



Cisco Crosswork Hierarchical Controller 7.0

Service Provisioning User Guide

April 2023

Introduction

This document is a how-to-use guide for Cisco Crosswork Hierarchical Controller Services Manager.

Contents

The document contains the following sections and explains:

- The need for services management
- Tunnels
- Point to Point
- Multi Point

The level of detail attempts to provide an understanding of the solution from an architectural and functional perspective as well as a how-to guide for users to execute the required tasks in the user interface.

Terminology

Table 1. Terms

Term	Definition
Adapter	The software used by Crosswork Hierarchical Controller to connect to a device or to the manager, to collect information required by the network model and configure the device.
Agg link	Agg is Link Aggregation Group (LAG) where multiple ETH links are grouped to create higher bandwidth and resilient link.
BGP	Border Gateway Protocol
Circuit E-Line	An Ethernet connection between two ETH client ports on Transponder or Muxponder over OTN signal.
CNC	Crosswork Network Controller.
CO	Domain controller.
Device	Optical network element, router, or microwave device.
Device Manager	The application that manages the deployed adapters.
eMBB	Enhanced Mobile Broadband.
ETH link	ETH L2 link, spans from one ETH UNI port of an optical device to another, and rides on top of ODU.
ETH chain	A link whose path is a chain of Ethernet links cross-subnet-connected (found using Crosswork Hierarchical Controller cross-mapping algorithm). Eth-chain is a replacement for R_PHYSICAL link in cases where one side of the link is in devices out of the scope discovered by Crosswork Hierarchical Controller.
Fiber segment	Physical fiber line that spans from one passive fiber endpoint (manhole, splice etc.) to another and is used as a segment in a fiber link.
Fiber	Chain of fiber segments that spans from one optical device to another.
IGP	IGP is the link between two routers that carries IGP protocol messages. The link represents an IGP adjacency.
IP-MPLS	IP multi-protocol label switching.
L3-VPN link	The connection between two sites of a specific L3-VPN (can be a chain of LSP connections or IGP path).

Term	Definition
L3 physical	L3 physical is the physical link connecting two router ports. It may ride on top of an ETH link if the IP link is carried over the optical layer.
L3-VPN	A virtual private network based on L3 routing for control and forwarding.
Logical link, IGP, LSP	Logical link connects VLANs on two IP ports.
LSP	Label Switched Path, used to carry MPLS traffic over a label-based path. LSP is the MPLS tunnel created between two routers over IGP links, with or without TE options.
NMC (OCH-NC, OTSiMC)	NMC is the link between the xPonder facing ports on two ROADMs. This link is the underlay for OCH and it is an overlay on top of OMS links. This is relevant only for disaggregation cases where the ROADM and OT box are separated.
NMS	Network Management System.
OC/OCG	SONET/SDH links that span from one optical device to another and carry SONET/SDH lower bandwidth services, the links ride on top of OCH links and terminate in TDM client ports.
OCH	OCH is a wavelength connection spanning between the client port one OT device (transponder, muxponder, regen) and another. 40 or 80 OCH links can be created on top of OMS links. The client port can be a TDM or ETH port.
OCH-NC	Wavelength link. New service is added as NMC link.
ODU	ODU links are sub-signals in OTU links. Each OTU links can carry multiple ODU links, and ODU links can be divided into finer granularity ODU links recursively.
ONC	Cisco Optical Controller (ONC).
OSPF	Open Shortest Path First, an Interior Gateway Protocol between routers.
OTN-Line	An OTN connection between two ODU client ports over OTN path.
OTS	OTS is the physical link connecting one line amplifier or ROADM to another. An OTS can be created over a fiber link.
out	OTU is the underlay link in OTN layer, used for ODU links. It can ride on top of an OCH.
Packet E-Line	A point-to-point connection between two routers or transponders/muxponders over MPLS-TP or IP-MPLS.
PCC	Path Computation Client. Delegated to controller. Router is responsible for initiating path setup and retains the control on path updates.
PCE	Path Computation Element. Controller-initiated.
QAM	Quadrature Amplitude Modulation.
QPSK	Quadrature Phase Shift Keying modulation. This carries less information per symbol than QAM modulation.
Radio Media	The media layer as a carrier of radio channels.
Radio Channel	Multiple radio channels can be on top of radio media, each channel represents a different ETH link with its own rate.
RD	Route Distinguisher.
RSVP-TE	Resource Reservation Protocol to control traffic engineered paths over MPLS network.
RT	Route Target.

Term	Definition
SCH	A super-channel is an evolution of DWDM in which multiple, coherent optical carriers are combined to create a unified channel of a higher data rate, and which is brought into service in a single operational cycle.
SDN Controller	Software that manages multiple routers or optical network elements.
SR Policy	Segment Routing Policy. A segment routing path between two nodes, with mapping to the IGP links based on SIDs list.
STS	Large and concatenated TDM circuit frame (such as STS-3c) into which ATM cells, IP packets, or Ethernet frames are placed. Rides on top of OC/OCG as optical carrier transmission rates.
uRLLC	Ultra-Reliable Low Latency Communications.
VRF	Virtual Routing Function, acts as a router in L3-VPN.
ZR Media	The media layer as a carrier of ZR channels, on top of OCH link.
ZR Channel	Multiple ZR channels can be on top of ZR media, each channel represents a different IP link with its own rate.

Service Provisioning

Crosswork Hierarchical Controller supports the creation of new transport client services and photonic services.

Crosswork Hierarchical Controller abstracts the service model and provides users with a simple and intuitive user interface to provision new services.

It is assumed that domain controller implicitly handles the creation/use of the underlay path (OTSiMC, OTN, MPLS-TP) as required to fulfil the service request.

The table below defines the required parameters per service type.

Crosswork Hierarchical Controller requires the optical controller to support the connectivity-service API by TAPI. A proper use of the layers is needed per the service type.

Table 2. Provisioning parameters

Service Type	Provisioning Parameters
IP Links	<ul style="list-style-type: none"> • Service name • Service ID • Link rate mode • Endpoints and transmit power • Link IP addresses • L Band/C Band • Frequency • Digital-to-Analog Converter (DAC) rate • Modulation

Service Type	Provisioning Parameters
	<ul style="list-style-type: none"> • Included nodes/links in path • Excluded nodes/links from path • Disjoint from a path of an existing service
OCH-NC/OTSiMC (between ROADMs)	<ul style="list-style-type: none"> • Service name • Service ID • Bandwidth • Baud rate • Frequency • Protection option (1+1, 1+1+r) • Endpoints • Optimization goal (minimize path by admin cost, latency, or number of hops) • Per path, for main, redundant, and restored paths <ul style="list-style-type: none"> ◦ Included nodes/links in path ◦ Excluded nodes/links from path • Disjoint from a path of an existing service
Photonic Services (OCH Trail between OT/Transponders)	<ul style="list-style-type: none"> • Service name • Service ID • Bandwidth • Baud rate • Frequency • Protection option (1+1, 1+1+r) • Endpoints • Optimization goal (minimize path by admin cost, latency, or number of hops) • Per path, for main, redundant, and restored paths <ul style="list-style-type: none"> ◦ Included nodes/links in path ◦ Excluded nodes/links from path • Disjoint from a path of an existing service
Circuit E-Line /OTN Line	<ul style="list-style-type: none"> • Service name • Service ID • ODU signal/ETH rate

Service Type	Provisioning Parameters
	<ul style="list-style-type: none"> • Protection option (1+1, 1+1+r) • Endpoints • Optimization goal (minimize path by admin cost, latency, or number of hops) • Per path, for main, redundant, and restored paths <ul style="list-style-type: none"> ◦ Included nodes/links in path ◦ Excluded nodes/links from path • Disjoint from a path of an existing service
Packet E-Line	<ul style="list-style-type: none"> • Service name • Service ID • Protection option (1+1, 1+1+r) • Endpoints <ul style="list-style-type: none"> ◦ CIR/EIR ◦ VLAN IDs • Optimization goal (minimize path by admin cost, latency, or number of hops) • Per path, for main, redundant, and restored paths <ul style="list-style-type: none"> ◦ Included nodes/links in path ◦ Excluded nodes/links from path • Disjoint from a path of an existing service

Crosswork Hierarchical Controller in Brief

The Crosswork Hierarchical Controller product family is a set of software applications built on a common Crosswork Hierarchical Controller platform, designed to accelerate automation and to increase efficiency and reliability of service providers networks. Crosswork Hierarchical Controller addresses the role of the multi-domain, multi-layer, and multi-vendor network controller.

Sedona’s innovative capability to learn the mapping between IP/MPLS and optical layer ports (cross-layer mapping) is key to providing a comprehensive view of the network. This has historically been a very difficult problem to solve since there are no standards to automatically provide discovery of such links. This process applies to IP/MPLS-optical links, as well as to cross-domain optical links.

Achieving automation of the complete process, without compromising on resiliency must involve fibers discovery and GIS information. Both enable the understanding of risks in planning phases and crucial information to assess failure impact on services in operations.

Crosswork Hierarchical Controller is the sole product of its type, in today’s market, that is fully multi-layer and multi-vendor. It is also the only product of this type to be deployed in production by Tier 1 service

providers. The system interfaces with SDN Domain Controllers for the packet layers (IP, MPLS) and transport layers (WDM, OTN, Packet-Optical, Microwave) to create a coherent view of the entire transport network, as shown in Figure 1 below, and enables automation of its functions and simplified abstracted interaction with Service Orchestrators and OSS tools.

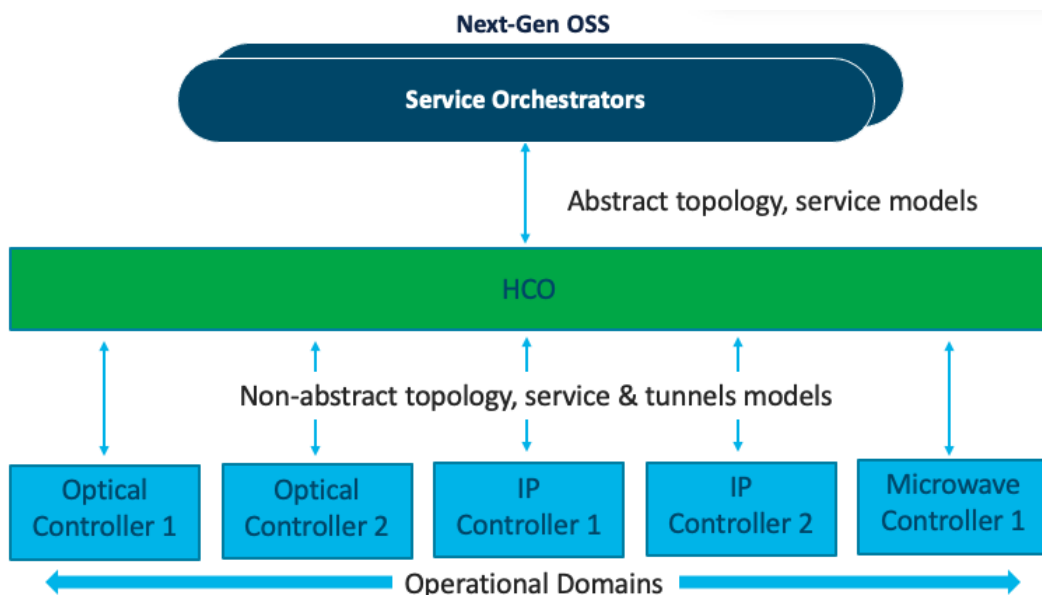


Figure 1.
Transport SDN Architecture

Services Management – The Need

Services Manager is a key Cisco Crosswork Hierarchical Controller application that allows for the creation of L1-L3 services and L1-L3 underlay tunnels and links across the entire SP network.

Crosswork Hierarchical Controller can discover L1-L3 services from area/domain controllers. It can discover intra-domain and inter-domain E-Line and L3-VPN services while completing the information on all LSPs along the path, VRFs, and all inter-AS options. This allows Crosswork Hierarchical Controller to discover existing services, as well as new services it has provisioned.

Crosswork Hierarchical Controller supports service lifecycle state (provisioned, pending, planned), operational state and admin state.

Basic service instantiation is supported by the Domain Controller for each domain. However, none of the Domain Controllers understand how to achieve a globally optimal path for an end-to-end service.

Using its own global Path Computation Element (PCE), Crosswork Hierarchical Controller can calculate the optimal end-to-end multidomain path for the service, set it up in each Domain Controller and make sure the service parts are stitched together across domain boundaries.

In fact, a service can span different layers for its delivery. For example, an E-Line service can start on an OTN metro network, then be handed off to the MPLS core network, where it is carried over a pseudowire (PW) in an MPLS tunnel, and then over a packet-optical access network to its final destination. Crosswork Hierarchical Controller figures out which layers should be used to set up the service, based on user-defined policies.

Crosswork Hierarchical Controller supports IP services as defined by IETF in L2NM, L3NM and optical services as defined by ONF TAPI interface.

Crosswork Hierarchical Controller abstracts the service configuration and provides simple, intent-based API and UI to create new services with endpoint details, SLA, and associations to a predefined template that can be overridden for better adjustment.

Services and tunnels currently supported for provisioning and modification by the Services Manager:

- Tunnels:
 - RSVP-TE tunnel over single domain
 - SR policy over single domain
- Point-to-Point:
 - IP links between two routers over ZR/+ and over alien lambda (as multi-vendor optical network)
 - OCH Link
 - OCH-NC Link
 - OTN Line
 - Circuit E-Line
 - Packet E-Line over packet-optical network
- Multi-Point:
 - L3 VPN over multi domain and multi-vendor IP-MPLS (currently in demo mode only)

Service configuration is based on the use of templates (these will be available in a future version). This helps to abstract service provisioning requests, using templates as a reference, and loading service configuration as a basic default that can be overridden per specific request. The configuration will still be able to be overridden for a specific service provisioning request.

Endpoints can be added to the UI wizard by selecting them from the inventory. Ports enabled for selection are those applicable for the service type. Per endpoint, the bandwidth can be defined (as CIR, EIR, CBS, PBS) and VLAN and COS classification can be added.

Crosswork Hierarchical Controller has a sophisticated global multilayer PCE to calculate services and underlay paths. The calculation is based on the selected criteria: number of hops, latency, or admin cost. It also considers the preferences for protection, diversity, SRLG, specific links, devices, or service paths to include or exclude, and resources available per the requested bandwidth.

PCE works over multiple domains, where it can calculate paths' diversity between domains as a full path of end-to-end service.

Depending on the implementation, PCE knows how to work with vendor-specific capabilities and constraints and how to verify the feasibility of a path before putting it in action.

Creation of a service is managed as a network transaction. Commands are sent to all participating Domain Controllers. Upon completion, the configuration undergoes validation in all domains before notifying the user of configuration success. In the event of failure, PCE knows to roll back and leave no broken configuration in any Domain Controller.

This transaction mechanism knows how to overcome a failure in Crosswork Hierarchical Controller because the backup system can continue tracking the transaction and act according to the response from the Domain Controllers.

Each action on a service or tunnel (creation, modification, deletion) done via the UI or via APIs is recorded as an operation. An operation contains the full details of the action and its results, log of the service scheme sent to the controllers, the returned results, error messages from domain controllers, and the operation status.

Operations can be viewed per selected service or tunnel and as a list of all operations.

Brownfield Services

Services Manager allows you to view and delete services that were not created by Crosswork Hierarchical Controller but are discovered and managed by the CO (domain controller). For these services, they appear as **Is Brownfield: True**.

The following delegated service types are supported: Packet E-Line, Circuit E-Line, OTN-Line, and OCH (Wavelength) services.

Tunnels

A tunnel is a unidirectional link between source and destination routers, riding over IGP links with only primary, or primary and secondary LSPs. You can create tunnels of type:

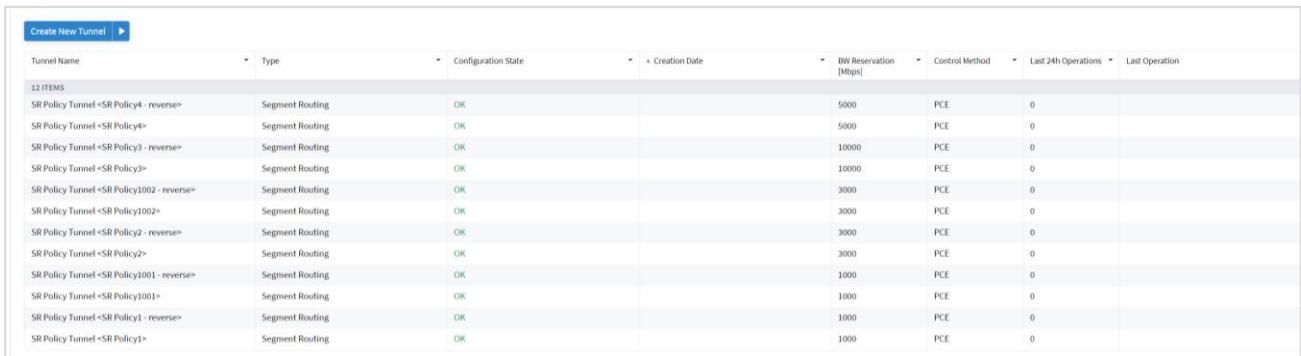
- RSVP
- SR Policy

View Tunnels

You can view a list of the tunnels.

To view tunnels:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Tunnels**. A list of the tunnels appears in the **Tunnels** pane with the following information:
 - **Tunnel Name:** The tunnel name.
 - **Type:** The type of tunnel, for example, **Segment Routing**.
 - **Configuration State:** The configuration state (**OK**, **ABANDONED**, **REMOVED**).
 - **Creation Date:** The date the tunnel was created.
 - **BW Reservation (Mbps):** The bandwidth reserved for the tunnel.
 - **Control Method:** The control method: by device (**PCC**) or by controller (**PCE**).
 - **Last 24H Operations:** The volume of operations in last 24 hours.
 - **Last Operation:** The last operation executed on the tunnel.



Tunnel Name	Type	Configuration State	Creation Date	BW Reservation [Mbps]	Control Method	Last 24h Operations	Last Operation
12 ITEMS							
SR Policy Tunnel<SR Policy4 - reverse>	Segment Routing	OK		5000	PCE	0	
SR Policy Tunnel<SR Policy4>	Segment Routing	OK		5000	PCE	0	
SR Policy Tunnel<SR Policy3 - reverse>	Segment Routing	OK		10000	PCE	0	
SR Policy Tunnel<SR Policy3>	Segment Routing	OK		10000	PCE	0	
SR Policy Tunnel<SR Policy1002 - reverse>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel<SR Policy1002>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel<SR Policy2 - reverse>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel<SR Policy2>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel<SR Policy1001 - reverse>	Segment Routing	OK		1000	PCE	0	
SR Policy Tunnel<SR Policy1001>	Segment Routing	OK		1000	PCE	0	
SR Policy Tunnel<SR Policy1 - reverse>	Segment Routing	OK		1000	PCE	0	
SR Policy Tunnel<SR Policy1>	Segment Routing	OK		1000	PCE	0	

2. Select the required tunnel.
3. To view more tunnel details, see the lower pane view with the following tabs:
 - **Summary:** Additional details about the tunnel, such as, Description, Admin State.
 - **Endpoints:** The source and destination endpoint details.
 - **Underlay Path:** The underlay path items traversed by the tunnel.
 - **Operations:** The tunnel operations.
 - **Events:** The tunnel events.
 - **Actions:** The modification actions (if applicable) and the option to **Delete Tunnel**.

Create New Tunnel

Tunnel Name	Type	Configuration State	Creation Date	BW Reservation [Mbps]	Control Method	Last 24h Operations	Last Operation
32 ITEMS							
SR Policy Tunnel <SR Policy4 - reverse>	Segment Routing	OK		5000	PCE	0	
SR Policy Tunnel <SR Policy4>	Segment Routing	OK		5000	PCE	0	
SR Policy Tunnel <SR Policy3 - reverse>	Segment Routing	OK		10000	PCE	0	
SR Policy Tunnel <SR Policy3>	Segment Routing	OK		10000	PCE	0	
SR Policy Tunnel <SR Policy1002 - reverse>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel <SR Policy1002>	Segment Routing	OK		3000	PCE	0	
SR Policy Tunnel <SR Policy2 - reverse>	Segment Routing	OK		3000	PCE	0	

SR Policy Tunnel <SR Policy4>

Summary Endpoints Underlay Path Operations Events Actions

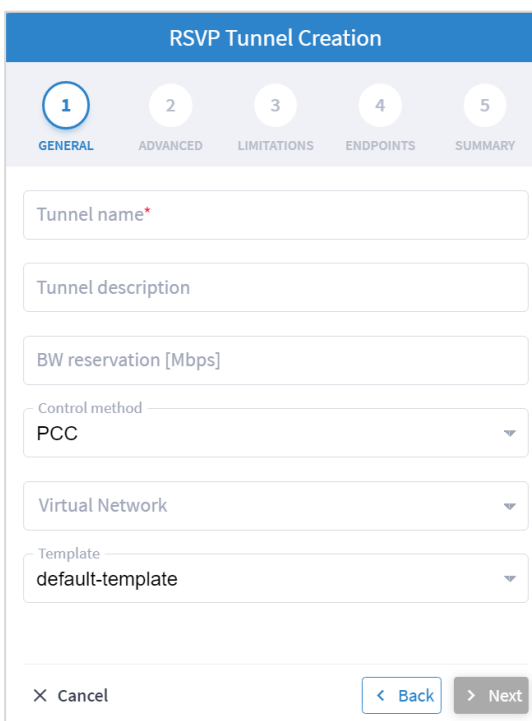
GUID: 51/SRPolicy4
Name: SR Policy Tunnel <SR Policy4>
Tunnel ID: -
Description: SR Policy Tunnel <SR Policy SR Policy4 from ZR_ER2.MAD to ZR_ER2.SQY via ZR_CR2.MAD, ZR_CR2.BCN, ZR_CR2.MIL, ZR_CR2.SQY>
Creation Time: -
Last Changed: -
BW Reservation [Mbps]: 5000
Virtual Network: -
Tunnel Type: Segment Routing
Control Method: PCE
Template Name: Default SR Policy Template
Admin State: Up
Path Priority: -
Holding Priority: -

Add RSVP Tunnel

You can create an RSVP tunnel between source and target endpoints, with a bandwidth reservation, controlled by device or controller, associate with a specific virtual network. Various advanced settings and limitations (items to be included or excluded from the path) can be added. An RSVP tunnel can only be created over a single domain.

To add a RSVP tunnel:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
1. Click **Create New Tunnel**.
2. Select **RSVP**.



The screenshot shows the 'RSVP Tunnel Creation' wizard with five steps: GENERAL (selected), ADVANCED, LIMITATIONS, ENDPOINTS, and SUMMARY. The GENERAL step includes the following fields:

- Tunnel name* (text input)
- Tunnel description (text input)
- BW reservation [Mbps] (text input)
- Control method (dropdown menu, currently set to PCC)
- Virtual Network (dropdown menu)
- Template (dropdown menu, currently set to default-template)

At the bottom, there are three buttons: 'Cancel', '< Back', and '> Next'.

3. Specify the following **GENERAL** settings:
 - **Tunnel name:** The unique user defined name of this tunnel.
 - **Tunnel description:** A description of the tunnel.
 - **BW reservation (Mbps):** The bandwidth reserved for this tunnel.
 - **Control method:** The control method, by device (**PCC**) or by controller (**PCE**).
 - **Virtual Network:** The virtual network (tunnels can be grouped using tags to construct a virtual network. L3-VPN can be assigned to specific virtual network).
 - **Template:** This is not available in the current version (there is a **default-template**).

4. Click **Next**.

The screenshot shows the 'RSVP Tunnel Creation' dialog box with five steps: 1. GENERAL, 2. ADVANCED, 3. LIMITATIONS, 4. ENDPOINTS, and 5. SUMMARY. Step 2 is active. The fields are: Admin State (Up), Setup Priority (7), Holding Priority (7), Path Criteria (Number of Hops), Max Delay [ms], Max Hops, and Path Policy. At the bottom, there are buttons for 'Cancel', '< Back', and '> Next'.

5. Specify the following **ADVANCED** settings:


- **Admin State:** The admin state (**Up** or **Down**).
- **Setup Priority:** The setup priority (between 0 and 7). Default is 7.
- **Holding Priority:** The holding priority (between 0 and 7). Default is 7.
- **Path Criteria:** The path control method (**Number of Hops** or **Latency** or **Admin Cost**).
- **Max Delay (ms):** The maximum permissible delay in 100 of ms (between 0 to 500). Only relevant when the path criteria is set to **Latency**.
- **Max Hops:** The maximum number of hops (between 1 to 100). Only relevant when path criteria is set to **Number of Hops**.
- **Path Policy:** Select a policy (**Strict** or **Loose**). If **Strict**, must include the list of nodes and IGP links to be included in the new tunnel path.

6. Click **Next**.

RSVP Tunnel Creation


1 GENERAL 2 ADVANCED 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

▼ Include Nodes or Links

Select Node or Link 

(No items)




▼ Exclude Nodes or Links

Select Node or Link 

(No items)

X Cancel < Back > Next

7. Specify the following **LIMITATIONS** settings:

- **Include Nodes or Links:** Click  and in the **Advanced** tab, select node or IGP link, or click on the **3D Explorer** tab to select node or IGP link.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select node or IGP link, or click on the **3D Explorer** tab to select node or IGP link.
- (Optional) Click  to remove any of the include/exclude items.

RSVP Tunnel Creation

1 GENERAL 2 ADVANCED 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

▼ Include Items in Path

Model Item

ZR_ER2.ROM

ER1.ATH

▼ Exclude Items from Path

Model Item

CR2.VIE

× Cancel < Back > Next

8. Click **Next**.

RSVP Tunnel Creation



1 GENERAL 2 ADVANCED 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

Source Endpoint*

Destination Endpoint*

× Cancel < Back > Next

9. Specify the following **ENDPOINTS** settings:

- **Source Endpoint:** Click  and select the node (router) or IGP interface as the source endpoint.
- **Destination Endpoint:** Click  and select the node (router) or IGP interface as the destination endpoint.

10. Click **Next**.

11. Review the **SUMMARY**.

The screenshot shows a configuration wizard titled "RSVP Tunnel Creation" with five steps: 1. GENERAL, 2. ADVANCED, 3. LIMITATIONS, 4. ENDPOINTS, and 5. SUMMARY. The SUMMARY step is selected and highlighted. The configuration details are as follows:

- Name:** TestTunnel
- Description:** None
- BW Reservation [Mbps]:** None
- Control Method:** PCC
- Template Name:** default-template
- Admin State:** Up
- Setup Priority:** 7
- Holding Priority:** 7
- Path Criteria:** Number of Hops
- Max Delay [us]:** None
- Max Hops:** None
- Path Policy:** Strict
- Excluded List:** -
- Included List:** -
- Source Endpoint:** CR2 MAD

At the bottom of the window, there are three buttons: "Cancel" (with a close icon), "< Back", and "> Finish".

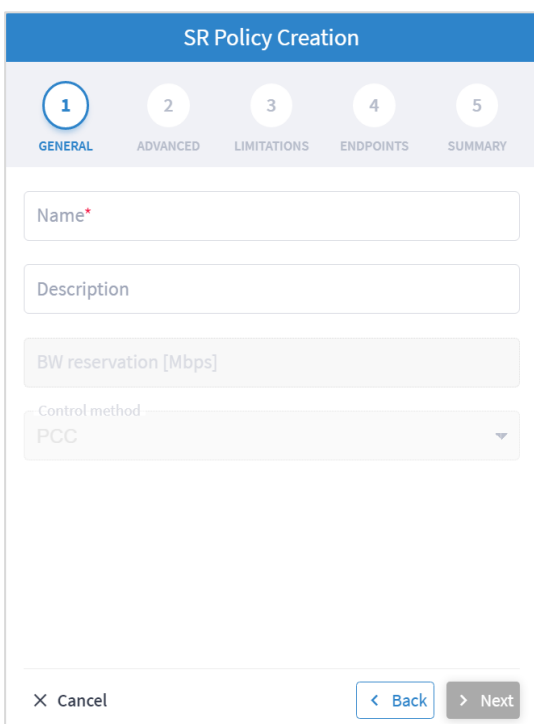
12. Click **Finish**.

Add SR Policy Tunnel

The Crosswork Hierarchical Controller network model supports Segment Routing (SR) Policies and SR Segments over IGP links, and the Crosswork Hierarchical Controller adapters can discover policies from network controllers, with their SID list, color, preference, and candidate path attributes. It maps all discovered policies to create SR Segments as a layer between IGP links and SR policies. An SR Segment is the path between two SIDs, shared by multiple SR policies. An SR Policy tunnel can only be created over a single domain.

To add an SR Policy tunnel:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Click **Create New Tunnel**.
3. Select **SR Policy**.



The screenshot shows the 'SR Policy Creation' form with the 'GENERAL' tab selected. The form has five steps: 1. GENERAL, 2. ADVANCED, 3. LIMITATIONS, 4. ENDPOINTS, and 5. SUMMARY. The 'GENERAL' tab is active, showing the following fields: 'Name*' (required), 'Description', 'BW reservation [Mbps]', and 'Control method' (set to 'PCC'). At the bottom, there are buttons for 'Cancel', '< Back', and '> Next'.

4. Specify the following **GENERAL** settings:
 - **Name:** The unique user defined name of this SR Policy.
 - **Description:** A description of the SR Policy.

5. Click **Next**.

SR Policy Creation

1 GENERAL 2 **ADVANCED** 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

Min Criteria (Metric)*

Color*

Candidate path preference*
100

× Cancel < Back > Next

6. Specify the following **ADVANCED** settings:

- **Min Criteria (Metric):** The criteria metric to minimize (**IGP**, **TE**, **Delay** or **Number of Hops**).
- **Color:** The SR Policy color (a unique identifier of the policy).
- **Candidate path preference:** The candidate path preference (integer value). The highest preference path is the active one. Multiple candidate paths per policy are currently not support.

7. Click **Next**.

SR Policy Creation

1 GENERAL 2 ADVANCED 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

▼ Include Nodes or Links

Select Node or Link

(No items)




▼ Exclude Nodes or Links

Select Node or Link

(No items)

X Cancel < Back > Next



8. Specify the following **LIMITATIONS** settings:

- **Include Nodes or Links:** Click  and in the **Advanced** tab, select node or IGP link, or click on the **3D Explorer** tab to select node or IGP link.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select node or IGP link, or click on the **3D Explorer** tab to select node or IGP link.
- (Optional) Click  to remove any of the include/exclude items.

9. Click **Next**.

The screenshot shows the 'SR Policy Creation' wizard at step 4, 'ENDPOINTS'. The wizard has five steps: 1. GENERAL, 2. ADVANCED, 3. LIMITATIONS, 4. ENDPOINTS (current step), and 5. SUMMARY. Below the step indicators are two search fields: 'Source Endpoint*' and 'Destination Endpoint*', each with a search icon. At the bottom of the form, there are three buttons: 'Cancel', '< Back', and '> Next'.

10. Specify the following **ENDPOINTS** settings:

- **Source Endpoint:** Click  and select the node (router) or IGP interface as the source endpoint.
- **Destination Endpoint:** Click  and select the node (router) or IGP interface as the destination endpoint.

11. Click **Next**.

12. Review the **SUMMARY**.

The screenshot shows the 'SR Policy Creation' interface with the 'SUMMARY' step selected. The summary details are as follows:

- Name:** Test
- Description:** None
- BW Reservation [Mbps]:** None
- Control Method:** PCC
- Min Criteria (Metric):** IGP
- Color:** 1
- Candidate path preference:** 100
- Excluded List:** -
- Included List:** -
- Source Endpoint:** CR2.OVE
- Destination Endpoint:** CR1.ATH

At the bottom, there are three buttons: 'Cancel', 'Back', and 'Finish'.

13. Click **Finish**.

Delete Tunnel

To delete a tunnel:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Device Manager**.
2. Select a tunnel.
3. Select the **Actions** tab.
4. Click **Delete Tunnel**. A confirmation message appears.
5. Click **Confirm**. The tunnel is deleted.

Point-to-Point

You can create a point-to-point service of type:

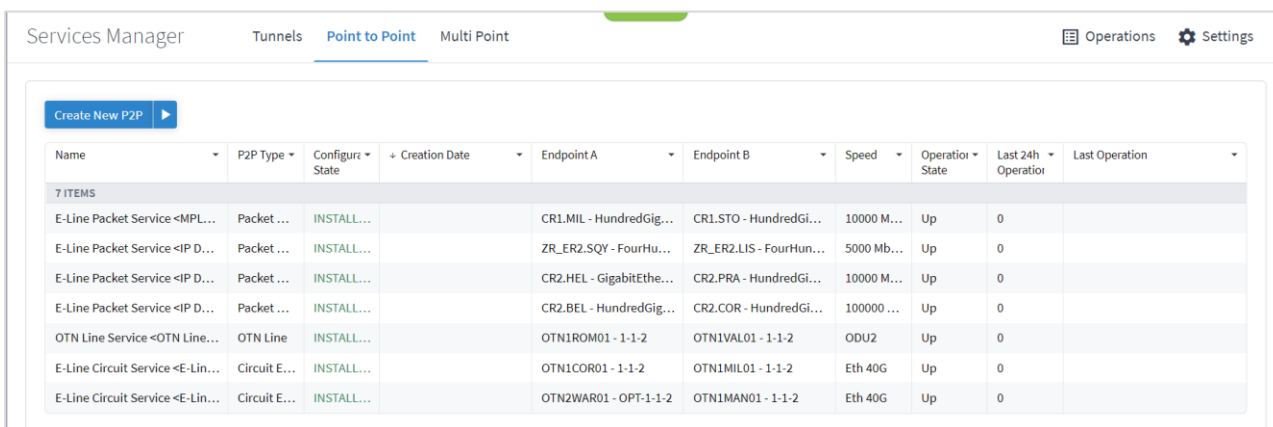
- IP Link
- OCH Link
- OCH-NC Link
- OTN-Line
- Circuit E-Line
- Packet E-Line

View Point to Point

You can view a list of the Point to Point services.

To view PSP services:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Point to Point**. A list of the point-to-point services appears in the **Point to Point** pane.



The screenshot shows the 'Services Manager' interface with the 'Point to Point' tab selected. A table lists 7 items of point-to-point services. Each row includes columns for Name, P2P Type, Configurz State, Creation Date, Endpoint A, Endpoint B, Speed, Operation State, Last 24h Operation, and Last Operation.

Name	P2P Type	Configurz State	Creation Date	Endpoint A	Endpoint B	Speed	Operation State	Last 24h Operation	Last Operation
7 ITEMS									
E-Line Packet Service <MPL...	Packet ...	INSTALL...		CR1.MIL - HundredGig...	CR1.STO - HundredGi...	10000 M...	Up	0	
E-Line Packet Service <IP D...	Packet ...	INSTALL...		ZR_ER2.SQY - FourHu...	ZR_ER2.LIS - FourHun...	5000 Mb...	Up	0	
E-Line Packet Service <IP D...	Packet ...	INSTALL...		CR2.HEL - GigabitEthe...	CR2.PRA - HundredGi...	10000 M...	Up	0	
E-Line Packet Service <IP D...	Packet ...	INSTALL...		CR2.BEL - HundredGig...	CR2.COR - HundredGi...	100000 ...	Up	0	
OTN Line Service <OTN Line...	OTN Line	INSTALL...		OTN1ROM01 - 1-1-2	OTN1VAL01 - 1-1-2	ODU2	Up	0	
E-Line Circuit Service <E-Lin...	Circuit E...	INSTALL...		OTN1COR01 - 1-1-2	OTN1MIL01 - 1-1-2	Eth 40G	Up	0	
E-Line Circuit Service <E-Lin...	Circuit E...	INSTALL...		OTN2WAR01 - OPT-1-1-2	OTN1MAN01 - 1-1-2	Eth 40G	Up	0	

2. Select the required point-to-point service.
3. To view more point to point link details, see the lower pane view with the following tabs:
 - **Summary:** Additional details about the point to point links.
 - **Endpoints:** The source and destination endpoint details.
 - **Underlay Path:** The underlay path items traversed by the link.
 - **Operations:** The point to point link operations.
 - **Events:** The point to point link events.
 - **Actions:** The modification actions (if applicable) and the option to Delete P2P.

testWSS_2

Summary Endpoints Underlay Path Operations Events Actions

GUID: SI/b5d6e0f698d24e918962166d6ddd4828
Name: testWSS_2
Creation Time: 31-05-2022 12:36:41 UTC
Last Changed: 31-05-2022 12:36:41 UTC
Template Name: default-template

▼ **Service Links:**
 LI/R_PHY/PO/xr/PHY-P-BOTTOMLEFT:FourHundredGigE0/0/0/2/PO/xr/PHY-P-BOTTOMRIGHT:FourHundredGigE0/0/0/2

IP Address Assignment Policy: User Allocated
Is Bundle? No
Channel Config: 1 X 400G
Path Criteria: Latency

For services that were created by using the MCP controller and not the Services Management application, the service appears as **Is Brownfield: True**. The Crosswork Hierarchical Controller MCP adapter discovers these services and creates service intent for each of them. The following delegated service types are supported: Packet E-Line, Circuit E-Line, OTN-Line, and OCH (Wavelength) services.

Services Manager Tunnels Point to Point IP Services Operations Settings

Create New P2P ▶

Name	P2P Type	Configuration State	Creation Date	Endpoint A	Endpoint B	Speed	Operational State	Last 24h Operations	Last Operation
S ITEMS									
CH09-OTUC4-WSAI-ROUTE1	Wavelength	INSTALLED	04-04-2023 06:31:08 UTC	PTHLAB-WG8-102 - 1-1-2	PTHLAB-WG8-101 - 1-1-2	400 GB	Up	1	Create OCH: ✓ Done
OTU_A	Wavelength	INSTALLED	04-04-2023 06:31:08 UTC	PTHLAB-WG8-103 - 1-1-1	PTHLAB-WG8-104 - 1-1-1	400 GB	Up	1	Create OCH: ✓ Done
CH03-10G-OTN-TEST01_HCD 1-14-1	Circuit E-Line	INSTALLED	04-04-2023 06:31:08 UTC	PTHLAB-WG4-102 - 1-14-1	PTHLAB-WG4-101 - 1-14-1	Eth 10G	Up	1	Create Circuit E-Line: ✓ Done
CH03-OTUCn-PKT/OTN-ROUTE1	Wavelength	INSTALLED	04-04-2023 06:31:08 UTC	PTHLAB-WG4-102 - 1-1-1	PTHLAB-WG4-101 - 1-1-1	100 GB	Up	1	Create OCH: ✓ Done
CH04-OTUCn-PKT/OTN-ROUTE2	Wavelength	INSTALLED	04-04-2023 06:31:08 UTC	PTHLAB-WG4-102 - 1-2-1	PTHLAB-WG4-101 - 1-2-1	100 GB	Up	1	Create OCH: ✓ Done

CH09-OTUC4-WSAI-ROUTE1

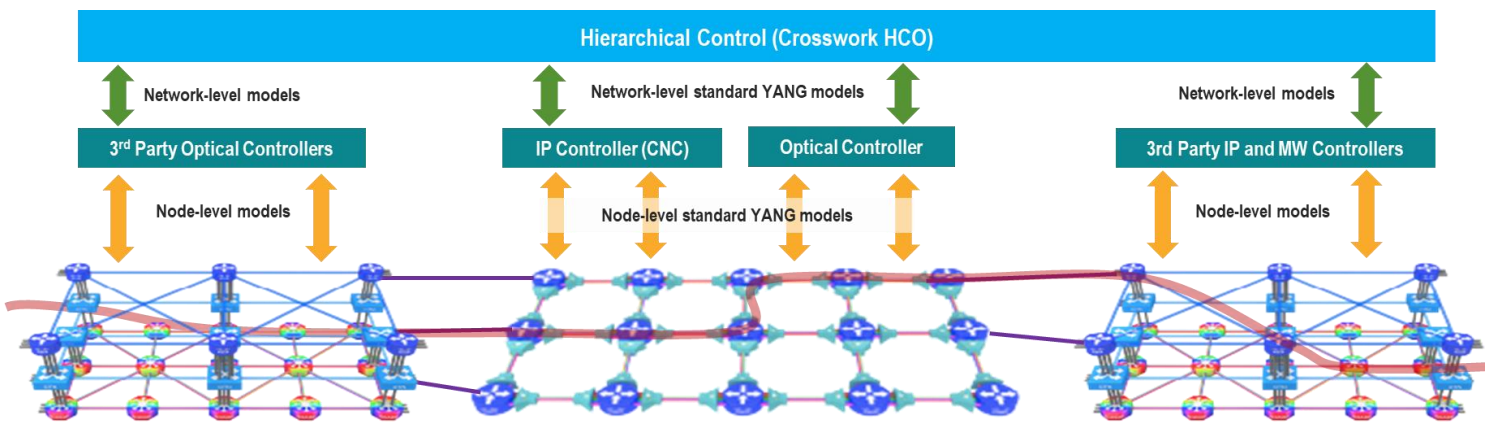
Summary Endpoints Underlay Path Operations Events Actions

GUID: SI/61f1315f-20b4-459d-acac-ba48bed4f4c7
Name: CH09-OTUC4-WSAI-ROUTE1
Creation Time: 04-04-2023 06:31:08 UTC
Last Changed: 04-04-2023 06:31:08 UTC
Template Name: None
Is Brownfield: True
Service Link: CH09-OTUC4-WSAI-ROUTE1

Create IP Link

You can create an IP Link between two ZR pluggable components in routers (creating a new link or adding it to a LAG). Various advanced settings and limitations (such as node or link to be included in the path or excluded from the path of the OCH Link) can be added. The end-to-end service between ZR/+ ports may optionally traverse through OLSs (or ONEs, Optical Network Elements, Cisco, or 3rd party). Crosswork Hierarchical Controller decomposes the service into domains and provisions the optical line between ROADMs on the optical domain controller. The activation mode works directly from Crosswork Hierarchical Controller to IP and optical domain controllers (CNC, ONC).

ZR and ZR+ pluggables manufactured by Cisco output a maximum of -10dBm. There are ROADM setups that can benefit from or require a stronger signal. The new ZR bright pluggable outputs 0dBm and is supported for IP provisioning. BRT appears in the device description, for example, Cisco QDD 400G BRT ZRP Pluggable Optics Module.



You can create L Band and C Band links. L-Band introduces a second OMS over the line-side OTS.

For example, Fiber-1 (OTS link is used) by two OMS-1 and OMS-2 (OMS links).



With both L Band and C Band, for a single OTS there are 2 (or more) OMS links.

For example:

Port[.type = "OMS" and .provider = "onc-titan"] | link [.layer = "OMS"]

SHQL

Saved Queries Save

`port[.type = "OMS" and .provider = "onc-titan"] | link [.layer = "OMS"]`

RESULTS (2)

OMS Link (2)

Guid	Layer	Protectio	Desc	OperStat	Paths	PathGrou	PortA	PortB	Name	Provider	Role	Extra
2 ITEMS												
Ll/onc-titan/oms/5bbb1e00-88c7-3132-a654-14c13cab...	OMS	N_A	OMS: 0/...	UP	{{'guid':...	SINGLE...	PO/onc-...	PO/onc-...	0/0/0/0-...	onc-titan	REGULAR	{'onc-tit...
Ll/onc-titan/oms/c7c1f4fa-20ae-3797-bcc7-384f288667...	OMS	N_A	OMS: 0/...	UP	{{'guid':...	SINGLE...	PO/onc-...	PO/onc-...	0/0/0/0-...	onc-titan	REGULAR	{'onc-tit...

For a single OTS link, there are 2 OTS ports and 4 (or more) OMS ports where the UpperPorts field holds the “upper” OMS ports for each OTS port.

For example:

port[.type = "OMS"] | link | port | downward ("OTS")

SHQL

Saved Queries Save

`port[.type = "OMS" and .provider = "onc-titan"] | link | port | downward ("OTS")`

RESULTS (6)

OTS Port (2) **OMS Port (4)**

Guid	Type	UpperPorts
2 ITEMS		
PO/onc-titan/o...	OTS	{{'guid': 'PO/onc-titan/oms/1568d1bc-ca43-3d61-ad67-be39a92570de/c7c1f4fa-20ae-3797-bcc7-384f288667c3', 'type': 'OMS'}, {'guid': 'PO/onc-ti...
PO/onc-titan/o...	OTS	{{'guid': 'PO/onc-titan/oms/1bfc10a3-2559-3b7c-a26a-4175eb00e79b/9aab7383-165e-3c4f-a2fc-4ec2d28283e1', 'type': 'OMS'}, {'guid': 'PO/onc-ti...

For more info on how to view links and ports in SHQL, see the *Cisco Crosswork Hierarchical Controller NBI and SHQL Reference Guide*.

To create an IP Link:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Select the **Point to Point** tab.
3. Click **IP Link**.

The screenshot shows the 'IP Link Creation' form. At the top, there is a blue header with the title 'IP Link Creation'. Below the header is a navigation bar with four tabs: '1 GENERAL', '2 ENDPOINTS', '3 ADVANCED', and '4 SUMMARY'. The 'GENERAL' tab is selected and highlighted. The form contains the following fields:

- Name***: A text input field.
- Description**: A text input field.
- Link Rate Mode***: A dropdown menu.
- Router Configuration Only**: A checkbox.





At the bottom of the form, there are three buttons: 'X Cancel', '< Back', and '> Next'.

4. Specify the following **GENERAL** settings:
 - **Name**: Enter a name for the service.
 - **Description**: Enter a description for the service.
 - **Link Rate Mode**: Select a link rate mode, for example, **100G - 1x100G**. Bundles are offered when the selected rate is for muxponder mode. From version 7.0, a bundle option is offered for 400G.
 - **Router Configuration Only**: Select this option when configuring a router only (direct routers connections, not via OLS).

5. Click **Next**.

The screenshot shows the 'IP Link Creation' wizard at the 'ENDPOINTS' step. The wizard has four steps: 1. GENERAL, 2. ENDPOINTS (current), 3. ADVANCED, and 4. SUMMARY. The 'ENDPOINT A' section contains three input fields: 'Site A' with a search icon, 'Port A*' with a search icon, and 'Transmit Power [dBm]'. The 'ENDPOINT B' section also contains three input fields: 'Site B' with a search icon, 'Port B*' with a search icon, and 'Transmit Power [dBm]'. At the bottom, there are three buttons: 'Cancel', '< Back', and '> Next'.

6. Specify the following **ENDPOINTS** settings:

- **Site A:** Click  and in the **Advanced** tab, select a site, or click on the **3D Explorer** tab to select a site.
- **Port A:** Click  and in the **Advanced** tab, select an OCH port, or click on the **3D Explorer** tab to select a port. If the port selected is an adjacency port, endpoint B is automatically updated and cannot be edited.
- **Transmit Power (dBm):** Select the transmit power for Endpoint A.
- **Site B:** Click  and in the **Advanced** tab, select a site, or click on the **3D Explorer** tab to select a site.
- **Port B:** Click  and in the **Advanced** tab, select an OCH port, or click on the **3D Explorer** tab to select a port.
- **Transmit Power (dBm):** Select the transmit power for Endpoint B.
- **LINK #1 IP ADDRESSES:** Enter the **IP Address A (CIDR)** and **IP Address B (CIDR)**.
- (Optional depending on the **Link Rate Mode** selected) Enter the **LINK #2 IP ADDRESSES**, **LINK #3 IP ADDRESSES** and **LINK #4 IP ADDRESSES**.

7. Click **Next**.

IP Link Creation

1 GENERAL 2 ENDPOINTS 3 **ADVANCED** 4 SUMMARY

Add to existing LAG

FREQUENCY

L Band

C Band

Frequency THz*

191.3

Digital-to-Analog Converter (DAC) rate

Modulation

Set Path Preferences

Min Path Criteria

Latency

▼ Include Nodes or Links

Select Node or Link



× Cancel < Back > Next


The screenshot shows the 'IP Link Creation' interface at the 'ADVANCED' step (step 3 of 4). The interface is divided into three main sections for selection:

- Include Nodes or Links:** A search box labeled 'Select Node or Link' with a magnifying glass icon. Below it, the text '(No items)' is displayed.
- Exclude Nodes or Links:** A search box labeled 'Select Node or Link' with a magnifying glass icon. Below it, the text '(No items)' is displayed.
- Disjoint From Links:** A search box labeled 'Select Node or Link' with a magnifying glass icon. Below it, the text '(No items)' is displayed.

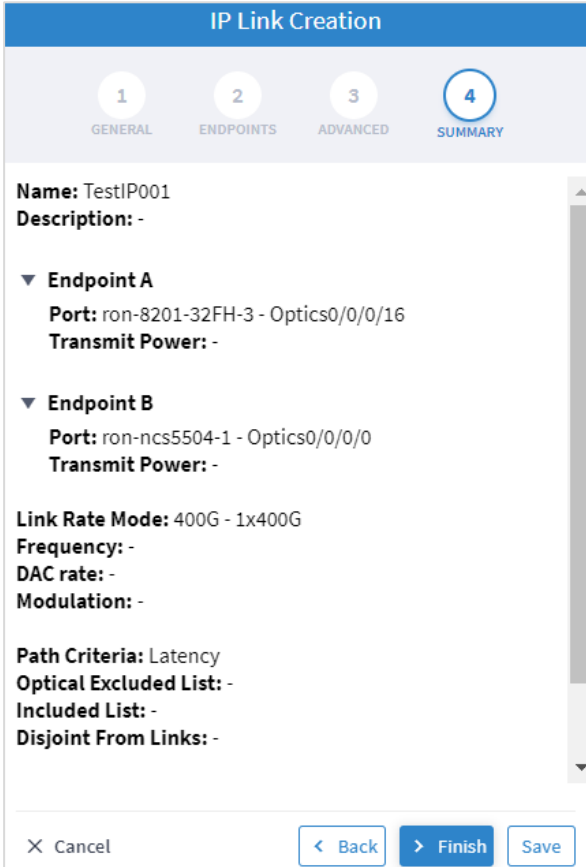
At the bottom of the interface, there are three buttons: 'Cancel' (with a close icon), '< Back', and 'Next >'.

8. Specify the following **ADVANCED** settings:

- **Add to existing LAG:** Select one of the existing LAGs (bundles) between the two selected routers. This option is only available if there is a bundle already configured between the routers.
- **Frequency:** Select **L Band** or **C Band** and specify the **Frequency Thz** for this link. L-Band introduces a second OMS over the line-side OTS.
- **Digital-to-Analog Converter (DAC) rate:** The DAC rate is only relevant for ZR+ and bright ZR port selection. For 100G, there is no need to change the DAC rate. Select **1 X 1** (standard compatible mode) or **1 X 1.25** (Cisco-proprietary mode if both ends of the link are Cisco pluggables). For QAM modulation, only **1 x 1.25** is supported.
- **Modulation:** Select **8 QAM**, **16 QAM** or **QPSK** (default) to reduce the baud rate for 200G links. It is not necessary to apply modulation to 100G, 300G or 400G links as the correct modulation is automatically applied: 100G (QPSK), 300G (8 QAM) and 400G (16 QAM).
- **Set Path Preferences:** Not enabled. Set to **Latency**.
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select a ONE node or OTS/OMS link, or click on the **3D Explorer** tab to select the required item.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select a ONE node or OTS/OMS link, or click on the **3D Explorer** tab to select the required item.
- **Disjoint From Link:** Not enabled.

- (Optional) Click  to remove any of the include/exclude items.

9. Click **Next**.



The screenshot shows the 'IP Link Creation' dialog box, specifically the 'SUMMARY' step (4). The dialog has a blue header with the title 'IP Link Creation'. Below the header is a progress bar with four steps: 1. GENERAL, 2. ENDPOINTS, 3. ADVANCED, and 4. SUMMARY (highlighted with a blue circle). The main content area is a scrollable list of configuration details for a link named 'TestIP001'. The details include: Name: TestIP001, Description: -, Endpoint A (Port: ron-8201-32FH-3 - Optics0/0/0/16, Transmit Power: -), Endpoint B (Port: ron-ncs5504-1 - Optics0/0/0/0, Transmit Power: -), Link Rate Mode: 400G - 1x400G, Frequency: -, DAC rate: -, Modulation: -, Path Criteria: Latency, Optical Excluded List: -, Included List: -, and Disjoint From Links: -. At the bottom of the dialog, there are four buttons: 'Cancel' (with a close icon), '< Back', '> Finish' (highlighted in blue), and 'Save'.

IP Link Creation

1 GENERAL 2 ENDPOINTS 3 ADVANCED 4 SUMMARY

Name: TestIP001
Description: -

▼ **Endpoint A**
Port: ron-8201-32FH-3 - Optics0/0/0/16
Transmit Power: -

▼ **Endpoint B**
Port: ron-ncs5504-1 - Optics0/0/0/0
Transmit Power: -

Link Rate Mode: 400G - 1x400G
Frequency: -
DAC rate: -
Modulation: -

Path Criteria: Latency
Optical Excluded List: -
Included List: -
Disjoint From Links: -

× Cancel < Back > Finish Save

10. Review the **SUMMARY**.

11. Click **Finish**.

Create OCH Link

You can create an OCH Link between line side of Transponders/Muxponders, define its capacity, add 1+1 protection if required, and optimize based on number of hops, latency, or admin cost. Various advanced settings and limitations (such as nodes or links to be included or excluded from the OCH Link) can be added.

In this phase, the Transponder and the ROADM must be controlled by the same optical controller. A use case of disaggregated topology is planned for future releases.

To create an OCH Link:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Select the **Point to Point** tab.
3. Click **OCH Link**.

The screenshot shows the 'OCH Creation' form with the following fields and controls:

- Tabbed interface with 5 tabs: GENERAL (1), SETTINGS (2), ENDPOINTS (3), PATH (4), SUMMARY (5).
- Form fields:
 - Name* (required text input)
 - Description (text input)
 - Template (dropdown menu, currently set to 'default-template')
- Navigation buttons at the bottom:
 - Cancel (with an 'X' icon)
 - Back (with a left arrow icon)
 - Next (with a right arrow icon)

4. Specify the following **GENERAL** settings:
 - **Name:** The unique user defined name of this link.
 - **Description:** A description of the link.

5. Click **Next**.

The screenshot shows the 'OCH Creation' wizard at the 'SETTINGS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS (highlighted), 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The main content area contains three dropdown menus: 'Bandwidth Capacity [Gbps]' set to '100 GB', 'Baud Rate' set to 'Auto', and 'Protection' set to 'No Protection'. At the bottom, there are three buttons: 'Cancel', 'Back', and 'Next'.



6. Specify the following **SETTINGS**:

- **Bandwidth Capacity (Gbps):** The bandwidth capacity for this OCH link (100 GB, 200 GB, 300 GB, 400 Gb or 800 GB).
- **Baud Rate:** The baud rate for this IP link (Auto or 35 G or 56 G).

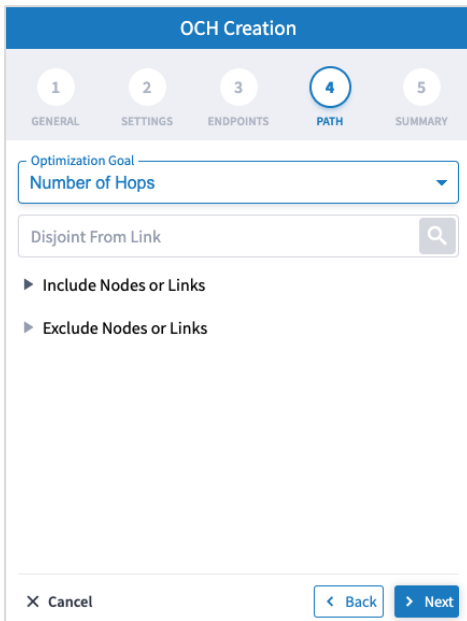
7. Click **Next**.

The screenshot shows the 'OCH Creation' wizard at the 'ENDPOINTS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS (highlighted), 4. PATH, and 5. SUMMARY. The main content area contains two input fields for endpoints: 'Endpoint A*' with the value 'NE13 - 13-1-1' and 'Endpoint B*' with the value 'WSAi1 - 1-3-1'. Each input field has a search icon and a clear icon. At the bottom, there are three buttons: 'Cancel', 'Back', and 'Next'.

8. Specify the following **ENDPOINTS** settings:





- **Endpoint A:** Click  and in the **Advanced** tab, select an OCH endpoint, or click on the **3D Explorer** tab to select an OCH endpoint.
- **Endpoint B:** Click  and in the **Advanced** tab, select an OCH endpoint, or click on the **3D Explorer** tab to select an OCH endpoint.

9. Click **Next**.



The screenshot shows the 'OCH Creation' dialog box with the 'PATH' tab selected. The dialog has a blue header and a navigation bar with five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS, 4. PATH (highlighted), and 5. SUMMARY. Below the navigation bar, there is a dropdown menu for 'Optimization Goal' set to 'Number of Hops'. Below that is a search field for 'Disjoint From Link'. There are two expandable sections: 'Include Nodes or Links' and 'Exclude Nodes or Links'. At the bottom, there are buttons for 'Cancel', '< Back', and '> Next'.

10. Specify the following **PATH** settings:

- **Optimization Goal:** The optimization goal (**Number of Hops** or **Latency** or **Admin Cost**).
- **Disjoint From Link:**  and in the **Advanced** tab, select an OCH link, or click on the **3D Explorer** tab to select an OCH link. This means that the new OTN-Line must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select an optical node or OMS link, or click on the **3D Explorer** tab to select an optical node or OMS link.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select an optical node or OMS/OTS link, or click on the **3D Explorer** tab to select an optical node or OMS/OTS link.
- (Optional) Click  to remove any of the include/exclude items.

11. Click **Next**.

The screenshot shows the 'OCH Creation' wizard at the 'SUMMARY' step (Step 5). The wizard has five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The configuration details are as follows:

- Name:** test
- Description:** None
- Customer Name:** None
- Capacity [Gbps]:** 100 GB
- Baud Rate:** Auto
- Protection Policy:** No Protection
- Computation Provider:** Domain Controller
- Path Criteria:** Number of Hops
- Disjoint From Link:** None
- Excluded List:** -
- Included List:** -
- Endpoint A:** NE13 - 13-1-1
- Endpoint B:** WSAi1 - 1-2-1

At the bottom, there are three buttons: 'Cancel', '< Back', and '> Finish'.

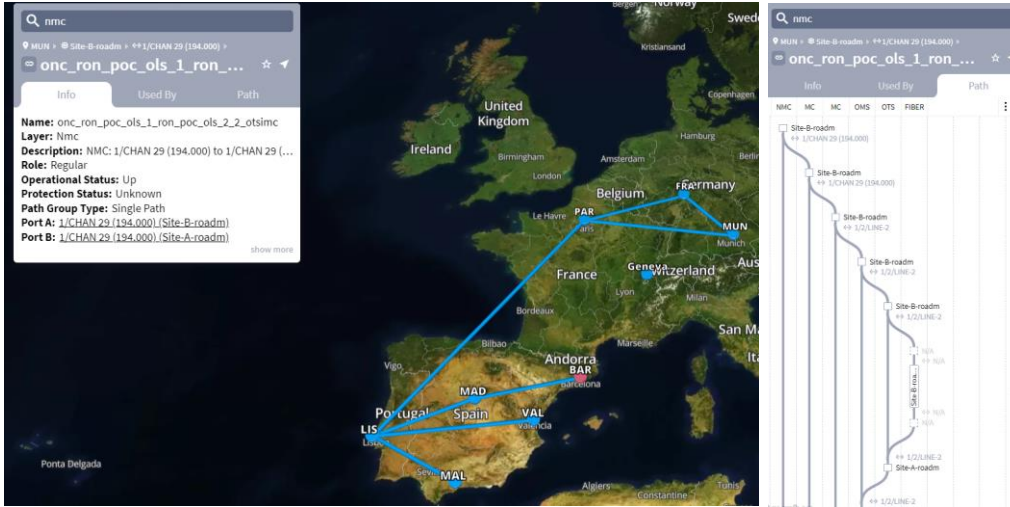
12. Click **Finish**.

Create OCH-NC Link

You can create an OCH-NC (or OTSiMC) link. This is the connection between client sides of ROADMs, the ports facing Transponder/Muxponder. You can define its capacity, add 1+1 protection if required, and optimize based on number of hops or admin cost. Various advanced settings and limitations (such as nodes or links to be included or excluded from the OCH-NC Link) can be added.

Before using this wizard, go to the [Settings](#) page and upload a file of app codes. Once the file is uploaded, the wizard enables you to select specific codes, which selects an item from the list in the uploaded file.

This only works with Cisco Optical Controller (ONC). The new service is added as an NMC link.



To create an OCH-NC Link:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Select the **Point to Point** tab.
3. Click **OCH-NC Link**.

OCH-NC Creation

1 GENERAL 2 SETTINGS 3 APPLICATION CODE 4 ENDPOINTS 5 PATH 6 SUMMARY

Name*

Description

Template
default-template

× Cancel < Back > Next

4. Specify the following **GENERAL** settings:
 - **Name:** The unique user defined name of this link.
 - **Description:** A description of the link.
5. Click **Next**.

OCH-NC Creation

1 GENERAL 2 SETTINGS 3 APPLICATION CODE 4 ENDPOINTS 5 PATH 6 SUMMARY

Allow Auto Regeneration

Optical Feasibility Threshold
NONE

Admin State
ENABLED

Central Frequency (Thz)

× Cancel < Back > Next

6. Specify the following **SETTINGS**:

- **Allow Auto Regeneration:** Whether to allow auto regeneration.
- **Optical Feasibility Threshold:** Select **RED**, **GREEN**, **YELLOW** or **NONE**.
- **Admin State:** Select **ENABLED** or **DISABLED**.
- **Central Frequency (Thz):** The frequency for this OCH-NC link. A number in range of nine digits, with a dot after the first 3 digits (xxx.xxxxx). Range is between 000.000000 to 999.999999 in steps of 000.000001.

7. Click **Next**.

The screenshot shows the 'OCH-NC Creation' interface with a progress bar at the top containing six steps: 1. GENERAL, 2. SETTINGS, 3. APPLICATION CODE (highlighted), 4. ENDPOINTS, 5. PATH, and 6. SUMMARY. Below the progress bar are several input fields: 'Vendor Name*' (dropdown), 'Product ID*' (dropdown), 'FEC*' (dropdown), 'Data Rate*' (dropdown), 'Baud Rate*' (dropdown), 'Sub Mode' (dropdown), and 'Application Code*' (text input). At the bottom, there is a 'Reset' button with a left arrow, a 'Cancel' button with an 'X' icon, and 'Back' and 'Next' buttons with left and right arrows respectively.

8. Specify the following **APPLICATION CODE** settings to generate the required **Application Code**:

- **Vendor Name:** The vendor name.
- **Product ID:** The product ID.
- **FEC:** The FEC depending on the product, for example, CFEC or OFEC.
- **Data Rate:** The data rate supported by the selected product.
- **Baud Rate:** The baud rate supported by the selected product.
- **Sub Mode:** This may appear depending on the other settings.

9. Click **Next**.

OCH-NC Creation

1 GENERAL 2 SETTINGS 3 APPLICATION CODE 4 ENDPOINTS 5 PATH 6 SUMMARY

Single Channel
 Multiple Channel

BASE ENDPOINTS

Endpoint A*

Endpoint B*

× Cancel < Back > Next

10. Specify the following **ENDPOINTS** settings:

- Select **Single Channel** or **Multiple Channel**.
- **Endpoint A:** Click and in the **Advanced** tab, select an NMC port, or click on the **3D Explorer** tab.
- **Endpoint B:** Click and in the **Advanced** tab, select an NMC port, or click on the **3D Explorer** tab.

11. Click **Next**.

OCH-NC Creation

1 GENERAL 2 SETTINGS 3 APPLICATION CODE 4 ENDPOINTS 5 PATH 6 SUMMARY

Optimization Goal
Number of Hops





Disjoint From Link

▶ Include Nodes or Links

▶ Exclude Nodes or Links

× Cancel < Back > Next

12. Specify the following **PATH** settings:

- **Optimization Goal:** The optimization goal (**Number of Hops** or **Admin Cost**).
- **Disjoint From Link:**  and in the **Advanced** tab, select an OCH-NC link, or click on the **3D Explorer** tab to select an OCH-NC link. This means that the new OCH-NC link must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select a ONES or OMS link, or click on the **3D Explorer** tab to select a ONES or OMS link.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select a ONES or OMS/OTS link, or click on the **3D Explorer** tab to select a ONES or OMS link.
- (Optional) Click  to remove any of the include/exclude items.

13. Click **Next**.

The screenshot shows the 'OCH-NC Creation' wizard at the 'SUMMARY' step. The progress bar at the top indicates steps 1 through 6, with step 6 being the current step. The configuration details are as follows:

- Name:** TestOCHNCLink
- Description:** None
- Customer Name:** None
- Allow Auto Regeneration:** False
- Optical Feasibility Threshold:** RED
- Admin State:** ENABLED
- Baud Rate:** 36.63G
- Data Rate:** R300G
- Central Frequency(Thz):** None
- Application Code:** 00B08E#NCS1K4-1.2T-K9#2#SD_FEC_15_DE_OFF#R300G#QPSK_32QAM#36.63
- Optimization Goal:** NUMBER_OF_HOPS
- Disjoint From Link:** -
- Included List:** -
- Excluded List:** -
- Endpoints:** -

At the bottom of the form, there are three buttons: 'Cancel', '< Back', and '> Finish'.

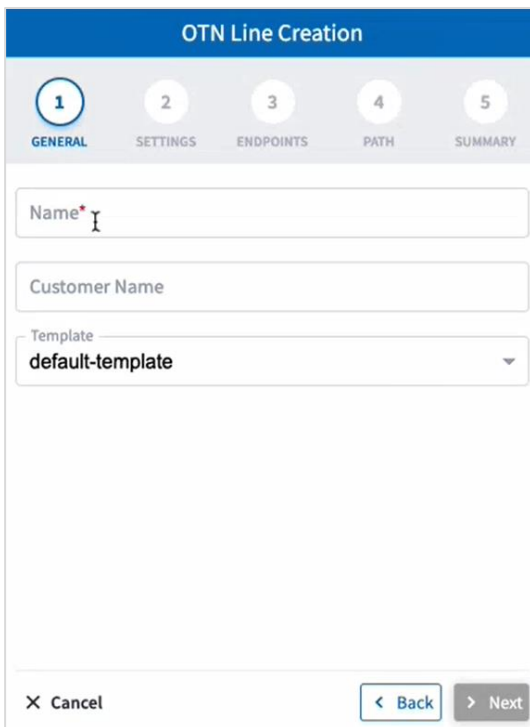
14. Click **Finish**.

Create OTN-Line

You can create an OTN Line service between OTN client ports on Transponders/Muxponders, define its capacity, add 1+1 protection if required, and optimize based on **number of hops, latency, or admin cost**. Various advanced settings and limitations (such as node or links to be included in or excluded from the OTN Line) can be added.

To create an OTN Line:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Select the **Point to Point** tab.
3. Click **OTN Line**.



The screenshot shows the 'OTN Line Creation' wizard in the 'GENERAL' step. The wizard has five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The 'GENERAL' step is active. The form contains the following fields:

- Name***: A text input field with a cursor.
- Customer Name**: A text input field.
- Template**: A dropdown menu with 'default-template' selected.

At the bottom of the form, there are three buttons: 'X Cancel', '< Back', and '> Next'.

4. Specify the following **GENERAL** settings:
 - **Name**: The unique user defined name of this OTN Line.
 - **Customer Name**: The OTN Line customer name.

5. Click **Next**.

The screenshot shows the 'OTN Line Creation' interface at the 'SETTINGS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS (highlighted), 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. Below the progress bar, there are two dropdown menus. The first is labeled 'Service Capacity*' and has a red border. The second is labeled 'Protection' and is set to 'No Protection'. At the bottom of the form, there are three buttons: 'X Cancel', '< Back', and '> Next'.



6. Specify the following **SETTINGS**:

- **Service Capacity**: The capacity for this OTN-Line, for example, **ODU2**.
- **Protection**: The service protection (**No Protection** or **Protection 1+1**).

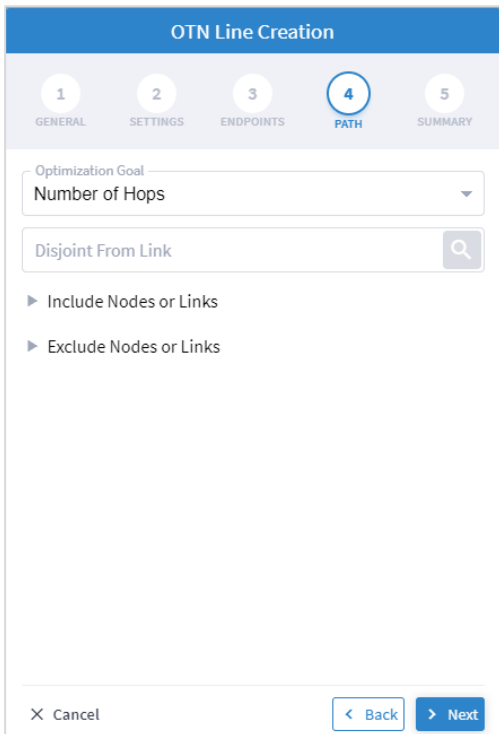
7. Click **Next**.

The screenshot shows the 'OTN Line Creation' interface at the 'ENDPOINTS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS (highlighted), 4. PATH, and 5. SUMMARY. Below the progress bar, there are two search input fields labeled 'Endpoint A*' and 'Endpoint B*', each with a magnifying glass icon. Below these is a dropdown menu labeled 'Path Calculation By' set to 'Domain Controller'. At the bottom of the form, there are three buttons: 'X Cancel', '< Back', and '> Next'.





8. Specify the following **ENDPOINTS** settings:

- **Endpoint A:** Click  and in the **Advanced** tab, select an endpoint as ODU client port, or click on the **3D Explorer** tab to select an endpoint.
- **Endpoint B:** Click  and in the **Advanced** tab, select an endpoint as ODU client port, or click on the **3D Explorer** tab to select an endpoint.
- **Path Calculation By:** Select **Domain Controller** or **HCO**.

9. Click **Next**.



10. Specify the following **PATH** settings:

- **Optimization Goal:** The optimization goal (**Number of Hops** or **Latency** or **Admin Cost**).
- **Disjoint From Link:**  and in the **Advanced** tab, select an OTN line, or click on the **3D Explorer** tab to select an OTN line. This means that the new OTN Line must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select a node or OTU link, or click on the **3D Explorer** tab to select a node or OTU link.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select a node or any optical link, or click on the **3D Explorer** tab to select a node or any optical link.
- (Optional) Click  to remove any of the include/exclude items.

11. Click **Next**.

The screenshot shows the 'OTN Line Creation' interface. At the top, there is a blue header with the title 'OTN Line Creation'. Below the header is a navigation bar with five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. Step 5 is highlighted with a blue circle. The main content area displays the following configuration details:

- Name:** TestOTN
- Customer Name:** None
- Template:** default-template
- Service Capacity:** ODU3E2
- Protection Policy:** No Protection
- Computation Provider:** Domain Controller
- Path Criteria:** Number of Hops
- Disjoint From Link:** -
- Excluded List:** -
- Included List:** -
- Endpoint A:** OTN1PRA01 - 1-1-3
- Endpoint B:** OTN2STO01 - OPT-1-1-4

At the bottom of the form, there are three buttons: 'Cancel' (with an 'X' icon), 'Back' (with a left arrow icon), and 'Finish' (with a right arrow icon).

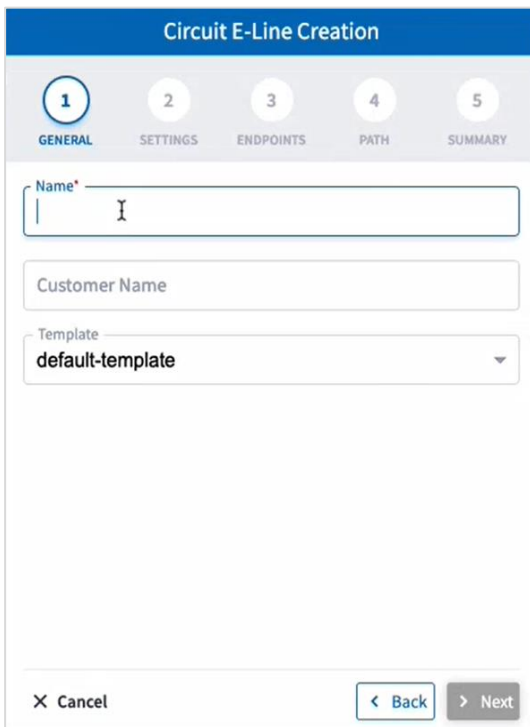
12. Click **Finish**.

Create Circuit E-Line

You can create a Circuit E-Line, as an Ethernet connection between ETH client ports on Transponders/Muxponders, define its capacity, add 1+1 protection if required, and optimize based on **number of hops, latency, or admin cost**. Various advanced settings and limitations (such as nodes or links to be included in or excluded from the Circuit E-line) can be added.

To create a Circuit E-Line:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
2. Select the **Point to Point** tab.
3. Click **Circuit E-Line**.



The screenshot shows the 'Circuit E-Line Creation' interface. At the top, there is a blue header with the title 'Circuit E-Line Creation'. Below the header is a navigation bar with five tabs: '1 GENERAL', '2 SETTINGS', '3 ENDPOINTS', '4 PATH', and '5 SUMMARY'. The 'GENERAL' tab is selected and highlighted. The main form area contains three input fields: 'Name' (with a cursor), 'Customer Name', and 'Template' (with a dropdown menu showing 'default-template'). At the bottom of the form, there are three buttons: 'X Cancel', '< Back', and '> Next'.

4. Specify the following **GENERAL** settings:
 - **Name:** The unique user defined name of this Circuit E-Line.
 - **Customer Name:** The Circuit E-Line customer name.

5. Click **Next**.

The screenshot shows the 'Circuit E-Line Creation' wizard at the 'SETTINGS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS (active), 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The main content area contains two dropdown menus: 'Service Capacity*' and 'Protection'. The 'Service Capacity*' dropdown is currently empty, and the 'Protection' dropdown is set to 'No Protection'. At the bottom, there are three buttons: 'Cancel', 'Back', and 'Next'.



6. Specify the following **SETTINGS**:

- **Service Capacity:** The capacity for this Circuit E-Line, for example, 10 GB WAN.
- **Protection:** The service protection (**No Protection** or **Protection 1+1**).

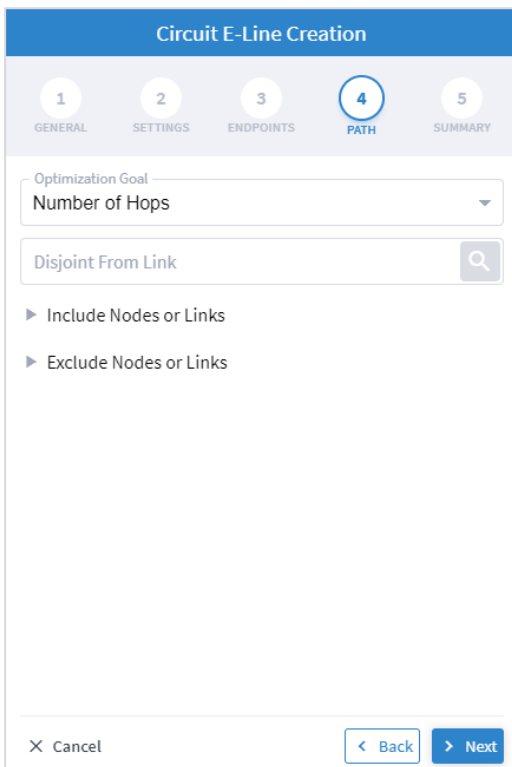
7. Click **Next**.

The screenshot shows the 'Circuit E-Line Creation' wizard at the 'ENDPOINTS' step. The progress bar at the top indicates five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS (active), 4. PATH, and 5. SUMMARY. The main content area contains two search input fields for 'Endpoint A*' and 'Endpoint B*', each with a search icon. Below these is a dropdown menu for 'Path Calculation By' set to 'Domain Controller'. At the bottom, there are three buttons: 'Cancel', 'Back', and 'Next'.





8. Specify the following **ENDPOINTS** settings:

- **Endpoint A:** Click  and in the **Advanced** tab, select an ETH endpoint, or click on the **3D Explorer** tab to select an endpoint.
- **Endpoint B:** Click  and in the **Advanced** tab, select an ETH endpoint, or click on the **3D Explorer** tab to select an endpoint.
- **Path Calculation By:** Select **Domain Controller** or **HCO**.

9. Click **Next**.



10. Specify the following **PATH** settings:

- **Optimization Goal:** The optimization goal (**Number of Hops** or **Latency** or **Admin Cost**).
- **Disjoint From Link:**  and in the **Advanced** tab, select Circuit E-Line, or click on the **3D Explorer** tab to select Circuit E-Line. This means that the new Circuit E-Line must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select a Circuit E-Line, or click on the **3D Explorer** tab to select a Circuit E-Line.
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select node or any optical link, or click on the **3D Explorer** tab to select node or any optical link.
- (Optional) Click  to remove any of the include/exclude items.

11. Click **Next**.

Circuit E-Line Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 PATH 5 **SUMMARY**

Name: TestE
Customer Name: None
Template: default-template
Service Capacity: 1 GB
Protection Policy: No Protection
Computation Provider: Domain Controller
Path Criteria: Number of Hops
Disjoint From Link: -
Excluded List: -
Included List: -
Endpoint A: OTN2TAMP01 - OPT-1-1-2
Endpoint B: OTN1BCN01 - 1-1-4

× Cancel < Back > **Finish**

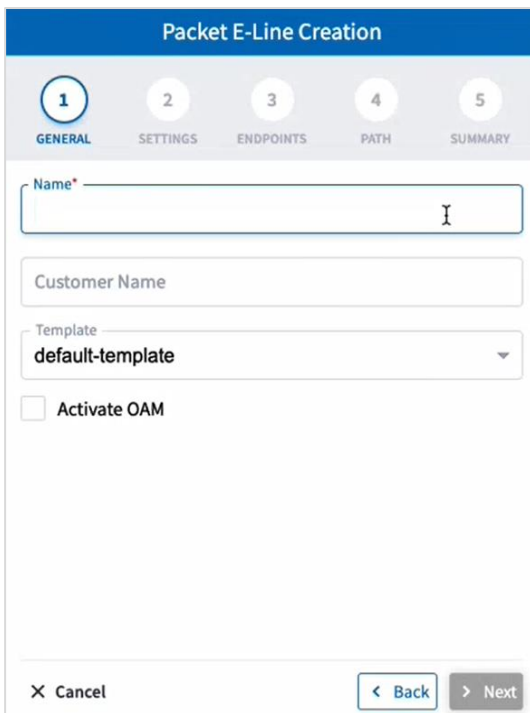
12. Click **Finish**.

Create Packet E-Line

You can create a Packet E-Line as an Ethernet service between Routers over RSVP-TE tunnels or SR policies, or between Transponders/Muxponders over MPLS-TP tunnels, define its capacity, add 1+1 protection if required, and optimize based on **number of hops, latency, or admin cost**. Various advanced settings and limitations (such as items to be included or excluded from the Circuit E-line) can be added.

To create a Packet E-Line:

1. Before creating a Packet E-Line service, create the MPLS-TP tunnels to be used (this is assumed to be handled implicitly by the optical controller).
2. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**.
3. Select the **Point to Point** tab.
4. Click **Packet E-Line**.



The screenshot shows the 'Packet E-Line Creation' form in the 'GENERAL' tab. The form has a blue header with the title 'Packet E-Line Creation'. Below the header is a progress bar with five steps: 1. GENERAL (selected), 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The form contains the following fields and controls:

- Name***: A text input field with a cursor.
- Customer Name**: A text input field.
- Template**: A dropdown menu with 'default-template' selected.
- Activate OAM**: A checkbox that is currently unchecked.
- Navigation**: A 'Cancel' button (with an 'X' icon), a '< Back' button, and a '> Next' button.

5. Specify the following **GENERAL** settings:
 - **Name**: The unique user defined name of this Packet E-Line.
 - **Customer Name**: The Packet E-Line customer name.
 - **Activate OAM**: Whether to enable OAM PM activation.

6. Click **Next**.

Packet E-Line Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 PATH 5 SUMMARY

Underlay Mode
Use any tunnels

Underlay Technology
SR-CS Policy

Pseudowire Signaling
EVPN-VPWS (BGP)

EVI

Protection
No Protection

X Cancel < Back > Next


7. Specify the following **SETTINGS**:

- **Underlay Mode:** The underlay mode, for example, **Use any tunnels**.
- **Underlay Technology:** The underlay technology, for example, **MPLS-TP**.
- **Pseudowire Signaling:** The pseudowire signaling, for example, **EVPN-VPWS (BGP)**.
- **EVI:** The **EVPN** instance.
- **Protection:** The service protection (**No Protection** or **Protection 1+1**).


8. Click **Next**.

The screenshot shows the 'Packet E-Line Creation' wizard at step 3, 'ENDPOINTS'. The wizard has five steps: 1. GENERAL, 2. SETTINGS, 3. ENDPOINTS (current), 4. PATH, and 5. SUMMARY. The 'Endpoint A' section contains a 'Port*' field with a search icon, a 'VLAN ID (format: 2,5-7)' field, and five optional fields: 'CIR [Mbps]*', 'EIR [Mbps]', 'CBS [KBytes]', 'EBS [KBytes]', and 'Local AC'. The 'Endpoint B' section has the same fields. At the bottom, there are 'Cancel', 'Back', and 'Next' buttons.

9. Specify the following **ENDPOINTS** settings for **Endpoint A** and **Endpoint B**:

- **Port:** Click  and in the **Advanced** tab, select a port, or click on the **3D Explorer** tab to select an Ethernet port. The port rates should be the same. In case selected ports has already a packet E-Line service defined, with VLAN IDs, the VLAN IDs must be specified for per endpoint for the new service
- **VLAN ID:** The VLAN ID in a range of 1-4094. Enter a single value, multiple values separate by commas, and/or ranges, where '-' designates the range, for example: 390-780. . If the selected endpoint has no services on it, the VLAN ID field is optional. Once defined, a VLAN ID must be defined in both endpoints, although different values/ranges can be specified. If you specify multiple VLANs, you must use the same values for both endpoints.

Bandwidth parameters are all optional

- **CIR (Mbps):** The CIR rate in Mbps, range is 0 to <port rate>. The values can be different per endpoint.
- **EIR (Mbps):** The EIR rate in Mbps, range is 0 to <port rate>. The values can be different per endpoint.
- **CBS (Kbytes):** The CBS rate in Kbytes, range is 0 to <port rate>. The values can be different per endpoint.
- **EBD (Kbytes):** The CBS rate in Kbytes, range is 0 to <port rate>. The values can be different per endpoint.
- **Local AC:** The local AC.
- **Endpoint B:** Click  and in the **Advanced** tab, select a port, or click on the **3D Explorer** tab to select a port.

10. Click **Next**.

Packet E-Line Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 PATH 5 SUMMARY

Optimization Goal
Number of Hops

Path Calculation By
HCO

Disjoint From Link

▶ Include Nodes or Links

▶ Exclude Nodes or Links






Disjoint From Link (Protection)



▶ Include Nodes or Links (Protection)

▶ Exclude Nodes or Links (Protection)

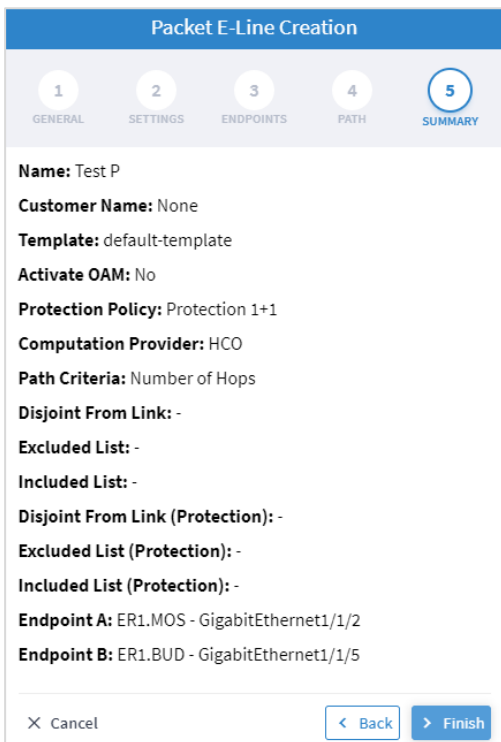
X Cancel < Back > Next

11. Specify the following **PATH** settings:

- **(Only required if tunnels are implicitly created) Optimization Goal:** The optimization goal (**Number of Hops** or **Latency** or **Admin Cost**).
- **(Only required if tunnels are implicitly created) Path Calculation By:** The path calculation mechanism: **Domain Controller** or **Crosswork Hierarchical Controller**. Currently in this version only the Domain Controller option is available.
- **Disjoint From Link:**  and in the **Advanced** tab, select a Packet E-Line, or click on the **3D Explorer** tab to select a Packet E-Line. This means that the new Circuit E-Line must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **Include Nodes or Links:** Click  and in the **Advanced** tab, select node or underlay link (IGP or OTU), or click on the **3D Explorer** tab to select node or underlay link (IGP or OTU).
- **Exclude Nodes or Links:** Click  and in the **Advanced** tab, select node or underlay link (IGP or OTU) or click on the **3D Explorer** tab to select node or underlay link (IGP or OTU).
- **(Only required with protections) Disjoint From Link (Protection):**  and in the **Advanced** tab, select a Packet E-Line, or click on the **3D Explorer** tab to select a Packet E-Line. This means that the new Circuit E-Line must not traverse this exclusionary path (this would be equivalent to adding all the links that constitute the disjoint path to the exclude items from path list).
- **(Only required with protections) Include Nodes or Links (Protection):** Click  and in the **Advanced** tab, select node or underlay link (IGP or OTU), or click on the **3D Explorer** tab to select node or underlay link (IGP or OTU).

- **(Only required with protections) Exclude Nodes or Links (Protection):** Click  and in the **Advanced** tab, select node or underlay link (IGP or OTU) or click on the **3D Explorer** tab to select node or underlay link (IGP or OTU).
- (Optional) Click  to remove any of the include/exclude items.

12. Click **Next**.



13. Click **Finish**.

Delete P2P

To delete a P2P Link:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Point to Point**.
2. Select a link.
3. Select the **Actions** tab.
4. Click **Delete P2P**. A confirmation message appears.
5. Click **Accept**. The link is deleted.

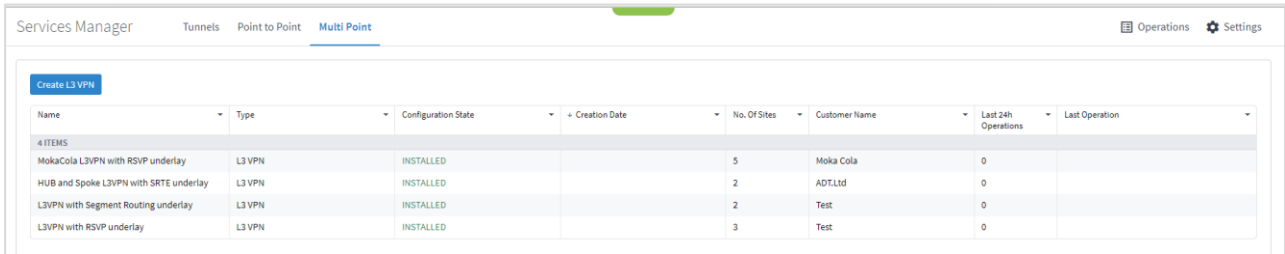
Multi Point

You can view and add L3-VPN.

View L3 VPN

To view L3 VPNs:

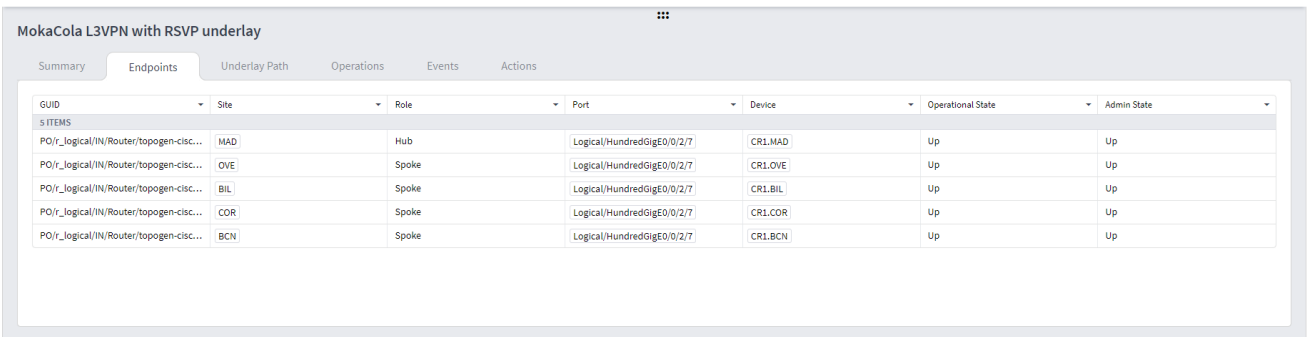
1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Multi Point**. A list of the L3VPNs appears in the **Multi Point** pane.



The screenshot shows the 'Services Manager' interface with the 'Multi Point' tab selected. A table lists several L3 VPNs with columns for Name, Type, Configuration State, Creation Date, No. Of Sites, Customer Name, Last 24h Operations, and Last Operation.

Name	Type	Configuration State	Creation Date	No. Of Sites	Customer Name	Last 24h Operations	Last Operation
4 ITEMS							
MokaCola L3VPN with RSVP underlay	L3 VPN	INSTALLED		5	Moka Cola	0	
HUB and Spoke L3VPN with SRTE underlay	L3 VPN	INSTALLED		2	ADTLtd	0	
L3VPN with Segment Routing underlay	L3 VPN	INSTALLED		2	Test	0	
L3VPN with RSVP underlay	L3 VPN	INSTALLED		3	Test	0	

2. Select the required L3 VPN.
3. To view more L3 VPN details, see the lower pane view with the following tabs:
 - **Summary:** Additional details about the L3 VPN.
 - **Endpoints:** The endpoint details.
 - **Underlay Path:** The underlay path items traversed by the link.
 - **Operations:** The L3 VPN link operations.
 - **Events:** The L3 VPN link events.
 - **Actions:** The modification actions (if applicable) and the option to **Delete VPN**.



The screenshot shows the 'MokaCola L3VPN with RSVP underlay' details pane with the 'Endpoints' tab selected. A table lists endpoint details with columns for GUID, Site, Role, Port, Device, Operational State, and Admin State.

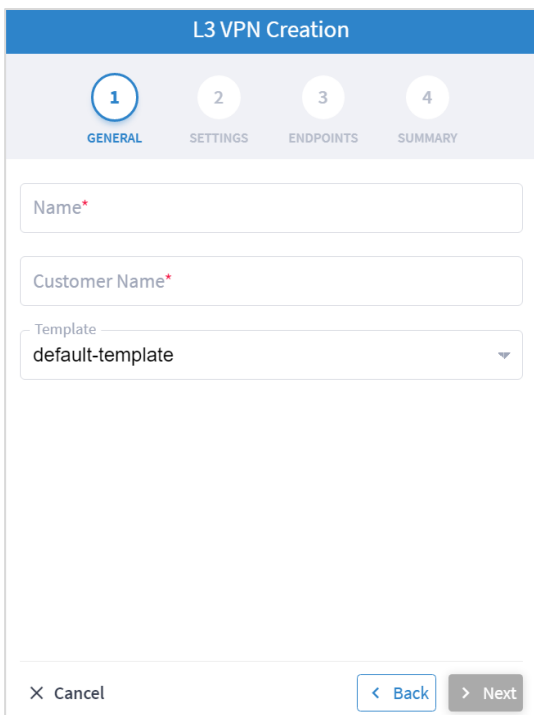
GUID	Site	Role	Port	Device	Operational State	Admin State
5 ITEMS						
PO/r_logical/IN/Router/topogen-cisc...	MAD	Hub	Logical/HundredGigE0/0/2/7	CR1.MAD	Up	Up
PO/r_logical/IN/Router/topogen-cisc...	OVE	Spoke	Logical/HundredGigE0/0/2/7	CR1.OVE	Up	Up
PO/r_logical/IN/Router/topogen-cisc...	BIL	Spoke	Logical/HundredGigE0/0/2/7	CR1.BIL	Up	Up
PO/r_logical/IN/Router/topogen-cisc...	COR	Spoke	Logical/HundredGigE0/0/2/7	CR1.COR	Up	Up
PO/r_logical/IN/Router/topogen-cisc...	BCN	Spoke	Logical/HundredGigE0/0/2/7	CR1.BCN	Up	Up

Add L3-VPN

You can add a managed L3 VPN, that is, a VPN created by Crosswork Hierarchical Controller or delegated to Crosswork Hierarchical Controller.

To add an L3 VPN:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager**
2. Select the **Multi Point** tab.
3. Click **Create L3 VPN**.



The screenshot shows the 'L3 VPN Creation' form. At the top, there is a blue header with the title 'L3 VPN Creation'. Below the header is a navigation bar with four tabs: 'GENERAL' (selected and highlighted with a blue circle and the number 1), 'SETTINGS' (with the number 2), 'ENDPOINTS' (with the number 3), and 'SUMMARY' (with the number 4). The main form area contains three input fields: 'Name*' (a text input field), 'Customer Name*' (a text input field), and 'Template' (a dropdown menu with 'default-template' selected). At the bottom of the form, there are three buttons: 'Cancel' (with an 'X' icon), '< Back' (a blue button), and '> Next' (a grey button).

4. Specify the following **GENERAL** settings:
 - **Name:** The unique user defined name of this L3 VPN.
 - **Customer Name:** The L3 VPN customer name.
 - **Template:** This is not available in the current version (there is a **default-template**).

5. Click **Next**.

The screenshot shows the 'L3-VPN Creation' wizard in the 'SETTINGS' step. The interface includes a progress bar at the top with four steps: 1. GENERAL, 2. SETTINGS (highlighted), 3. ENDPOINTS, and 4. SUMMARY. Below the progress bar, there are five configuration fields: 'Underlay Options*' (dropdown menu set to 'Virtual Network'), 'Virtual Network' (dropdown menu set to 'Virtual Network'), 'Topology' (dropdown menu set to 'Any to Any'), 'Resource Allocation Policy' (dropdown menu set to 'HCO Allocated'), and 'Min Number of Sites' (text input field containing '2'). At the bottom of the form, there are three buttons: 'Cancel', '< Back', and 'Next >'.

6. Specify the following **SETTINGS**:

- **Underlay Options:** this is to select whether to map the new service to any tunnels exist between the endpoints or to use only tunnels grouped as a virtual network (you can create new virtual network by creating a tag with the virtual network name as the tag value in the tag key VN). Select **All Network** or **Virtual Network**.
- **Virtual Network:** The user created virtual networks (example: **uRLLC** or **eMBB**).
- **Topology:** The topology of the L3 VPN (**Any to Any**, **Hub & Spoke**, **Hub & Spoke Disjoint** or **Unknown**).
- **Resource Allocation Policy:** Refers to allocation of RD and RT, which in this version are allocated by HCO (**HCO Allocated**, that is, allocated by Crosswork Hierarchical Controller).
- **Min. Number of Sites:** The minimum number of sites/endpoints (between 2 and 20). For Hub & Spoke, select the minimum number of hops and minimum number of spokes separately.

7. Click **Next**.

L3-VPN Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 SUMMARY

▶ 1. Endpoint

▶ 2. Endpoint

+ Add

X Cancel < Back > Next

8. Expand the **Endpoint**.

L3-VPN Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 SUMMARY

▼ 1. Endpoint

Port*

Role*

VLAN ID

IP Address*

Routing Method*


ROUTING INFORMATION

▶ 2. Endpoint

+ Add

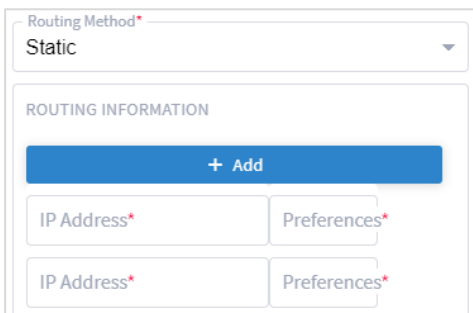
X Cancel < Back > Next

9. Specify the following settings for **Endpoint 1** and **Endpoint 2**:

- **Port:** Click  and in the **Advanced** tab, select a physical or logical port on a router, or click on the **3D Explorer** tab to select a physical or logical port on a router.
- **Role:** Select **Any To Any** or **Hub** or **Spoke** (depending on the option selected in the **SETTINGS** tab).
- **VLAN ID:** The VLAN ID in a range of 1–4094. Enter a single value, multiple values separate by commas, and/or ranges, where ‘-’ designates the range, for example: 390–780. If the selected endpoint has no services on it, the VLAN ID field is optional. Once defined, a VLAN ID must be defined in all endpoints, although different values/ranges can be specified. If you specify multiple VLANs, you must use the same values for all endpoints.
- **IP Address:** The IP address.
- **Routing Method:** The routing method (**Static**, **BGP** or **OSPF**).
- **ROUTING INFORMATION:** Specify the options depending on the **Routing Method** selected.

10. If **Static**, add the static routing information. You can add up to 10 entries, with:

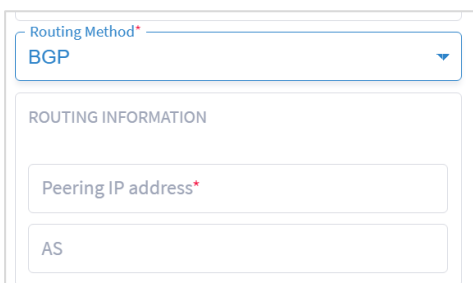
- **IP Address:** The IP address for the destination network in the format xxx.xxx.xxx.xxx/CIDR. The CIDR is a number (between 1 and 32).
- **Preferences:** The preference to allow next hop selection control where the customer prefixes are learned via multiple sources or multiple gateways using the same information source (between 0 and 255).



The screenshot shows a configuration window for the 'Routing Method' set to 'Static'. Below the dropdown, there is a section titled 'ROUTING INFORMATION' containing a blue '+ Add' button. Underneath, there are two rows of input fields, each with an 'IP Address*' field and a 'Preferences*' field.

11. If **BGP**, add:

- **Peering IP address:** The directly connected IP address of the Customer CE device.
- **AS:** The BGP Autonomous System number to peer with the Customer CE (between 64512 and 65535).



The screenshot shows a configuration window for the 'Routing Method' set to 'BGP'. Below the dropdown, there is a section titled 'ROUTING INFORMATION' containing two input fields: 'Peering IP address*' and 'AS'.

12. If **OSPF**, add:

- **OSPF Metric:** An optional parameter to denote the cost of the CE-PE link (0 to 65535).
- **OSPF Area ID:** The OSPF area ID that will be used for the CE-PE link (0 to 4294967295).

Routing Method*
OSPF

ROUTING INFORMATION

OSPF Metric

OSPF Area ID

13. Click **Add** to add additional endpoints (up to 100).

14. Click **Next**.

15. Review the **SUMMARY**.

16. Click **Finish**.

Service Settings

You can configure which rollbacks are allowed.

To view the service settings:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Settings**. A list of the service settings appears.

Services Manager Tunnels Point to Point Multi Point Operations Settings

Services Settings

OPTICAL TRANSCEIVERS APPLICATION CODES

Select a file to upload

CONFIGURATION

Develop Mode

Advanced Mode

Direct Optical Requests

DEMO MODE

RSVP Tunnel

L3-VPN

IP Link

SR Policy

TE++ Container

Circuit E-Line

OTN Line

OCH

Packet E-Line

OCH-NC

ALLOWED ROLLOBACKS

2. In **OPTICAL TRANSCEIVERS APPLICATION CODES**, click to select a file with the application codes.
3. Select which rollbacks are allowed when the services are provisioned (**RSVP Tunnel**, **L3-VPN**, **IP Link**, **SR Policy**, **TE++ Container**, **Circuit E-Line**, **OTN Line**, **OCH**, **Packet E-Line** and/or **OCH-NC**).

Services Manager Operations

You can view the latest Services Manager operations.

To view the operations:

1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Operations**. A list of the operations appears.

Operation Type	Service Intent	Source	Created	Last Update	Flow	State	Duration
Create Packet E-Line	TEST-PACKET-VLAN-301-401	UI	08-12-2021 17:56:53 UTC	08-12-2021 18:01:32 UTC	Rollback	✓ Done	0:00:00.278745
Create Packet E-Line	TEST-PACKET-PROT-0712-1	UI	07-12-2021 23:18:32 UTC	07-12-2021 23:23:07 UTC	Rollback	✓ Done	0:00:00.275480
Create Circuit E-Line	SI/f9a3e7e36ac444fc10916da7d90e8bc	UI	17-11-2021 21:05:09 UTC	17-11-2021 21:06:57 UTC	Normal	✓ Done	0:00:00.107706
Create Circuit E-Line	SI/fe745895a2c4730bd0ab7837aa86f42	UI	16-11-2021 07:35:42 UTC	16-11-2021 07:36:41 UTC	Normal	✓ Done	0:00:00.058800
Delete Circuit E-Line	SI/34d6ec3f9a24cd19187f12edbd1a0f	UI	16-11-2021 07:31:41 UTC	16-11-2021 07:32:58 UTC	Normal	✓ Done	0:00:00.077402
Create Circuit E-Line	SI/34d6ec3f9a24cd19187f12edbd1a0f	UI	14-11-2021 15:10:30 UTC	14-11-2021 15:11:41 UTC	Normal	✓ Done	0:00:00.071759
Delete Circuit E-Line	SI/38bb50a02875403d852c757c79ede17f	UI	14-11-2021 15:06:04 UTC	14-11-2021 15:06:08 UTC	Normal	✗ Failed	0:00:00.003507
Delete Circuit E-Line	SI/2b710e7145c04ddc9d26f8f68a82d233	UI	14-11-2021 15:04:22 UTC	14-11-2021 15:05:50 UTC	Normal	✓ Done	0:00:00.088153
Delete Circuit E-Line	SI/d2c72b86b4594eb98a377b690269f78	UI	14-11-2021 15:00:23 UTC	14-11-2021 15:02:38 UTC	Normal	✓ Done	0:00:00.134841
Delete Circuit E-Line	SI/17a5ce05e3be4c4f93e95860611ad980	UI	14-11-2021 15:00:19 UTC	14-11-2021 15:02:34 UTC	Normal	✓ Done	0:00:00.135178
Delete Circuit E-Line	SI/d2c72b86b4594eb98a377b690269f78	UI	14-11-2021 14:48:39 UTC	14-11-2021 14:48:42 UTC	Normal	✗ Failed	0:00:00.003085
Delete Circuit E-Line	SI/17a5ce05e3be4c4f93e95860611ad980	UI	14-11-2021 14:48:05 UTC	14-11-2021 14:48:08 UTC	Normal	✗ Failed	0:00:00.002605
Create Circuit E-Line	SI/17a5ce05e3be4c4f93e95860611ad980	UI	11-11-2021 16:32:46 UTC	11-11-2021 16:34:10 UTC	Normal	✓ Done	0:00:00.084374
Create Circuit E-Line	SI/d2c72b86b4594eb98a377b690269f78	UI	11-11-2021 16:17:35 UTC	11-11-2021 16:19:14 UTC	Normal	✓ Done	0:00:00.099545
Create Circuit E-Line	SI/92df4395ce3e49d9dadeda89b0b8e8d36	UI	11-11-2021 15:43:45 UTC	11-11-2021 15:44:19 UTC	Rollback	✓ Done	0:00:00.033931
Create Circuit E-Line	SI/38bb50a02875403d852c757c79ede17f	UI	11-11-2021 15:33:57 UTC	11-11-2021 15:35:20 UTC	Normal	✓ Done	0:00:00.083147
Delete Circuit E-Line	SI/d328da9758342a499010c995b056be2	UI	11-11-2021 15:23:43 UTC	11-11-2021 15:25:19 UTC	Normal	✓ Done	0:00:00.096597
Delete Circuit E-Line	SI/c73e1cf0b0e4f4dc503f88b3138582	UI	11-11-2021 15:21:27 UTC	11-11-2021 15:22:25 UTC	Normal	✓ Done	0:00:00.057368
Delete Circuit E-Line	SI/c73e1cf0b0e4f4dc503f88b3138582	UI	09-11-2021 21:46:30 UTC	09-11-2021 21:47:51 UTC	Normal	✓ Done	0:00:00.081065
Create Circuit E-Line	SI/32cea215f7de4f818efc634d06c52334	UI	09-11-2021 21:39:44 UTC	09-11-2021 21:40:18 UTC	Rollback	✓ Done	0:00:00.034169
Delete Circuit E-Line	SI/efc6a878e9c54a2db183263306ecbbfe	UI	09-11-2021 21:35:58 UTC	09-11-2021 21:36:45 UTC	Normal	✓ Done	0:00:00.047147
Create Circuit E-Line	SI/efc6a878e9c54a2db183263306ecbbfe	UI	09-11-2021 21:11:19 UTC	09-11-2021 21:12:23 UTC	Normal	✓ Done	0:00:00.064012
Create Circuit E-Line	SI/1a1c17bdcbc4c46e5aa24e3ea1559b33	UI	09-11-2021 20:58:59 UTC	09-11-2021 20:59:07 UTC	Rollback	✗ Failed	0:00:00.007709
Create Circuit E-Line	SI/d328da9758342a499010c995b056be2	UI	09-11-2021 20:32:07 UTC	09-11-2021 20:33:19 UTC	Normal	✓ Done	0:00:00.072413
Create Circuit E-Line	SI/e0697abfd2e4c37888e3d99c64639f8	UI	09-11-2021 20:05:55 UTC	09-11-2021 20:06:33 UTC	Rollback	✓ Done	0:00:00.037934

2. Select the required operation.

Operation Type: Create Packet E-Line
Service Intent: TEST-PACKET-VLAN-301-401
Source: UI
Created: 08-12-2021 17:56:53 UTC
Last Update: 08-12-2021 18:01:32 UTC
Flow: Rollback
State: ✓ Done
Duration: 0:00:00.278745

Summary | Logs | Errors

UUID: f20d24b06b3449e0b1756d492cbd965c
Action: Create Packet E-Line
Service Intent GUID: SI/f20d24b06b3449e0b1756d492cbd965c
Service GUID: None
Source: UI
Created at: 08-12-2021 17:56:53 UTC
Last Updated at: 08-12-2021 18:01:32 UTC
Status: Rollback ✓ Done
Extra

3. To view more details, select the **required** tab:

- **Summary:** Additional details about the operation, e.g., Status: Rollback Done.

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- **Logs:** The operation logs for normal and rollback flows.
 - **Errors:** The operation errors, e.g., Discovery took too long.

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