOS XR Configuration 7.7.1 srlg interface Bundle-Ether500 10 value 1000 20 value 1000 20 value 2000 ! interface Bundle-Ether500 interface Bundle-Ether500 interface Bundle-Ether500 interface Store 20:20:20:25:255:255.254 ! controller Optics0/00/20 description poc_circuit transmit-power -100 fec OFEC dwdm-carrier 100HHz-grid frequency 1952000 DAC-Rate 1x1.25 ! interface FourHundredGigE0/0/0/20 bundle id 500 mode active ! End</pre>	<pre>RP/0/RP0/CPUBron-poc-8201-1#show controllers optics 0/0/020 Won 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 DWDM carrier Info: C BAND, MSA ITU Channel=19, Frequency=195.20THz, Wavelength=1535.822nm Alarm Status:</pre>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Provision Routed Optical Networking ML Service Using Crosswork Hierarchical Controller

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

Crosswork Hierarchical Controller 8.0 in Routed Optical Networking 3.0 also supports "router only" provisioning which provisions optical parameters on router optics port and IP layer parameters but does not provision OLS.

a. Select Link Manager application.

Figure 32: Crosswork Hierarchical Controller



You get the following initial view that shows the list of Cross Links.

۲	Link Manager Cross Links							0	c 🌣
⊕	+ Add Cross Link							✓ Validate A	dl Manual Links
GROD	LinkName	* Description *	Type *	Created By *	Device A / Port A	Device B / Port B *	Status *	Method	
	Manual Cross Link ron-poc-8201-1 Optics0/0/0/10 to ron		NMC	Manual	ron-poc-ols-1-roadm / ron-poc-ols-1/1/CHAN 46 (192.725)	ron-poc-8201-1 / Optics0/0/0/10	Unknown	N/A	
۲	Manual Cross Link ron-poc-8201-2 Optics0/0/0/10 to ron		NMC	Manual	ron-poc-ols-2-roadm / ron-poc-ols-2/1/CHAN 46 (192.725)	ron-poc-8201-2 / Optics0/0/0/10	Unknown	N/A	
٢									
٢									
۲									

b. Click Add Cross Link.

Figure 33:

۲	Link Manager	Cross Links						0	C	۵
⊕	+ Add Cross Link							✓ Validate	All Manu	al Links
SHOL	Link Name 2 ITEMS	 Description 	∗ Туре ∗	Created By 👻	Device A / Port A	Device B / Port B	▼ Status	Ŧ	Method	-
	Manual Cross Link ron-poc-8201-1		NMC	Manual	ron-poc-ols-1-roadm / ron-poc-ols	ron-poc-8201-1 / Optics0/0/0/10	Unknown		N/A	
	Manual Cross Link ron-poc-8201-2		NMC	Manual	ron-poc-ols-2-roadm / ron-poc-ols	ron-poc-8201-2 / Optics0/0/0/10	Unknown		N/A	
١										
٢										
0										
<i>©</i>										

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

	Link Manager Cross Lin	ıks			_	
	+ Add Cross Link					
\bigcirc	Link Name Source Stress Control Contro	Description *	Туре 🔻	Provider	Device A / Port A	Device B / Port B
	Manual Cross Link ron-poc-8201-1 Optics		NMC	Manual	Add Cross Link	×
	Manual Cross Link ron-poc-8201-2 Optics		NMC	Manual		
SHOL	Manual Cross Link ron-poc-8201-1 Optics		NMC	MANUAL_C	_ Link Type	
					NMC .	
					Port A	Q
					Port B	٩
					Description	
					Description	
						n.
					Add Cross I	a b
					Add Cross L	ink .
0						

d. The Link Manager application allows you to select either router DCO port or optical add/drop first. In the following image we filter the ports by the router device that we use for our NMC cross link.

	Cross Links						
Link Name	**		Advanced	3D Explorer			
Manual Cross Link				PORTS			
Manual Cross Link	Name *	Device 💌	туре т	Capacity -	Description *	Admin Status	•
Manual Cross Link	815 ITEMS	Plan					
	1/CHAN 63 (191.450)	ron poc-8201-1 ×	NMC		Port: 1/CHAN 63 (191.450), Physical Dev	UP	- 11
	1/CHAN 45 (192.800)	ron	NMC		Port: 1/CHAN 45 (192.800), Physical Dev	UP	
	1/CHAN 61 (191.600)	ron Cancel Apply	NMC		Port: 1/CHAN 61 (191.600), Physical Dev	UP	
	1/CHAN 46 (192.725)	ron-poc-ols-1-roadm	NMC		Port: 1/CHAN 46 (192.725), Physical Dev	UP	
	1/CHAN 30 (193.925)	ron-poc-ols-2-roadm	NMC		Port: 1/CHAN 30 (193.925), Physical Dev	UP	
	1/CHAN 1 (196.100)	ron-poc-ols-2-roadm	NMC		Port: 1/CHAN 1 (196.100), Physical Devic	UP	
	1/CHAN 64 (191.375)	ron-poc-ols-1-roadm	NMC		Port: 1/CHAN 64 (191.375), Physical Dev	UP	1
	1/CHAN 30 (193.925)	ron-poc-ols-1-roadm	NMC		Port: 1/CHAN 30 (193.925), Physical Dev	UP	
	1/CHAN 64 (191.375)	ron-poc-ols-2-roadm	NMC		Port: 1/CHAN 64 (191.375), Physical Dev	UP	
	1/CHAN 48 (192.575)	ron-poc-ols-2-roadm	NMC		Port: 1/CHAN 48 (192.575), Physical Dev	UP	

e. The following image shows the filtered list. Our router, ron-poc-8201-1 has a single ZR+ optics port, select the port and click OK

Link Manag											
+ Add Cross Link											(
Link Name	* ~		ſ			Advanced					
Manual Cross Link						P	PORTS				
Manual Cross Link	Name	-	Device	۲	Туре		▼ Cap	pacity *	Description •	Admin Status	-
Manual Cross Link	1 ITEM MATCHING F	FILTERS			OCH				OCH port of Cisco OSEPDD 4006 7PP PI	IID	
											Cancel OK

f. Like in the previous step, select the second port which is the optical add/drop port. Filter by device as *ron-poc-ols-1* and the Name as *194.000* to filter to the add/drop port

Link Manag	ger Cross Link	s									
+ Add Cross Link											
Link Name	**					Advanced	1				
Manual Cross Link						PO	RTS				
Manual Cross Link	+ Name	۲	Device	۲	Туре	-	Capacity	-	Description *	Admin Status	*
Manual Cross Link	1 ITEM MATCHING FILTERS				NMC				Ports 1/CHAN 20 (104 000) Physical Do	110	
	1/CHAN 29 (194.000)	N	ron-poc-ols-1-roadm		NMC				Port: 1/CHAN 29 (194.000), Physical De	0P	
											Cancel OK

g. Select the two ports (Ethernet and OCH) in your NMC Cross Link. Click Add Cross Link.

(Optional) Add a description

Link Manager Cross Lin	iks							
+ Add Cross Link								
Link Name Source 20 ITEMS MATCHING FILTERS	Description *	Туре 🔻	Provider	۳	Device A / Port A	 Devic 	e B / Port B	
Manual Cross Link ron-poc-8201-1 Optics		NMC	Manual	Add Cross Link	(×
Manual Cross Link ron-poc-8201-2 Optics		NMC	Manual					
Manual Cross Link ron-poc-8201-1 Optics		NMC	MANUAL_C	– Link Type —				
				NMC				•
				Port A				
				ron-poc-82	201-1 / Optics0/0/0/22		×	
				Port B				
				ron-poc-ol	s-1-roadm / 1/CHAN 29 (194.000)		×	
				Description				
				ron-poc-82	01-1 port 0/0/0/22 to NCS 2000 ro	<u>1-poc-ols-1</u> M	ID-64 chanr	nel
				29				
								~
								<i>li</i>
					Add Cross Link	40		

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

	Link Manager	Cross Links								0	a 📅
_		cross canto								•	-
	+ Add Cross Link								🗸 Vē	ilidate All N	danual Links
	Link Name	*	Description *	Type *	Created By	 Device A / Port A 	Device B / Port B	* Status	×	Method	
SHOP	1 ITEM										
۲	ron-poc-ols-1/1/CHAN 46 (192.72	5) / Optics0/0/0/10	Bright ZR+ poc-82 Frequency: 192.725	NMC	Manual	ron-poc-ols-1-roadm / ron-poc-ols-1/1/CHAN 46 {1	ron-poc-8201-1 / Optics0/0/0/10	Unknown		N/A	
٢											
٢											
1					Summary	Evidence	History				
	LINK NAME ron-poc-ols-1/1/CHAN 46 (192	.725) / Optics0/0/0/	10		DEVICE A / PORT A ron-poc-ols-1-roadm/ron	-poc-ols-1/1/CHAN 46 (192.725)	DEVICE B / PORT B ron-poc-8201-1/Optics0/0/0/10				
۲											
٢	TIME ADDED 2024-03-27 03:15:26 EDT				SOURCE Manual		STATUS Unknown				
۲	METHOD				LAST CHANGE		DESCRIPTION	!- 1			
\odot	N/A				N/A		Bright 2R+ poc-8201-1 to ron-po Frequency: 192.725	C-015-1			

i. View the added crosslink in the explorer app by clicking on the link.



j. Similar to the previous steps, create the second NMC cross link.

Link Manager	Cross Links	_											(0 C
+ Add Cross Link													🗸 Valida	ate All Manu
Link Name	•	Description 💿	Туре	 Provider 	•	Device A / P	fort A	Device B / Port B	-	Status	*	Method *	Last Change	
2 OUT OF 21 ITEMS MATCHING FILTE	ERS													
Manual Cross Link ron-poc-8201-	1 Optics0/0	ron-poc-8201-1	NMC	Manual		ron-poc-82	201-1 / Optics0/0/0/22	ron-poc-ols-1-roadm / 1/CHA	N 29 (194.000)	Unknown		N/A	2023-04-24 10):23:34 EDT
Manual Cross Link ron-poc-57b1-	1 Optics0/0	NCS-57B1 0/0/0	NMC	Manual		ron-poc-57	7b1-1 / Optics0/0/0/24	ron-poc-ols-2-roadm / 1/CHA	N 29 (194.000)	Unknown		N/A	2023-04-24 10	0:29:55 EDT
					Summary		Evidence		History					
LINK NAME Manual Cross Link ron-poc-571 (194.000)	b1-1 Optics0/0	/0/24 to ron-poc-ol	ls-2-roadm	1/CHAN 29	DEVICE A / PORT ron-poc-57b1-1	TA 1/Optics0/0,	/0/24		DEVICE B / ron-poc-ol	PORT B s-2-roadm/1/CHAN 29 (194.0	00)			
TIME ADDED N/A					SOURCE Manual				STATUS Unknown					
METHOD N/A					LAST CHANGE N/A				DESCRIPTI NCS-57B1	DN 0/0/0/24 to NCS 2000 MD-64	chann	nel 29		

k. View the end-to-end network with both crosslinks in the Explorer app.



- 2. (Optional) Cross-Link Connectivity Verification
 - Cross-Link Connectivity Verification is supported on all router platforms and NCS 1010 with MD-32 and BRK-24 modules.
 - Connectivity Verification uses NSO CLI NED to modify router port state and TX power, is service affecting.

- When validation starts, Hierarchical Controller continuously checks the RX power on the optical add/drop port. Connectivity Verification is performed in the background.
- **a.** Configure NMC Validation Settings. Settings are used to control validation, **Wait period to receive samples while on** must be set to 180 seconds, **Wait period to receive samples while off** must be set to 50.

Provider	 Device A / Port A 	*	Device B / Port B	*
Manual	Settings		×	Optics0/0/0/0
	ETH validation	NMC Vali	dation	
Summary	Power on [dbm] : -11			History
DEVIC 0/3/0/6 ron2_	Power off [dbm] : -50			DEVICE B / I ron-ncs550
	Timestamp precision [sec]: Number of cycles:	2		
SOUR Manu	Wait period to receive samp	oles while on [se	c] : 200	STATUS Validated E
	Wait period to receive samp	oles while off [se	c] : 50	
	Sample interval [sec]: 2			
LAST 0 2023-	Buffer for power off/on [db	m] : 10		DESCRIPTIO ron-ncs550
	Con	nfirm		

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

Link Manager Cross Links								0	G	¢
+ Add Cross Link								✓ Validate Al	l Manu	al Links
Link Name 💿 Description 👻	Type - Provider	≁ Dev	vice A / Port A 👻	Device B / Port B	-	Status +	Method +	Last Change		•
1 OUT OF 24 ITEMS MATCHING FILTERS	Marco Manual		-0 -140 d (0.10.0015			the first state of the state of the state	all shows a local			
Manual Cross Link ron-nessou4-1 Optic ron-nessou4	. NMC Manual	ror	nz_oitz-roadm / 0/3/0/6	ron-ncs5504-1 / Optics0/0/0/0		validated By Shut No Shut	Shut no shut	2023-03-30 04	:39:03 E	וט
	Summa	ary	Evidence		History					
LINK NAME Manual Cross Link ron-ncs5504-1 Ontics0/0/0/0 to ron2	olt2-roadm 0/3/0/6	DEVICE A / PORT A	N 1/0/3/0/6		DEVICE B	/ PORT B 504-1/Optics0/0/0/0				
TIME ADDED 2023-03-30 03:16:34 EDT		SOURCE Manual			STATUS Validated	By Shut No Shut				
METHOD Shut no shut		2023-03-30 04:39	:03 EDT		ron-ncs55	ion 604-1 to ron2_olt2-roadm				
								_		
Validate Link								0	Delet	e Link

c. After validation completes, inspect the evidence of either successful or unsuccessful verification. The following image shows a successful verification. Status changes from **Unknown** to **Validated By Shut No Shut**. The time it takes for the ZR/ZR+ to start transmitting after no shut is set is typically 60–80 seconds.

Link	Manager	Cross Li	nks																				0	C	•
+ Add	Cross Link																						✓ Validate	All Ma	nual Links
Link Na	ime	۲	Description +	Type 🔹	Provider		Ŧ	Device A	/ Port A				Devic	e B / Por	t B			*	Status		Me	thod -	Last Change		•
1 OUT 0	DF 24 ITEMS MATCHING FILTI	ERS																							
Manua	l Cross Link ron-ncs5504-1	Optic	ron-ncs5504	NMC	Manual			ron2_ol	t2-roadn	n / 0/3/0	/6		ron-n	cs5504	-1 / Optic	:s0/0/0/	0		Validated By Sh	ut No Shut	Sh	ut no shut	2023-03-30	04:39:0	3 EDT
					Sun	nmary					Eviden	nce					Hist	tory							
	Validation Time		Validation Res	ult	•	ZR Port	- 1	ti			1			-	r							T			
	2023-03-30 04:39:03 EDT		Validated By S	ihut No Shut		0/3/0/6	-1	5			_														
	2023-03-21 03:25:50 ED	т	Validated By	Shut No Shut			-21																		
	2023-03-09 14:08:00 EST		Validated By S	ihut No Shut	Failed		-21	5																	
							(HBH)																		
							Power																		
							-3	5						_											
							-4																		
							-4																		
							- 44	1																	
							-51	0.000	2.8°.8°.	y 9° 5	? ₆ ? ₆ ?	8.8.2	9. 4. 4 9. 4	1.00.00	S. 10. 8	80.8°	چگ چ ⁹ رہ Time (Se	°_&'_& aconds	? (?,??,??;??;?;?;?)	89 2 8 8 8	5.0°	10 761 762 760 4	e a a a a a	1999 - 999	9

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

4ame 👳	Description - Ty	pe - Prov	der		 Device A / Pc 	art A	 Device B / Port 	в	 Status 	 Nethod 	 Last Change
FOF 24 ITEMS MATCHING FILTERS											
al Cross Link ron-ncs57c3-1 Optics0/0/2/0 to r	N	AC Man	ual		ron-ncs57c	3-1 / Optics0/0/2/0	ron2_olt1-roa	dm / 0/1/0/6	Validated By Shut No Shut	Shut no shut	2023-04-25 03:21:14 EDT
						(
				Summary		Evidence		History			
				-10							
Validation Time	 Validation Result 		ZR Po	et 👘			+		· · · · · · · · · · · ·		
STIERS	Multidented Burthan Marth		0/1/0/	6							
2023-04-23-03.21.14-001	Valuated by shut No al			-15							
2023-04-20 13:03:35 ED1	Never validated										
2023-04-20 10:44:25 EDT	Never Validated			-20							
2023-03-21 06:58:57 EDT	Validated By Shut No Sh	ut									
2023-03-09 14:11:12 EST	Validated By Shut No Si	ut Failed									
				-25							
				E							
				00 12 -30							
				Pom							
				-35							
				-40							
				-40							
				-50							
				0	2232	ゆゆいののりこうりょうり	コード さくまく や ちょう	さっち む や ち ち ち も も	こうちょう ちょうちょうちょう ちょうちょう しょう	2 4 4 4 4 4 4 4 4	ව ව ව ව ව ව ව ව ව ව
								Time (Seo	onds)		

- 3. 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.



The Service Manager Application shows you a list of services.

۲	service-manager-app	Tunnels	Point to Point	NSO Provisioning	-					Operations	🏟 Settings
⊕	Create New P2P										
<u></u>	Name	Р2Р Туре 👻	Configuratio * State	+ Creation Date *	Endpoint A 👻	Endpoint B 👻	Speed *	Operational * State	Last 24h * Operations	Last Operation	•
۲	8 OUT OF 25 ITEMS MATCHING FILTERS										
	RK_2K_OLS_2x100G_16QAM_1x1.2	IP Link	INSTALLED	27-03-2024 13:59:44 EDT	ron-ncs57c3-1 - Optics0/0/2	ron-ncs57c3-2 - Optics0/0/2	200 GB	Up	1	Create IP Link: 🖌 Done	
0	RK_8_2K_Router_Only	IP Link	INSTALLED	27-03-2024 07:02:42 EDT	ron-8201-32FH-3 - Optics0/0	ron-asr9903-1 - Optics0/0/1/	400 GB	Up	1	Create IP Link: ✓ Done	
	RK_OLS	OCH-NC Link	INSTALLED	27-03-2024 06:45:53 EDT	ron-ols-2-roadm - ron-ols-2/	ron-ols-4-roadm - ron-ols-4/	400 GB	Up	1	Create OCH-NC: ✓ Done	
9	RK_Test	OCH-NC Link	INSTALLED	27-03-2024 06:39:30 EDT	OLT1-roadm - ron_ncs1010	OLT4-roadm - ron_ncs1010	400 GB	Down	1	Create OCH-NC: ✓ Done	
	RK_12_100G	IP Link	INSTALLED	26-03-2024 04:34:55 EDT	ron-8201-32FH-3 - Optics0/0	ron-ncs57b1-1 - Optics0/0/0	100 GB	Up	1	Create IP Link: 🗸 Done	
S	RK_11	IP Link	INSTALLED	26-03-2024 04:05:14 EDT	ron-ncs57c3-1 - Optics0/0/3	ron-8201-32FH-3 - Optics0/0	200 GB	Up	1	Create IP Link: ✓ Done	
	RK_4x100G	IP Link	INSTALLED	26-03-2024 01:58:26 EDT	ron-asr9903-1 - Optics0/0/1/	ron-8201-32FH-3 - Optics0/0	400 GB	Up	1	Create IP Link: ✓ Done	
	RK_9_3x100G	IP Link	INSTALLED	26-03-2024 00:59:59 EDT	ron-8201-1 - Optics0/0/0/18	ron-ncs5504-1 - Optics0/0/0	300 GB	Up	1	Create IP Link: ✓ Done	
۲											
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0											

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

۲	service-manage	er-app	Tunnels	Point to Point	NSO Provisioning	_					Operations	🏟 Settings
\mathbf{w}	Create New P2P	-										
(SHQL)												
	IP Link	•	P2P Type 🔹	Configuratio * State	+ Creation Date *	Endpoint A *	Endpoint B *	Speed *	Operational * State	Last 24h * Operations	Last Operation	•
۲	OCH Link	CHING FILTERS										
	OCH-NC Link	.6QAM_1x1.2	IP Link	INSTALLED	27-03-2024 13:59:44 EDT	ron-ncs57c3-1 - Optics0/0/2	ron-ncs57c3-2 - Optics0/0/2	200 GB	Up	1	Create IP Link: ✓ Done	
	OTN Line	,	IP Link	INSTALLED	27-03-2024 07:02:42 EDT	ron-8201-32FH-3 - Optics0/0	ron-asr9903-1 - Optics0/0/1/	400 GB	Up	1	Create IP Link: ✓ Done	
	SDH Line		OCH-NC Link	INSTALLED	27-03-2024 06:45:53 EDT	ron-ols-2-roadm - ron-ols-2/	ron-ols-4-roadm - ron-ols-4/	400 GB	Up	1	Create OCH-NC: ✓ Done	
9	Circuit E-Line		OCH-NC Link	INSTALLED	27-03-2024 06:39:30 EDT	OLT1-roadm - ron_ncs1010	OLT4-roadm - ron_ncs1010	400 GB	Down	1	Create OCH-NC: ✓ Done	
	Packet F-Line		IP Link	INSTALLED	26-03-2024 04:34:55 EDT	ron-8201-32FH-3 - Optics0/0	ron-ncs57b1-1 - Optics0/0/0	100 GB	Up	1	Create IP Link: ✓ Done	
	Inc.aa		IP Link	INSTALLED	26-03-2024 04:05:14 EDT	ron-ncs57c3-1 - Optics0/0/3	ron-8201-32FH-3 - Optics0/0	200 GB	Up	1	Create IP Link: ✓ Done	
S	RK_4x100G		IP Link	INSTALLED	26-03-2024 01:58:26 EDT	ron-asr9903-1 - Optics0/0/1/	ron-8201-32FH-3 - Optics0/0	400 GB	Up	1	Create IP Link: ✓ Done	
	RK_9_3x100G		IP Link	INSTALLED	26-03-2024 00:59:59 EDT	ron-8201-1 - Optics0/0/0/18	ron-ncs5504-1 - Optics0/0/0	300 GB	Up	1	Create IP Link: ✓ Done	
W												
٠												
٥												
۲												
0												

The IP Link Creation wizard appears.

- **c.** Enter the Cisco Crosswork Hierarchical Controller service name, description of the router optical controller, and the Link Rate Mode in the **General** tab.
 - Here, we are creating a 1x400G link. In 2x100G, 3x100G, and 4x100G modes, you can choose to create separate IP links or create a Bundle with each channel link added as a member.



Alternatively

- To create a 200G 16-QAM link, Select the 200G 2x100G link rate mode.
- 200G 16-QAM allows the use of 200G signals on 50Ghz optical line systems. Default for 200G is QPSK at 60.1Ghz.

IP Link Creation
1 2 3 4 GENERAL ENDPOINTS ADVANCED SUMMARY
Name* 200G legacy mode support
Description Configure link as 200G 16QAM @ 30.1Ghz
Link Rate Mode* 200G - 2x100G
Router Configuration Only
k
× Cancel < Back > Next

Alternatively

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

I

You can create a 400G bundle interface (400G Member). Alternatively, 300G-bundle (3X100G Members) and 200G-Bundle (2x100G Members) can be created

	IP Link (
GENERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY
Name* 400G-Bundle-Ci	isco8000-ASRS	9903	
Description			
Link Rate Mode* —			
Router Confi	guration Only		
Router Confi	guration Only		
Router Confi	guration Only		

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

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

0					
Create New P2P	* P2P Type	Configuration + Creation Date	 Endpoint A 	 Endpoint B 	▼ Spe
0 OUT OF 2 ITEMS MATCHING FUTE	DC 21	State			
000101211EM3 MATCHING FIELE			IP Link Creation	on	
			1 2 3 GENERAL ENDPOINTS ADVAN	4 NCED SUMMARY	
			ENDPOINT A		
			Site A	٩	
			Port A*		
			Transmit Power [dBm]		
			ENDPOINT B		
			Site B	٩	
			Port B*	٩	
			Transmit Power [dBm]		

e. Click the magnifying glass icon to select the first 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

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

			ОСН	PORTS		
lame	-	Device *	Туре 👻	Capacity -	Description +	Admin Status
7 ITEMS						
Optics0/0/0/24		ron-poc-57b1-1	OCH		OCH port of Cisco QSEPDD 400G ZRP Plug	UP
Optics0/0/0/24		ron-ncs57b1-1	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/0/14		ron-8201-32FH-3	OCH		OCH port of Cisco QDD 400G BRT ZRP Plug	UP
Optics0/0/0/16		ron-8201-32FH-3	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/0/0		ron-ncs540-2dd-1	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/0/18		ron-8201-1	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/0/8		ron-8201-1	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	DOWN
Optics0/0/0/20		ron-8201-1	OCH		OCH port of Cisco QSFPDD 400G ZR Plugg	UP
Optics0/0/0/22		ron-8201-1	осн		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/1/4		ron-asr9903-1	OCH		OCH port of 400G ZRP-S QSFPDD Module	UP
Optics0/0/1/8		ron-asr9903-1	OCH		OCH port of 400G ZR-S QSFPDD Module	UP
Optics0/0/0/10		ron-8201-2	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP
Optics0/0/0/20		ron-8201-2	OCH		OCH port of Cisco QSFPDD 400G ZR Plugg	UP
Optics0/0/0/22		ron-poc-8201-1	осн		OCH port of Cisco QSFPDD 400G ZRP Plu	UP
Optics0/0/0/20		ron-8201-4	OCH		OCH port of Cisco QSFPDD 400G ZR Plugg	UP
Optics0/0/3/0		ron-ncs57c3-1	OCH		OCH port of Cisco QDD 400G BRT ZRP Plug	UP
Optics0/0/2/2		ron-ncs57c3-1	OCH		OCH port of Cisco QSFPDD 400G ZRP Plug	UP

- f. Similar to the previous step, choose ron-poc-57b1-1 Optics 0/0/0/24 as the second router port.
- **g.** (Optional) Set the transmit power in dBm on each port. If OLS provisioning is being performed, the OLS controller returns the optical power. If the OLS controller does not return the optical power or **router only** provisioning is being used, the router default power is used.
- **h.** (Optional) Enter the IP address information for interfaces. If IP addresses are not entered, ZR/ZR+ router optical configuration happens; however, IP addresses are not configured.
- i. Click Next to move to Advanced configuration.

	IP Link (Creation	
1 GENERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY
Iransmit Power [dB -10	m] ———		
ENDPOINT B			
Site B			
Port B*	- Optics0/0/0/	24	x Q
Transmit Power [dB -10	m]		
LINK #1 IP ADDRES	SES		
IP Address A (CIDR) 100.28.30.22/31			
IP Address B (CIDR) 100.28.30.23/31	I		
X. Concol			Pack Nov

- **j.** (Optional) Set the Frequency. If optical provisioning is being performed, the OLS controller can return the frequency to be used, and it may be omitted. If **router only** provisioning is being performed, the Frequency must be specified.
- k. (Optional) Set the DAC rate. A DAC rate setting can be used to enable OpenZR+ compatibility mode, disabling TX shaping and enhanced modem mode. See OpenZR+ Compatibility Mode for more information on mode support.

	IP Link (Creation	
1 GENERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY
 Add to existing LAG 			v
FREQUENCY			
L Band C Band Frequency THz 194.00			
 Digital-to-Analog Cor 	nverter (DAC) rat	e ———	
1 X 1 1 X 1.25			
Set Path Preferenc	es		lin Path Criteria atency v
 Include Nodes 	or Links		
Select Node	or Link		Q
× Cancel		<	Back > Next

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

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

	IP Link	Creation		
1 GENERA	2 L ENDPOINTS	3 ADVANCED	4 SUMMARY	
Add to existing of the second	LAG ————————————————————————————————————	her1		
L Band C Band Frequency TH 195.200	Z*			
Digital-to-An	alog Converter (DAC) rate		•
Modulation				v
Set Path Prefe	rences		lin Path Criteri atency	a •
▼ Include No	des or Links			
Select No	ode or Link			Q
× Cancel		<	Back	Next

n. (Optional) If you are configuring a 200G 16-QAM link, set the DAC rate to 1x1.25.

200G link rate mode enables the **Modulation** selection drop-down. Modulation selection is not available in any other mode. Select the16 QAM (30Ghz) modulation.

		IP Link C	reation		
GEN	1 IERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY	
Add to exist	ing LAG				-
FREQUENC	CY				
L Bar C Bar Frequency 195.2	nd nd y THz				
Digital-to-A 1 X 1.25	nalog Conv	verter (DAC) rate			-
- Modulation					
✓ 8 QAM 16 OAM					
QPSK					
▼ Include	Nodes o	or Links			
Select	t Node o	r Link			٩
× Cancel			<	Back	Next

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

I

		IP Link (Creation	
	1 GENERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY
Name: ror Descriptio	n-poc-8201-: on: ron-poc-	1_ron-poc-57 8201-1 0/0/0/	b1-1_194000 20 to ron-poo	0 c-57b1-1 over NCS2K
 Endpo Port: r Transr 	int A on-poc-820 nit Power: -	1-1 - Optics0/0 -10.0 dBm	0/0/22	
 Endpo Port: r Transr 	int B on-poc-57b nit Power: •	1-1 - Optics0/ 10.0 dBm	0/0/24	
Link Rate Frequency DAC rate: Modulatio	Mode: 4000 y: 194.0 THz - on: -	G - 1x400G	,	•
Path Crite Optical Ex Included I Disjoint Fi	ria: Latency cluded List List: - rom Links: -	/ :-		
× Cancel			< Back	Finish Save

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

		IP Link (Creation	
	1 GENERAL	2 ENDPOINTS	3 ADVANCED	4 SUMMARY
Name Descr	200G legat iption: Cont	cy mode supp figure link as 2	ort 2∯0G 16QAM	@ 30.1Ghz
▼ En Po Tr	ndpoint A ort: ron-ncs5 ransmit Pow	540-2dd-1 - Oj V er: -	otics0/0/0/0	
▼ En Po Tr	ndpoint B ort: ron-ncs5 ransmit Pow	57b1-1 - Optic 7 er: -	s0/0/0/24	
Link F Frequ DAC r Modu	Rate Mode: 2 iency: 195.2 ate: 1 X 1.25 ilation: MT_	200G - 2x100G THz 16QAM		
Path (Optic Inclue Disjoi	Criteria: Lat al Excluded ded List: - int From Lin	ency List: - Iks: -		
× c	ancel		< Back	> Finish Save

p. Go to Services Manager to view provisioning progress.

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

Ser	vices Manager	Tunn	els Point to Po	int IP Service	s											Operations	🕸 Settings
I	Create New P2P																
	Name	-	Р2Р Туре 👻	Configuration 👻 State	+ Creation Date		 Endpoint A 	-	Endpoint B	*	Speed	•	Operational * State	Last 24h Operations	•	Last Operation	•
	1 OUT OF 3 ITEMS MATCHIN	G FILTERS															
	ron-poc-8201-1_ron-poc	-57b1-1_1940	IP Link	IN PROGRESS	24-04-2023 14:4	4:21 UTC	ron-poc-57b1	-1 - Optics0/0/0/2	ron-poc-8201-1 - Optics0/0	0/0/2	400 GB			1		Create IP Link: Discovery	
-												-					
r	on-poc-8201-1_r	ron-poc-57l	01-1_1940000)													
	Summary	Endpointe	Underlay Path	Onerati	Even Even	onte A	ctions										
	ounnury	enoponita	onconayradi	Operau	U10	- A											
	Action	 Lifecyc 	le State	Creation Date		Last Update	*		SUMMARY				LOGS			ERRORS	
	1 ITEM							T Normal F									
	Create IP Link	ODis	covery	24-04-2023 1	4:44:20 UTC	24-04-2023 14:	44:27 UTC	• Normal F	er#1: onc-noc-90 √								
								, gruupe	ate service								
								► cri	eate service response								

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

۲	Services Mar	lager Tunn	els Poin	t to Po	int IP Service	es							Operations	🕸 Settings
	Create New P2													
	Name	•	P2P Type	•	Configuration 💿 State	+ Creation Date	-	Endpoint A *	Endpoint B *	Speed *	Operational * State	Last 24h * Operations	Last Operation	•
	1 OUT OF 3 ITEM	S MATCHING FILTERS												
	ron-poc-8201-1	_ron-poc-57b1-1_1940	IP Link	÷	INSTALLED	24-04-2023 14:44:21 UTC		ron-poc-57b1-1 - Optics0/0/0/2	ron-poc-8201-1 - Optics0/0/0/2	400 GB	Up	1	Create IP Link: ✓ Done	
E														
0														
۲														
	ron-poc-82	01-1_ron-poc-57	b1-1_194	40000	D									
	Summary	Endpoints	Underl	ay Path	n Operat	tions Events	Act	ions						
	GUID: SI/70	4cd30b6c6d4eb7ad44	41269d2d4	5b										
	Creation T	me: 24-04-2023 14:44:2	1 UTC											
	Last Chang	ed: 24-04-2023 14:44:2	1 UTC											
	Template P	lame: default-template												
	100.28	10.23 to 100.28 30.22												
	IP Address	Assignment Policy: Us	er Allocated	4										
	Is Bundle?	No												
	Channel Co Both Critor	onfig: 1 X 400G												
	Path Criter	a: Latency												

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

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



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

Select Links For In-Depth Analysis	100.28.30.23 to 100.2	8.30.22 L3 Logical Lir	ık			
Define Valid Links For Inspection By:	Ch	arleston	Jac	:ksonville		
 Specific link(s) / underlay link(s) 	LOG -					
Tags	LAG					
Device(s) in 1 of the endpoints	PHY					
Q, Add Link	ron-poc-57b1-1			ron-poc-8	201-1	
Optics0/0/0/24 to Optics0/0/0/22						
	осн					
	NMC -					
	MC					
	MC	ron-poc-ols-2	ron-poc-ols-1			
	OMS					
	OTE					
	013					
Name v Tune v Status v						
2 ITEMS						
100 28 30 23 to 100 28 3	Summary	Performance	Events			
	Name	Layer	Admin Status	Op	perational Status	Endpoint A
Optics0/0/0/24 to Optics OCH UP	Fiber-1	015	UP	U	P	ron-poc-ols-1-roadm
	Endpoint Z	Port A Tx Power (dbm)	Port Z Tx Power (dbn	n] Po	ert A Rx Power (dbm)	Port Z Rx Power (dbm)
	ron-poc-ols-2-roadm	Min: -0.50	Min:	2.60 Mi	n: -4.00	Min: -7.30
		Average: =0.50	fiverage:	2.60 Åv	erage: =4.00	Average: =7.30

Operate Phase

To monitor the ZR/Z+ optics:

- 1. 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 70.
- (Optional) Setup router ZR/ZR+ optics data collection in CW Health Insights. See Monitor Performance of ZR/ZR+ Optics Using KPIs, on page 79.

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

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

Monitor ZR or ZR+ Optics Using EPNM

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.

Internetion / Devices Management / Networks Devices * Image: Control (Control (C	Evolved Programn	nable Netw	ork Manager	9.					O. + Application Sea	rch 🔶 😫 2	root - ROI	dt-domain 🌣 🛛 🐻
Device drows from Proving (Proving Proving Prov	Inventory / Device Manager	ment / Netw	ork Devices	*								00 -
• * Til + • * * * * * * * * * * * * * * * * * * *	Device Groups	Device Gr Cisco 8	oups / Device Type 000 Series Ro	/ Routers Duters							Selected	0/Total 4 ① 연 후 -
Question All Reachability Admin Status Device Name P Address DBS Name Device Type Last Investery Collection Status Last Successed All Devices () > Obrics Type () Image: Coll Methoding ()	← * 10 +	+ •		dmin State 🔻 Sync	Groups & Sites 🔻	vice Revoke Certi	ficate OAM Co			Show	Quick F	lter 🔻 🏹
All Dockes ()	Q Search All		Reachability	Admin Status	Device Name	IP Address		DNS Name	Device Type	Last Inventory Collection St	itus	Last Successful Collect
• (point Networking () □ 2 Managet mn4251-1 172.2911.30 0: 0: Close 8201 Router Completed 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0: 0:	All Devices (i) • Device Type (i)											
• Roders () Image rps4201-2 172.28.11.21 Image Case EXOT Rovier Completed with Waning () Image rps4201-2 172.28.11.21 Image <	► Optical Networking ()			Managed	ron-8201-1	172.29.11.20	H ()	172.29.11.20	Cisco 8201 Router	Completed	<i>()</i>	2021-Jun-24 12:37:07 Eas
Classic 8000 Statistic Routing () Image ron-4291-3 17229.1122 Image Classic 800 Statistic Routing Completed () 2021-June 412.362	▼ Routers ①			Managed	ron-8201-2	172.29.11.21	U ()	172.29.11.21	Cisco 8201 Router	Completed with Warning	0	
k (sealing / /)	Cisco 8000 Series Routers (j)		\checkmark	Managed	ron-8201-3	172.29.11.22	11 ()	172.29.11.22	Cisco 8201 Router	Completed	<i>(i)</i>	2021-Jun-24 12:36:29 East
■ Managed ron-8201-4 172.29.11.23 🔃 () 172.29.11.23 Cisco 8201 Router Synchronizing ()	Location ()		\checkmark	Managed	ron-8201-4	172.29.11.23	U ()	172.29.11.23	Cisco 8201 Router	Synchronizing	()	

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

Evolved Programm	able Network Ma	inager				Q . Application S	earch 🔶 🐥 😒 2	1001 - ROOT-DOMAIN 🌣 🛛 🌉
Inventory / Device Manager	nent / Network De	vices 🖈						00 -
Device Groups	Device Groups / Dev Cisco 8000 Se	rice Type / Routers ries Routers						Selected 0 / Total 4 💭 🖻 🔅
+ ≣ +	+• / >	Admin State Sync	Groups & Sites 🔻		cate OAM Commands		Show	Quick Filter
All Devices (7)	Add Device Bulk Import	lity Admin Status	Device Name	IP Address	DNS Nam	e Device Type	Last Inventory Collection Sta	tus Last Successful Colle
* Device Type (j)								
 Optical Networking (j) 		Managed	ron-8201-1	172.29.11.20	王 ② 172.29.11.	20 Cisco 8201 Router	Completed	2021-Jun-24 12:37:07 E
▼ Routers ①		Managed	ron-8201-2	172.29.11.21	172.29.11	21 Cisco 8201 Router	Completed with Warning	0
Cisco 8000 Series Routers ()		Managed	ron-8201-3	172.29.11.22	① 172.29.11.	22 Cisco 8201 Router	Completed	2021-Jun-24 12:36:29 E
Location (i)		Managed	ron-8201-4	172.29.11.23	置 ⑦ 172.29.11.	23 Cisco 8201 Router	Synchronizing	(j)
Can being ()								

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		
• CALAD	O DNS Name			
(Optional if TL1 is configured)	License Level	Full	• @	
Telnet/SSH	Device Role	Select	• @	
	Add to Group	Select	• @	
HTTP/HTTPS	Credential Profile	Select	• @	
TL1				
Civic Location				

	Telnet/SSH Parameters			
* General 🗸	Protocol	SSH2	•	
		• Port	22	
Optional if TL1 is configured)		• Timeout	60	(secs)
Talpat/92H	• Username	admin		
Telleuson V	e Password			
HTTP/HTTPS	e Confirm Password			
	Enable Password			0
TL1	Confirm Enable Password			
		Add	/erify Credential	SCancel
d Device	* SNMP Parameters	Add	/erify Credential	s Cancel
d Device • _{General} ✓	* SNMP Parameters Version	Add V v2c	/erify Credential	s Cancel
d Device • General 🗸	* SNMP Parameters Version	Add V v2c * SNMP Retries	Verify Credential	s Cancel
d Device • General 🗸	* SNMP Parameters Version	Add V v2c * SNMP Retries * SNMP Timeout	Verify Credential	s Cancel
d Device • General ✓ • SNMP • Optional if TL1 is configured)	* SNMP Parameters Version	Add v2c • SNMP Retries • SNMP Timeout • SNMP Port	Verify Credential	s Cancel
d Device · General ✓ SNMP Optional if TL1 is configured) Telnet/SSH ✓	* SNMP Parameters Version	Add v2c SNMP Retries SNMP Timeout SNMP Port	Verify Credential	s Cancel
d Device · General · SNMP Optional if TL1 is configured) Telnet/SSH HTTP/HTTPS	* SNMP Parameters Version * Read Community * Confirm Read Community	Add v2c * SNMP Retries * SNMP Timeout * SNMP Port	Verify Credential	s Cancel
d Device General SNMP Optional if TL1 is configured) Telnet/SSH HTTP/HTTPS	* SNMP Parameters Version • Read Community • Confirm Read Community Write Community	Add V v2c SNMP Retries SNMP Timeout SNMP Port	Verify Credential	s Cancel
d Device General SNMP Optional if TL1 is configured) Telnet/SSH HTTP/HTTPS TL1	* SNMP Parameters Version * Read Community * Confirm Read Community Write Community Confirm Write Community	Add V v2c SNMP Retries SNMP Timeout SNMP Port	Verify Credential	s Cancel
d Device • General • SNMP Optional if TL1 is configured) Telnet/SSH HTTP/HTTPS TL1 Civic Location	* SNMP Parameters Version * Read Community * Confirm Read Community Write Community Confirm Write Community	Add V v2c SNMP Retries SNMP Timeout SNMP Port	Verify Credential	s Cancel

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.
India Evolved Programmable Network Manager			$\mathbf{O}_{\mathbf{k}}$ ~ Application Search	🐥 🔀 2 root	I-ROOT-DOMAIN 🏟 🛛 🐻
1 / / Device Type / Routers / Cisco 8000 Series Routers / ron-8201-1 *					00000
Chassis View Logical View Device Details					
۹ ۲ ۲	ron-8201-1	guration Inventory Inte	rfaces Circuits Image	Configuration Archive	
		6 All	2 4 0 Critical Major Mino	C C C C C C C C C C C C C C C C C C C	2021-Jun-24 16:07:38 EST 🛛 💭
	Export			Show Q	uick Filter 🗸 🔽
	Severity	Condition	Timestamp V	Affected Objects	Alarm ID
	v	isisAdjacencyChangeDown	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509938
	V	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/20	11509937
	V	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/8	11509939
	0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20-mpls la	11509935
	0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20	11509936
	V	cefcPowerStatusChange	2021-Jun-23 00:05:47 EST	0/PM0	11509854

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

estimate Evolved Programmable Network Manager					O v Application Search	🐥 😣 2 root	- ROOT-DOMAIN 🎝 🛛 🐻
1 / / Device Type / Routers / Cisco 8000 Series Routers / ron-8201-1	*						00 - 0
Chassis View Logical View Device Details							
9		>	ron-8201-1 💟	I			
1		+	1011-0201-1				
			Alarms Cor	ntiguration Inventory Inte	rtaces Circuits Image	E Configuration Archive Last Updated:	2021-Jun-24 16:07:38 EST (5
FourHundredGigE0/0/0/8-IDPROM	\times			6	2 4 0		~
di Hardware Version		R		0	Citical Main Mar	r Warning Information	
Part Number				78	спаса тари нит	w maning montation	_
QDD-400G-ZRP-S			Export			Show Q	uick Filter 🗸 🔽
Serial Number ACA2501003X			Severity	Condition	Timestamp V	Affected Objects	Alarm ID
CLEI Code							
Equipment Type			V	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
State No Data Available			V	ROUTING-ISIS-5-ADJCHA	2021-Jun-24 12:37:44 EST	FourHundredGigE0/0/0/8	11509939
Location			0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20-mpls la	11509935
FourHundredGigE0/0/0/8-IDPROM Product ID			0	LINK_DOWN	2021-Jun-24 12:37:09 EST	FourHundredGigE0/0/0/20	11509936
QDD-400G-ZRP-S			V	cefcPowerStatusChange	2021-Jun-23 00:05:47 EST	0iPM0	11509854
Show Details		x 243 243 x 243 0					
te le s te le	11 JI AN #25	AN TZF AN TZS AN TS1 AN TS5 AN TS					

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 8
Chassis View Logical Y	Optics0/0/0/8 @ Interface 1 Transport Admin 5 Device N Adjacent Interfac	(ype OPTICALCHANNEL tate IS same ron-8201-1 (j) e(s) N/A				udredG	igE/8-IDPROM				
6	Alarms Optical Physical FEC	Interface Circuits/V	Cs			~				Selected 0 /	Total 2 💭 🖻
H					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	-13.36 dBm -	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.

the second	Interface 360° Auto-Refresh Off V	10				Last Up	dated: 06/24/2021 04:1 View V	2 PM ⊡ ★ × Actions ∨	D, ∨ A	oplication Search		2	root - ROOT-DOMA	n 🗘 🕞
Chassis View Logical Vie		Coherer Transpo Adjace	If Speed Interface Type of Admin State Device Name Int Interface(s)	00.0Gbps DTNOTU S on-8201-1 (j) V/A					idredGi s (gE/8-IDPROM				
•	Alarms FEC	OTU	Interface	Circuits/VCs					~				Selected 0	/Total 2 💭 🖻
(d)							Tota	4 0 0				SI	All	v y
	Set Baseline					Show	Quick Filter	V Y		Туре	Admin Status		Operational Status	Transport Admi
	Timestamp		UCW	BIEC	PreFEC_BER-MIN	ProFE	C_BER-AVG		>0	OTNOTU	O Up	٢	O Up	IS
									١	OPTICALCHANNEL	🕢 Up	(i)	🚱 Up	IS
	16:04:14, 24-Jun-2	021 EST	0	493733542753	1.3E-03	1.4E-0	3							
	16:04:34, 24-Jun-2	021 EST	0	507114399500	1.3E-03	1.4E-0	3							
	16:04:54, 24-Jun-2	021 EST	0	520413161689	1.3E-03	1.4E-0	3							
	16:05:14, 24-Jun-2	021 EST	0	533591199474	1.3E-03	1.4E-0	3							
1					2				49					

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

Figure 34: Optical Physical Parameters

Interface 360°												Last Updated:	04/14/2021 09:13 PM	Ð∓×
Auto-Refresh Off ∨ ↓ Ø													View \sim	Actions $ \lor $
Optics0/0/0/ Inter Transport Ad De Adjacent In	20 O O face Type Of Imin State IS escription M rice Name ro terface(s) N	PTICALCHANNEL anaged by NSO .58, do n-8201-1 (7) A	not change manually											
Alarms Optical Physical	FEC I	nterface Circui	ts/VCs									Show Quic	Total 4	Ø ☆~ ▼
Timestamp	OSNR	RX-POWER	TX-POWER	LBC	DGD	PCR	PDL	CD	FREQ-OFF	RX-SIG	^ (Q-FACTOR	Q-MARGIN	
21:13:55, 14-Apr-2021 IST	35.60	-13.99 dBm	-10.53 dBm	0	1.00	0	1.70	-489	57	-13.37	1	9.80	3.50dB	
21:14:15, 14-Apr-2021 IST	35.60	-13.98 dBm	-10.53 dBm	0	1.00	0	1.70	-489	57	-13.37	1	9.80	3.50dB	
21:14:35, 14-Apr-2021 IST	35.60	-13.98 dBm	-10.54 dBm	0	1.00	0	1.70	-489	57	-13.37	1	9.70	3.50dB	
21:14:55, 14-Apr-2021 IST	35.60	-13.94 dBm	-10.53 dBm	0	1.00	0	1.70	-490	57	-13.37	1	9.70	3.50dB	

cuit Optical Physical	otu odu et	Manager	6DH		O . • Application Se	arch 🔶 🐥 😒	9 root - ROOT-DOMAIN 🌣
Filters Interface Optics	0/0/0/20× • Time Fram	Past 1 Hour 🔻	Apply				
Interface Details			/@Øピ-X	Optical Power			00ď-×
Property	Value			Transmitted(OPT) Received(C	PR)		
Interface Name	Optics0/0/0/20						
Interface Type	OPTICALCHANNE	EL		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 Soft	ware (8000), Version 7.3.15.1	9I-CVT_19I_45rpms Copyright (c) 2013				
★ 2021-Apr-15, 20:32:59	IST						
Optical Signal to No	oise Ratio (OSNR)		0 0 C - X	∠ ∠ ∧ 202	21-Apr-15, 20:33:00 IST		
oom: 1h 6h 1d 1w 2	w 4w 3m 6m 1y			Second Order Polar	ized Mode Disp	ersion (SOPMD)	@ II I ->
Time	Minimum	Average	Maximum	Zoom: 1h 6h 1d 1w 2v	v 4w 3m 6m 1y		
2021-Apr-15, 19:45:00 IST	35.6	35.6	35.6	Time	Minimum	Average	Maximum
2021-Apr-15, 20:00:00 IST	35.6	35.6	35.6	2021-Apr-15, 19:45:00 IST	7	47.17	153
2021-Apr-15, 20:15:00 IST	35.6	35.6	35.6	2021-Apr-15, 20:00:00 IST	5	47.57	148
				2021-Apr-15, 20:15:00 IST	10	48.94	252

Figure 36: Historical Optical Physical Parameters

Polarization Depend	lent Loss (PDL)		002-X	202	21-Apr-15, 20:33:00 IST		
Zoom: 1h 6h 1d 1w 2v	v 4w 3m 6m 1y			Chromatic Dispersio	on (CD)		0 S G
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 G t ² – X		21-Apr-15, 20:33:00 IST		
Zoom: 1h 6h 1d 1w 2v	v 4w 3m 6m 1y			Differential Group D	olay (DCD)		0.01
Data is unavailable. Possible re • The Monitoring Policy is disable	asons: led			Zoom: 1h 6h 1d 1w 2v	v 4w 3m 6m 1y		0.01
The devices are not being mar The technology is not support	naged in the system and/or are ed on the device	e not reachable		Time	Minimum	Average	Maximum
The server unle is inaccurate a	anuror is not synchronized with	i the devices		2021-Apr-15, 19:45:00 IST	1	1.9	2
				2021-Apr-15, 20:00:00 IST	1	1.9	2
				2021-Apr-15, 20:15:00 IST	1	1.94	2

521884

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Figure 37: Historical Optical Physical Parameters

Coptical Power Signa	21-Apr-15, 20:33:00 IST	SIG)	0 0 P – X				
Zoom: 1h 6h 1d 1w 2v	w 4w 3m 6m 1y Minimum	Average	Maximum	Frequency Difference	ce (FREQ_OFF)		ම ට ඒ -
2021-Apr-15, 19:45:00 IST	-13.39	-13.35	-13.33	200m: 1n en 1d 1w 2v	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
∠ ■ • → • 202	21-Apr-15, 20:33:00 IST						
				∠ ≥ ≥ 202	21-Apr-15, 20:33:00 IST		

Figure 38: FEC Parameters

erface 360' utc-Refresh Off	Coherer Transpo Adjace	ntDSP0/0/0 If Spee Interface Typ set Admin Stal Device Nam ent Interface(:	(20) (0) (0) ed 400.060ps ed 0TNOTU te IS er rom-6201-1 (7) e) N/A						Last Updated	: 04/14/2021 09:0 View 🗸	1 PM 🖻	∓ : ions ∨
Narms FEC	OTU	Interfac	e Circuits/VCs									
										Total	12 0 1	¢.
Set Baseline									Show Qui	ck Filter	~	Y
Timestamp	~	UCW	BIEC	PreFEC_BER-MIN	PreFEC_BER-AVG	PreFEC_BER-MAX	PostFEC_BER-MIN	PostFEC_BER-AVG	PostFEC_BER-MAX	Interface I	Name	
21:09:30, 14-Apr-	2021 IST	0	259424538363	9.3E-04	1.0E-03	1.0E-03	0	0	0			
21:09:10, 14-Apr-	2021 IST	0	250149080948	9.3E-04	1.0E-03	1.0E-03	0	0	0			
21:08:50, 14-Apr-	2021 IST	0	241029855399	9.3E-04	1.0E-03	1.0E-03	0	0	0			
21:08:29, 14-Apr-	2021 IST	0	231895488278	9.3E-04	1.0E-03	1.0E-03	0	0	0			
21:06:20, 14-Apr-	2021 IST	0	171915528470	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:06:01, 14-Apr-	2021 IST	0	162585187635	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:05:41, 14-Apr-	2021 IST	0	153200151905	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:05:21, 14-Apr-	2021 IST	0	143986313725	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:05:01, 14-Apr-	2021 IST	0	134689474400	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:04:40, 14-Apr-	2021 IST	0	125294694470	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21:04:21, 14-Apr-	2021 IST	0	116370733446	9.7E-04	1.0E-03	1.0E-03	0	0	0			
21-04-00 14-Anr.	2021 IST	0	106598278765	9.7F-04	1.0E-03	1.0F-03	0	0	0			

Figure 39: Historical FEC Parameters

Forward Error Correct Bit Errors Corrected Uncorrect Zoom: 1h 6h 1d 1w 2w	ction (FEC) able Words Pre-FEC BER Po 4w 3m 6m 1y	st-FEC BER	© ∽ Z − 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 40: Historical FEC Parameters

Quality Factor (Q)			0 C C - X				
Zoom: 1h 6h 1d 1w 2	w 4w 3m 6m 1y	r -		0.5.5.4.4	. (0.14		
Time	Minimum	Average	Maximum	Quality Factor Marg	in (Q-Margin)		
2021-Apr-14, 21:30:00 IST	9.7	9.77	9.8		w r ww r on r on r ry		
2021-Apr-14, 21:45:00 IST	9.7	9.76	9.8	Time	Minimum	Averaç	1e
2021-Apr-14, 22:00:00 IST	9.7	9.76	9.8	2021-Apr-14, 21:30:00 IST	3.5	3.5	
2021-Apr-14, 22:15:00 IST	9.7	9.77	9.8	2021-Apr-14, 21:45:00 IST	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	
2021-Apr-14, 22:45:00 IST	9.7	9.77	9.8	2021-Apr-14, 22:15:00 IST	3.5	3.5	
2021-Apr-14, 23:00:00 IST	9.7	9.75	9.8	2021-Apr-14, 22:30:00 IST	3.5	3.5	
2021-Apr-14, 23:15:00 IST	9.7	9.77	9.8	2021-Apr-14, 22:45:00 IST	3.5	3.5	
2021-Apr-14, 23:30:00 IST	9.7	9.76	9.8	2021-Apr-14, 23:00:00 IST	3.5	3.5	
2021 Apr 14 22:45:00 IQT	0.7	0.75	6.9	2021-Apr-14, 23:15:00 IST	3.5	3.5	
∠ ▲ · → · 20	21-Apr-15, 20:52:58 IST			2021-Apr-14, 23:30:00 IST	3.5	3.5	
				2021 Apr 14 22-45-00 IST	2.5	2.6	
	(005) 0		001 4				

521889

Figure 41: Historical OTN Parameters

	w ; 3m ; em ; 1y		Severely Errored Sec	onds (SES) Section		808-X
Time	FEND	NEND	Zoom: 1h 6h 1d 1w 2w	4w 3m 6m 1y		
2021-Apr-14, 21:30:00 IST	0	0				
2021-Apr-14, 21:45:00 IST	0	0	Time	NEND	FEND	
2021-Apr-14, 22:00:00 IST	0	0	2021-Apr-14, 21:30:00 IST	0	0	
2021-Apr-14, 22:15:00 IST	0	0	2021-Apr-14, 21:45:00 IST	0	0	
2021-Apr-14, 22:30:00 IST	0	0	2021-Apr-14, 22:00:00 IST	0	0	
2021-Apr-14, 22:45:00 IST	0	0	2021-Apr-14, 22:15:00 IST	0	0	
2021-Apr-14, 23:00:00 IST	0	0	2021-Apr-14, 22:30:00 IST	0	0	
2021-Apr-14, 23:15:00 IST	0	0	2021-Apr-14, 22:45:00 IST	0	0	
2021-Apr-14, 23:30:00 IST	0	0	2021-Apr-14, 23:00:00 IST	0	0	
2021 Apr 14 22:45:00 IQT	0	0	2021-Apr-14, 23:15:00 IST	0	0	
2021-Ap	r-15, 20:52:58 IST		2021-Apr-14, 23:30:00 IST	0	0	
			2021 Apr 14 22-46-00 IRT	0	0	
rrored Seconds (ES) S	Section	@ £	5 ピ − × 🖉 🖉 🏕 2021-	-Apr-15, 20:52:58 IST		
s ES Ratio xom: 1h 6h 1d 1w 2w 4	w 3m 6m 1y		Unavailable Seconds	(UAS) Section		© C ⊵" – >
Time	FEND	NEND	Zoom: 1h 6h 1d 1w 2w	4w 3m 6m 1y		
2021-Apr-14, 21:30:00 IST	0	0	Time	FEND	NEND	
2021-Apr-14, 21:45:00 IST	0	0	2021-Apr-14, 21:30:00 IST	0	0	
2021-Apr-14, 22:00:00 IST	0	0	2021-Apr-14, 21:45:00 IST	0	0	
2021-Apr-14, 22:15:00 IST	0	0	2021-Apr-14, 22:00:00 IST	0	0	
2021-Apr-14, 22:30:00 IST	0	0	2021-Apr-14, 22:15:00 IST	0	0	
2021-Apr-14 22:45:00 IST	0	0	2021-Apr-14, 22:30:00 IST	0	0	
2021-401-14, 22,45,00151						
2021-Apr-14, 23:00:00 IST	0	0	2021-Apr-14, 22:45:00 IST	0	0	
2021-Apr-14, 23:00:00 IST 2021-Apr-14, 23:15:00 IST	0	0	2021-Apr-14, 22:45:00 IST 2021-Apr-14, 23:00:00 IST	0	0	

Figure 42: Historical OTN Parameters

om: 1h 6h 1d 1w 2w 4v	w 3m 6m 1y		
lime	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	
0021 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.

A / Performance Alerts / Key Performance Indicators (KPI)				
KPI Categories (17)	Key Performance Indicators (KPIs	;)		Selected 0 / Total 6 🔿 🌣
	+ 🗊 🕞 🕞 Link Playbook Unlink			T
All KPIs	KPI Name	Category	Description	Linked Playbook
BASICS	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 Monitors per-port optical FEC errors; generate	
Filesystem	Layer 1 optical power	Layer1-Optics	Monitors per-port optical power; generates ale	
LLDP	Layer 1 optical temperature Layer 1 optical voltage	Layer1-Optics Layer1-Optics	Monitors per-port optical temperature; generat Monitors per-port optical voltage; generates al	
Layer1-Traffic				
Layer2-Interface				
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.

A / Performanc	e Alerts / KPI Profiles / Create Profile				
Create Nev	w Profile				
Profile N	lame* optics_profile		⑦ Description	Measure optics parameters	
External Dest	ination Details (?)				
Serve	r Type	~	Name		\checkmark
Add KPIs to All KPIs	Profile Recommended KPIs				
	Category T	KPI			Summary
	optics				
	Layer1-Optics	Layer 1 op	ptical alarms		Monitors per-port optical alarms
	Layer1-Optics	Layer 1 op	ptical errors		Monitors per-port Layer 1 errors; generates alert when error rates exceeds the configured threshold
	Layer1-Optics	Layer 1 op	ptical FEC errors		Monitors per-port optical FEC errors; generates an alert when FEC errors exceeds the configured th
~	Layer1-Optics	Layer 1 op	ptical power		Monitors per-port optical power; generates alert when power levels exceeds the configured threshold
~	Layer1-Optics	Layer 1 op	ptical temperature		Monitors per-port optical temperature; generates alert when temperature exceeds the configured th
\checkmark	Layer1-Optics	Layer 1 op	ptical voltage		Monitors per-port optical voltage; generates alert when voltages exceeds the configured threshold
Save	Cancer				

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	/ Performance Alerts / Enable/Disable KPI Profiles								
Select	By 💿 Device 🔿 Device Ta	ags							
Devi	Devices Selected 1 / Total 13 🔿 🌣								
Enai	ble KPI Profiles Disable KPI	I Profiles				Clear All Filters			
	Reachability	Name T ron-8201-1	Device Type	Operational State	Enabled Profiles				
	Reachable	ron-8201-1	ROUTER	О К	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.

/ Perfo	mance Alerts / Enable/Disable KPI Profiles				
		O	Select KPI Profiles	O Verify Details	
		0000000000	outer la fritance	tony botono	
KPI F	Profiles				Selected 1 / Total 4 🔿
					Clear All Filters
	Name T	Devices Enabled		Description	
	optics				
	optics_profile	0		Measure optics parameters	
Ca	incel				Previous Next

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.

/ Performance Alerts / Enable/Di	sable KPI Profiles					
		O	Select K	PI Profiles	Verify Details	
elected Device(s)	Selected Profile(s)					
Name	Name	optics_profile				3 0
ron-8201-1	optics_profile	Description : Measure Destination :	optics parameters Server Type :	- Topic : -		#KPIs on Enabled Profile Devices
		KPI On Profile				
		Layer 1 optical p	ower	Layer 1 optical temperature	Layer 1 optical voltage	
		Alerts Cadence(sec) Alert Frequency Alert Type	OFF 300 1 alarm_stat	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	
Cancel						Previous Enable

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.