



Cisco Crosswork Hierarchical Controller 7.1

Service Provisioning User Guide

August 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. |
| NSP | |
| 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. |

| Term | Definition |
|----------------|---|
| RT | Route Target. |
| 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. |
| SDH-Line | SDH line between STM-64 or STM-256 ports. |
| 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 ● 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 |

| 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 |
| 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/SDH Line | <ul style="list-style-type: none"> ● Service name ● Service ID ● ODU signal/ETH rate/SDH STM rate ● 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 |

| Service Type | Provisioning Parameters |
|--------------|---|
| | <ul style="list-style-type: none"> ● 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.

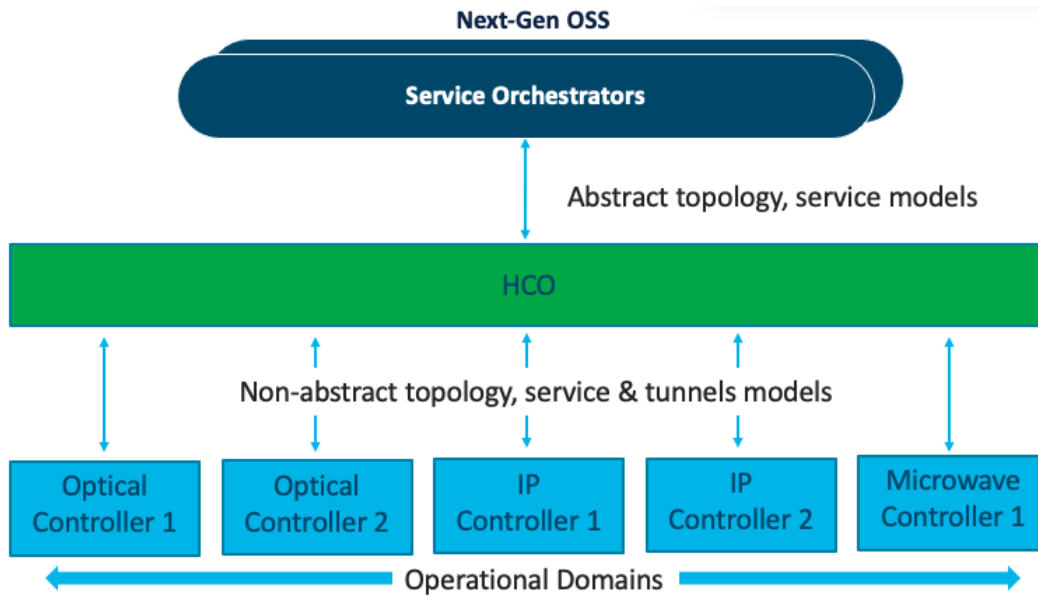


Figure 1.
Transport SDN Architecture

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
 - SDH 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.

VPN Service using Network Services Orchestrator Crosswork Hierarchical Controller - Function Pack

This topic describes the fundamentals of Network Services Orchestrator (NSO) instance deployment, as part of the Crosswork Hierarchical Controller solution for IP VPN automation. The adopted architecture is to use the NSO as an engine in Crosswork Hierarchical Controller with the programmability options as provided by service function packs.

About NSO:

- NSO is a model-driven (YANG) platform for automating your network orchestration. It supports multi-vendor networks through a rich variety of Network Element Drivers (NEDs).
- NSO supports the process of validating, implementing, and abstracting the network config and network services, providing support for the entire transformation into intent based networking.

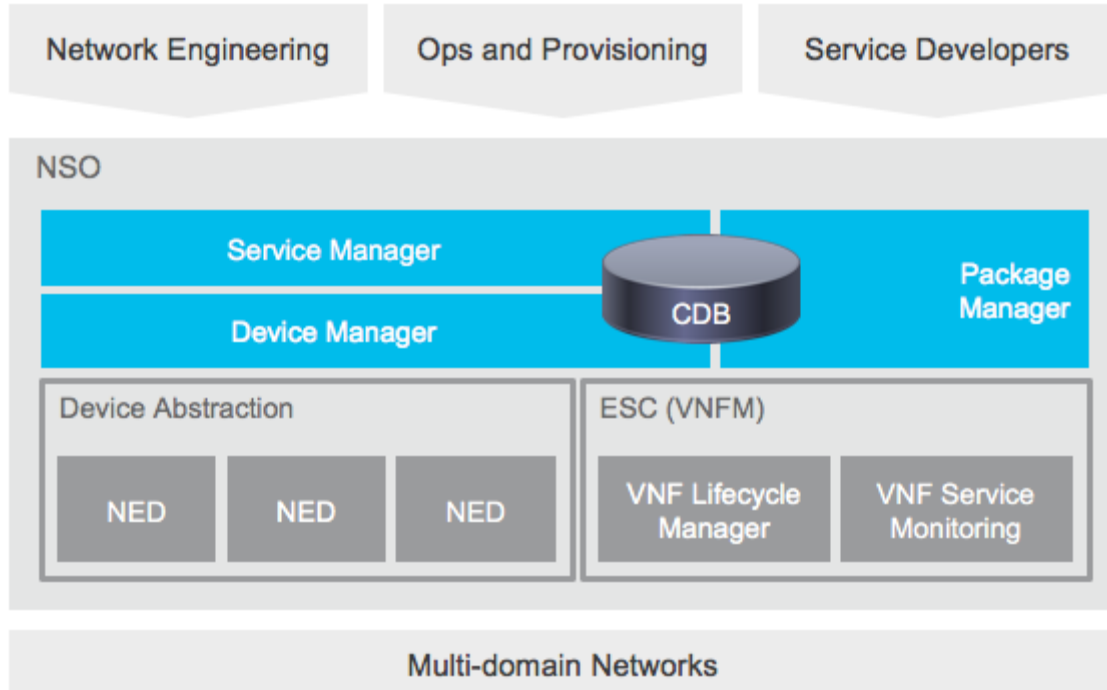


Figure 2.
NSO Overview

NSO has two major components to provide the service CRUD:

- **NED** – a driver to map the relevant get and set operations towards a device or controller and provide them as a YANG model that can contain configuration, NED provides a device configuration model (device can be controller as well). The NEDs for IP COs implement the LxNM model as exposed by the vendors.
- **Function pack** – a template of service specific configuration and the mapping to NED model. A function pack can abstract the service request, can include a complex processing to generate the request to the NED. Such processing can be to decompose a request into multiple NEDs, use topology info to complete configuration not provided by user, and more. Crosswork Hierarchical Controller is going to provide function packs for all service types supported. The long term target is to **allow** local operator's teams to customize function packs and adjust them to their needs. It can be used to extend configuration, add policies, and change abstraction level.

Note: Since optical services are not handled in NSO, NSO has no intervention in deployment of optical use cases.

Unified Architecture

The unified architecture of the Crosswork Hierarchical Controller solution has the NetFusion engine and the NSO engines installed side by side. In the southbound, both NetFusion and NSO communicate with the domain controller.

In the Northbound interface

- NSO engine provides Restconf, IETF based interface to L2-VPN and L3-VPN service CRUD (Create, Read, Update, Delete)
- NetFusion engine provides Rest based interface to get full topology, inventory, and TE paths, all using SHQL queries embedded into Rest APIs, and get traffic utilization APIs for ports and TE tunnels.

Each of the engines has a high availability solution, with multiple instances on separate nodes. This is transparent to TDO as per engine there is VIP (Virtual IP) that redirects traffic to the active node.

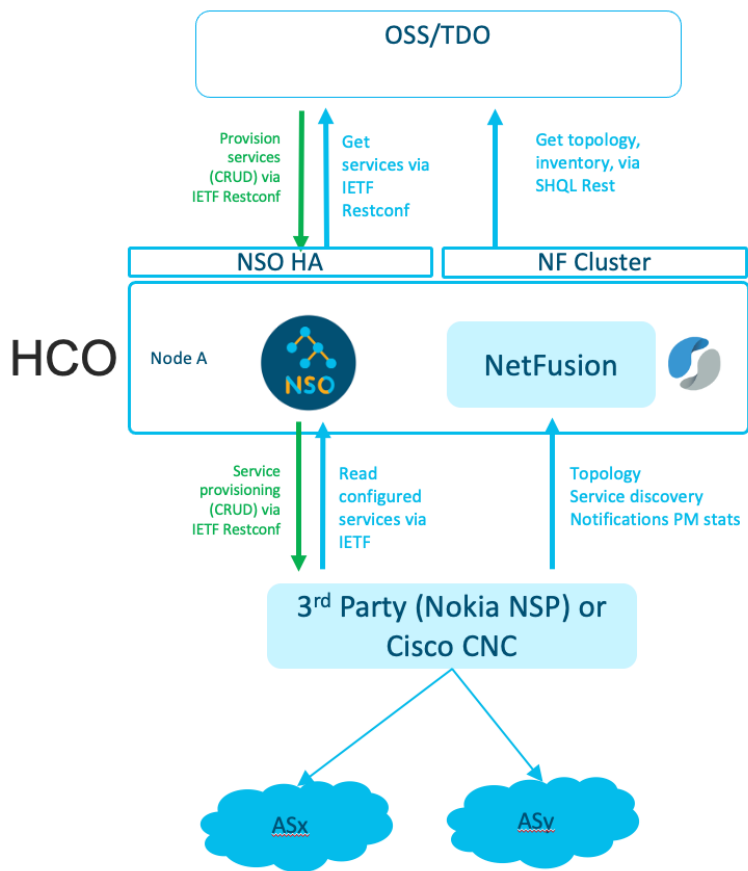


Figure 3.
Crosswork Hierarchical Controller Architecture

L2-VPN and L3-VPN Services on NSP Controllers

Cisco Crosswork Network Services Orchestrator (NSO) uses the NSP Function Pack to provision L2-VPN or L3-VPN services on the NSP controllers.

Once the services are provisioned using NSO (using the UI or JSON files), they are detected by Crosswork Hierarchical Controller and can be visualized in Explorer and viewed in the Service Assurance application.

NSP Function Pack

1. The NSP Function Pack exposes standard IETF L2 and L3 VPN network data models as service.
2. The NSP Function Pack interacts with the Cisco NSP NED to realize the L2 and L3 VPN services.
3. The Cisco NSP NED is RESTCONF based, and services are committed to the NSP controllers synchronously.
4. The IETF Models are extended to accommodate plan data models to showcase the service progress.

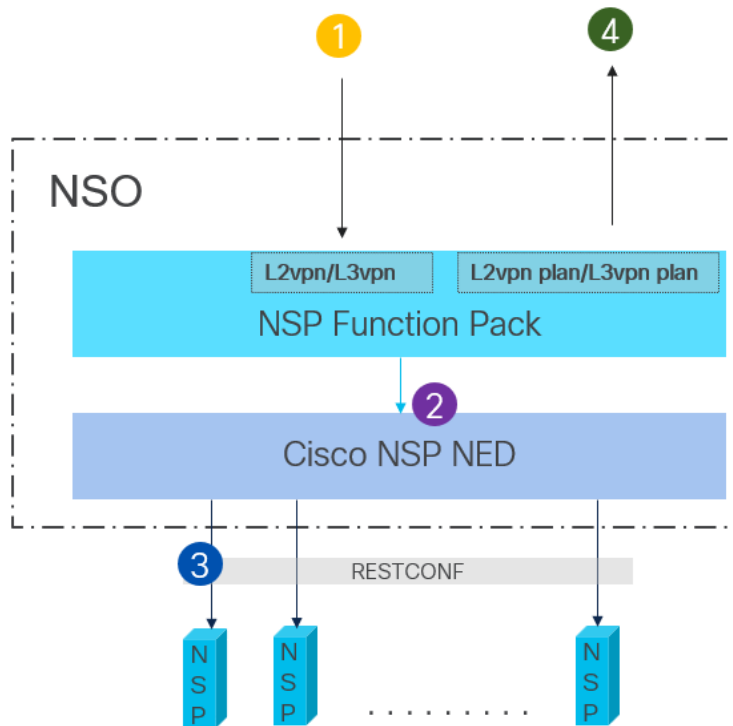


Figure 4.
NSP Function Pack

5. The `vpn-service` model under `l2vpn-ntw` and `l3vpn-ntw` are the NSO services.
6. The `vpn-service-plan` data model represents a simple vpn-service plan.
7. A specific `nsp-controller` for a given `vpn-service` can be set under `nsp-controller`.
8. The function pack allows for a global default `nsp-controller`.

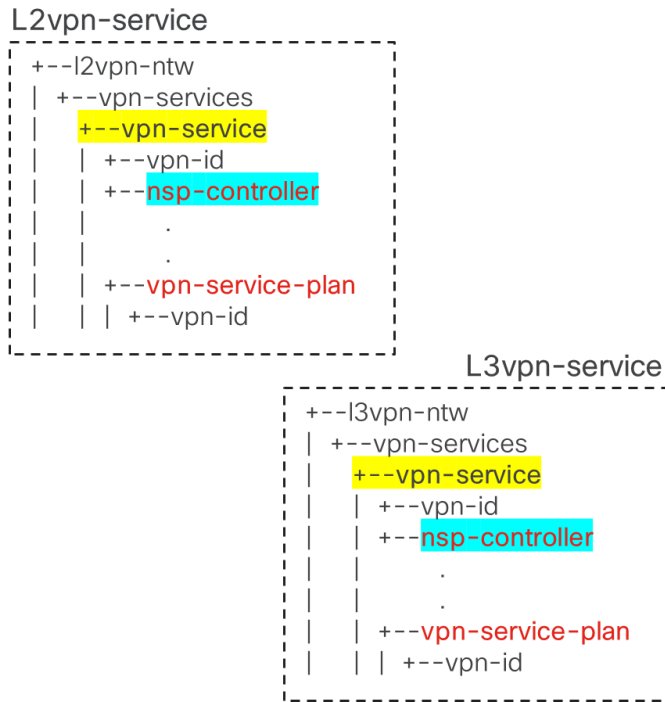


Figure 5.
NSP Data Model

Initial Discovery Workflow

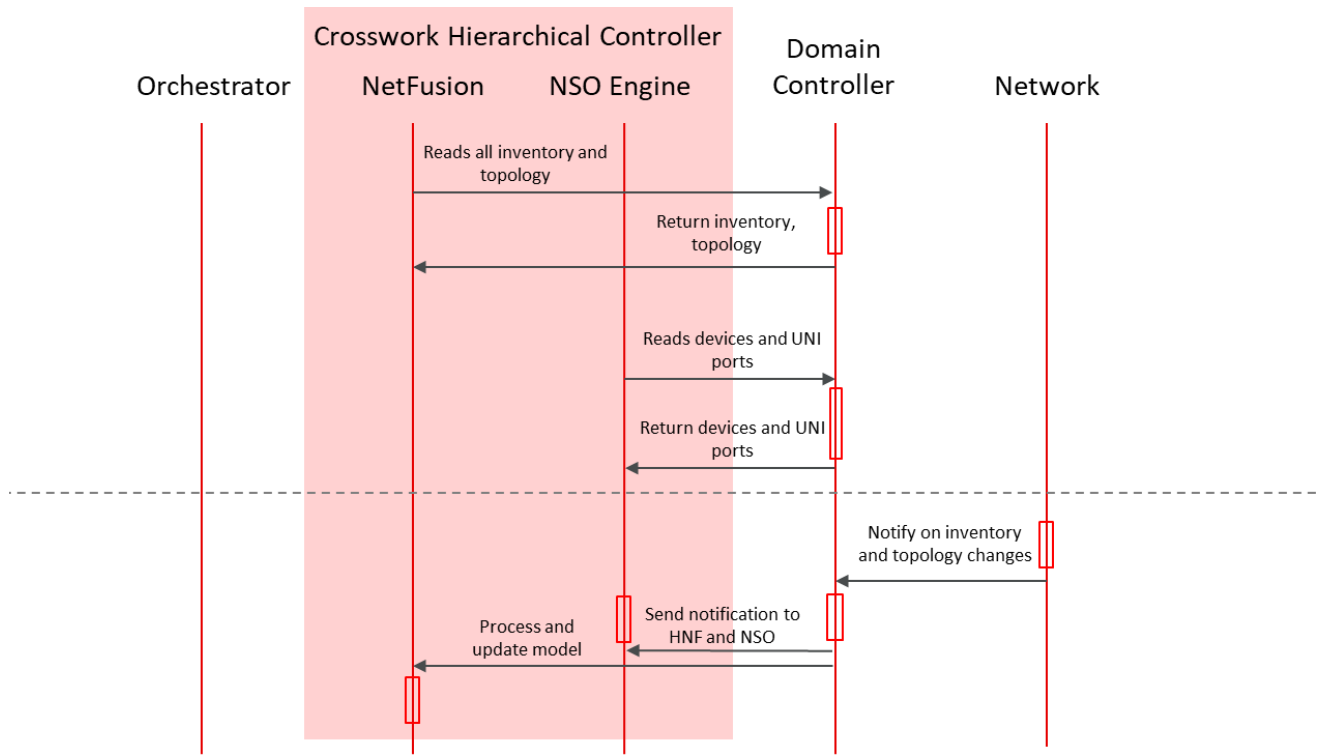


Figure 6.
Initial Discovery Workflow

Provisioning Workflow

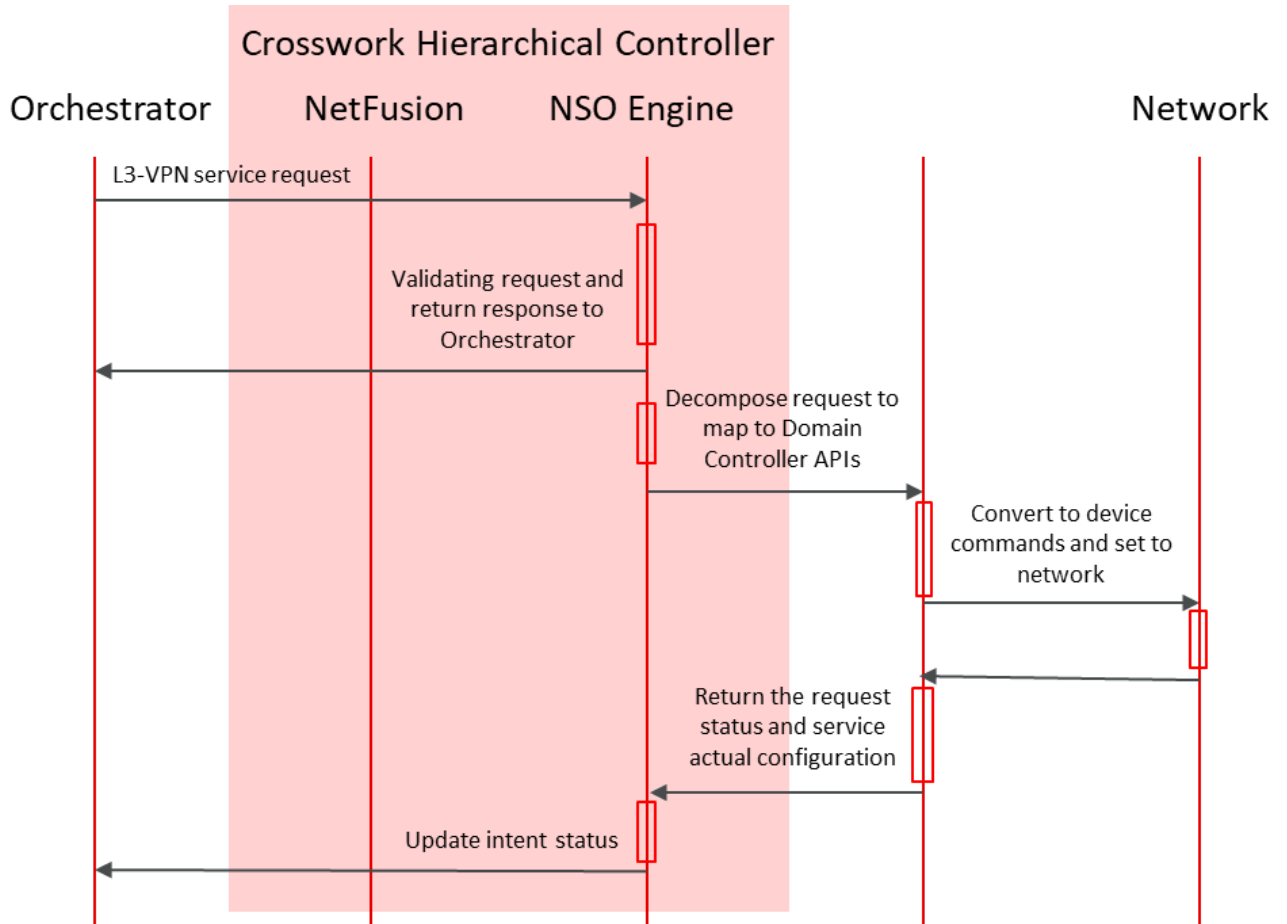


Figure 7.
Provisioning Workflow

Service Discovery Workflow

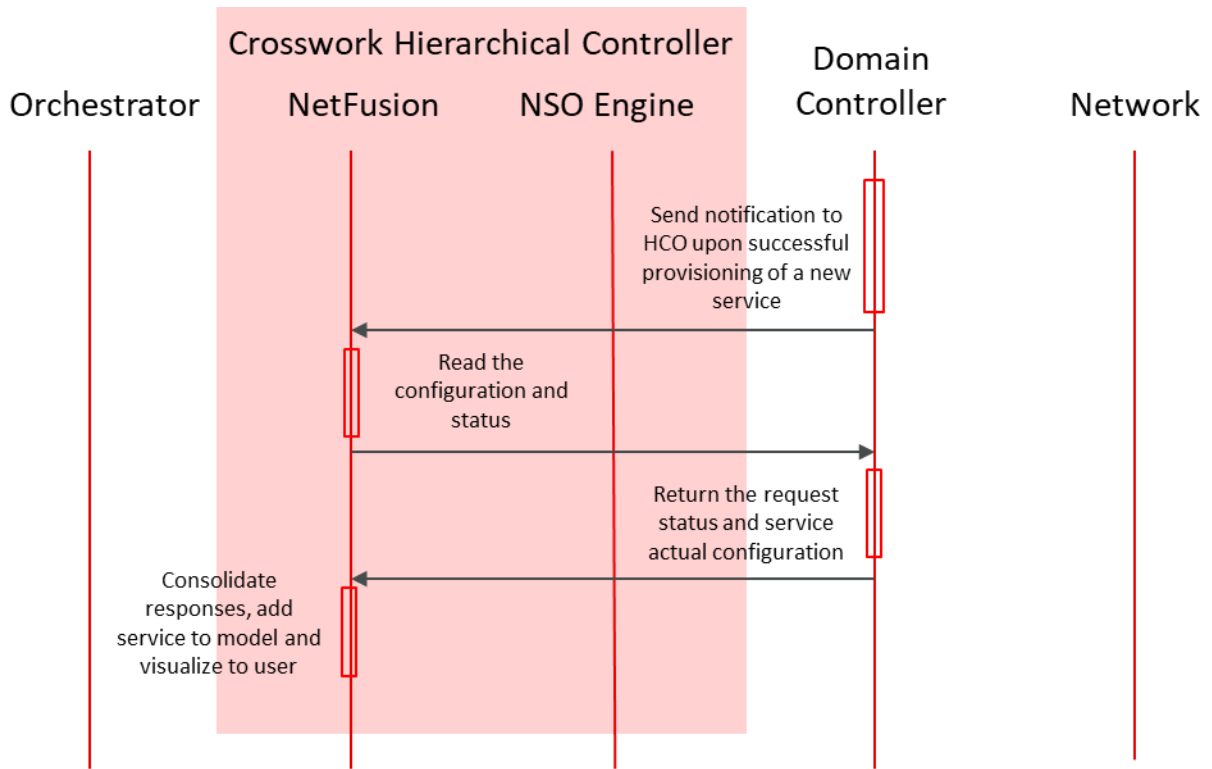


Figure 8.
Service Discovery Workflow

Configure L3-VPN using NSO (JSON)

For full details on L3-VPN service provisioning using NSO, see the *Cisco NSO Crosswork Hierarchical Controller - Function Pack User Guide*.

The L3-VPN JSON requires the following high-level structure.

```
{
  "ietf-l3vpn-ntw:l3vpn-ntw":{
    "vpn-services":{
      "vpn-service":[
        {
          "vpn-id":"Kobi100",
          "vpn-name":"Kobi100",
          "vpn-description":"Kobi100",
          "customer-name":"1",
          "vpn-type":"ietf-vpn-common:l3vpn",
          "vpn-service-topology":"ietf-vpn-common:hub-spoke",
          "status":{},
          "vpn-instance-profiles":{},
          "underlay-transport":{},
          "vpn-nodes":{}
        }
      ]
    }
  }
}
```

This corresponds to the L3-VPN service page in the NSO user interface.

The screenshot displays the Cisco NSO Configuration editor interface. At the top, there is a navigation bar with tabs for 'Edit config', 'Config', 'Operdata', and 'Actions'. The current page is titled 'Configuration editor' and shows the path '/3nm:l3vpn-ntw/vpn-services/vpn-service(Bert222)'. Below the path, there is a link to 'See Bert222 in Service manager'. The main configuration area is divided into several sections:

- vpn-id:** Bert222
- customer-name:** (empty text field)
- vpn-service-topology:** (any-to-any) (dropdown menu)
- vpn-name:** (empty text field)
- parent-service-id:** (empty text field)
- nsp-controller:** (empty text field)
- vpn-description:** (empty text field)
- vpn-type:** Select... (dropdown menu with an information icon)
- status:** (empty text field)
- vpn-instance-profiles:** (empty text field)
- underlay-transport:** (empty text field)
- external-connectivity:** (empty text field)
- vpn-nodes:** (empty text field)

Table 3. Parameters

| Parameter | Description |
|--|---|
| vpn-service | |
| vpn-id | The VPN ID. |
| vpn-name | The VPN name as a string. |
| vpn-description | The VPN description as a string. |
| customer-name | The customer's name exactly as configured in the NSP controller (this is an integer and not a string) |
| vpn-type | The VPN type, ietf-vpn-common:l3vpn. |
| vpn-service-topology | The topology: ietf-vpn-common: hub-spoke or any-to-any . |
| status admin-status status | The status of the vpn-service: vpn-common: admin-up . |
| vpn-instance-profiles | |
| profile-id | The profile ID. |
| rd | The rd. For example, 0:65000:223. |
| address-family | |
| address-family | The address family. For example, ietf-vpn-common:ipv4. |
| vpn-targets | |
| vpn-policies | |
| import-policy | The import policy. |
| export-policy | The export policy. |
| underlay-transport protocol | The underlay-transport: ietf-vpn-common: rsvp-te |
| vpn-nodes | |
| vpn-node | |
| vpn-node-id | The VPN node ID. |
| description | The VPN node description. |
| ne-id | The NE ID. |
| router-id | The router ID. |
| active-vpn-instance-profiles vpn-instance-profile profile-id | The profile ID. |

| Parameter | Description |
|--|---|
| vpn-network-access | |
| id | The VPN network access ID in the format int_<number> , for example, int_223_1. |
| interface-id | The VPN network access interface ID, for example, 1/1/c1/1. |
| description | The VPN network access description. |
| vpn-instance-profile | The VPN network access VPN instance profile. |
| status admin-status status | The status of the VPN network access interface. |
| connection | |
| encapsulation | |
| type | The connection encapsulation type: ietf-vpn-common:dot1q |
| dot1q cvlan-id | The CVLAN ID for the dot1q encapsulation. |
| ip-connection | |
| ipv4 | |
| local-address | The IP connection local address. |
| prefix-length | The IP connection prefix length. |

Detailed JSON Example

```
{
  "ietf-l3vpn-ntw:l3vpn-ntw": {
    "vpn-services": {
      "vpn-service": [
        {
          "vpn-id": "Kobi100",
          "vpn-name": "Kobi100",
          "vpn-description": "Kobi100",
          "customer-name": "1",
          "vpn-type": "ietf-vpn-common:l3vpn",
          "vpn-service-topology": "ietf-vpn-common:hub-spoke",
          "status": {
            "admin-status": {
              "status": "ietf-vpn-common:admin-up"
            }
          }
        },
        {
          "vpn-instance-profiles": {
```

```
"vpn-instance-profile": [
  {
    "profile-id": "profile_1",
    "rd": "0:65000:223",
    "address-family": [
      {
        "address-family": "ietf-vpn-common:ipv4",
        "vpn-targets": {
          "vpn-policies": {
            "import-policy": "Bert-223-Import",
            "export-policy": "Bert-223-Export"
          }
        }
      }
    ]
  }
],
"underlay-transport": {
  "protocol": [
    "ietf-vpn-common:rsvp-te"
  ]
},
"vpn-nodes": {
  "vpn-node": [
    {
      "vpn-node-id": "Bert-223-R1",
      "description": "Bert-223-R1",
      "ne-id": "10.10.10.1",
      "router-id": "10.10.10.1",
      "active-vpn-instance-profiles": {
        "vpn-instance-profile": [
          {
            "profile-id": "profile_1"
          }
        ]
      }
    },
    {
      "status": {
        "admin-status": {
          "status": "ietf-vpn-common:admin-up"
        }
      }
    }
  ],
}
```

```

"vpn-network-accesses": {
  "vpn-network-access": [
    {
      "id": "int_223_1",
      "interface-id": "1/1/c1/1",
      "description": "int_223_1",
      "vpn-instance-profile": "profile_1",
      "status": {
        "admin-status": {
          "status": "ietf-vpn-common:admin-up"
        }
      },
      "connection": {
        "encapsulation": {
          "type": "ietf-vpn-common:dot1q",
          "dot1q": {
            "cvlan-id": 223
          }
        }
      },
      "ip-connection": {
        "ipv4": {
          "local-address": "1.1.1.1",
          "prefix-length": 24
        }
      }
    }
  ]
},
{
  "vpn-node-id": "Bert-223-R5",
  "description": "Bert-223-R5",
  "ne-id": "10.10.10.5",
  "router-id": "10.10.10.5",
  "active-vpn-instance-profiles": {
    "vpn-instance-profile": [
      {
        "profile-id": "profile_1"
      }
    ]
  }
},

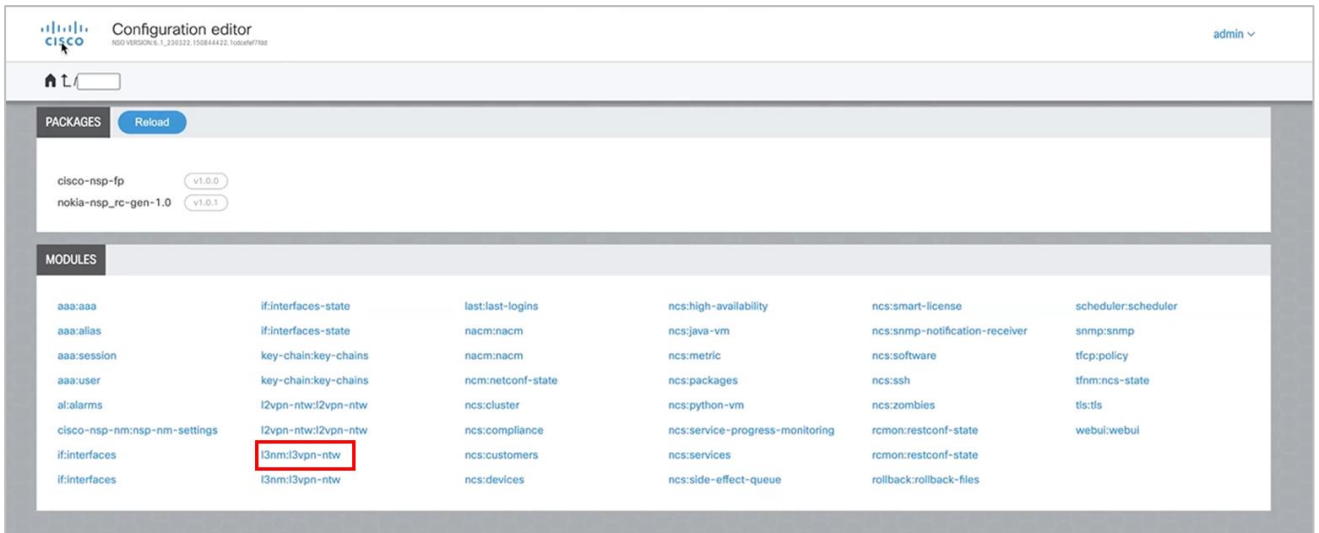
```


Configure L3-VPN using NSO (UI)

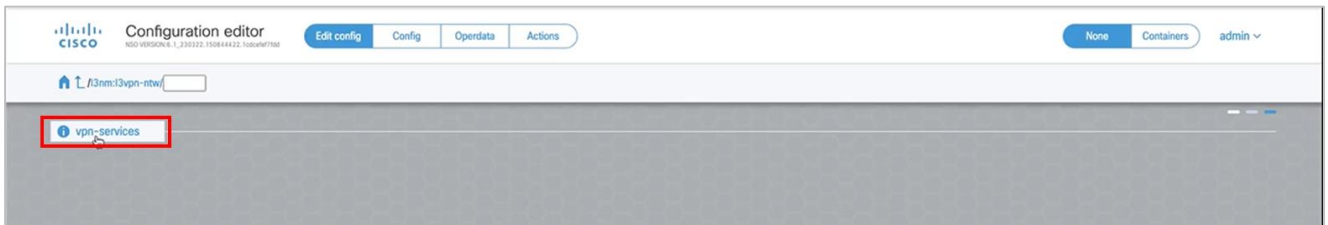
To add a L3-VPN service, add two VPN nodes, each with their interface. This is useful for testing a L3-VPN service.

To add an L3-VPN:

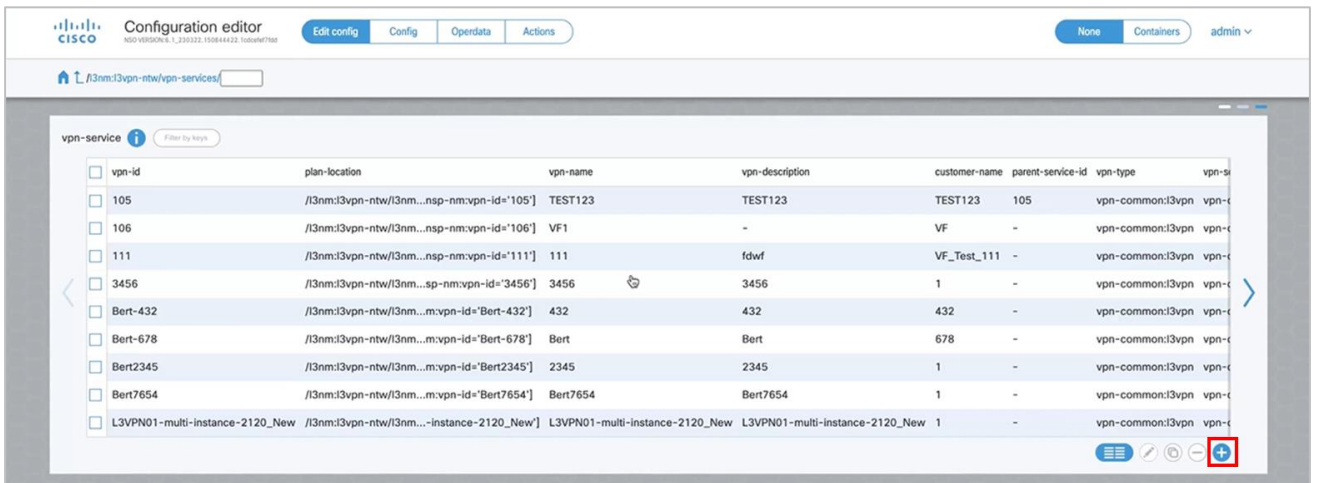
1. Launch NSO.



2. Click I3nm:I3vpn-ntw.



3. Click vpn-services.



4. Click +.

Add new list item

vpn-id

5. Enter a unique **vpn-id** and click **confirm**.

Configuration editor

NSO VERSION: 6.1.3.0.0.22 15084422 106467768

Edit config Config Operdata Actions

None Containers admin

/3nm:3vpn-ntw/vpn-services/

vpn-service Filter by keys

| vpn-id | plan-location | vpn-name | vpn-description | customer-name | parent-service-id | vpn-type | vpn- |
|--|--|---------------------------------|---------------------------------|---------------|-------------------|-----------------|------|
| <input type="checkbox"/> 105 | /3nm:3vpn-ntw/3nm...nsp-nm:vpn-id='105'] | TEST123 | TEST123 | TEST123 | 105 | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> 106 | /3nm:3vpn-ntw/3nm...nsp-nm:vpn-id='106'] | VF1 | - | VF | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> 111 | /3nm:3vpn-ntw/3nm...nsp-nm:vpn-id='111'] | 111 | fdwf | VF_Test_111 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> 3456 | /3nm:3vpn-ntw/3nm...sp-nm:vpn-id='3456'] | 3456 | 3456 | 1 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> Bert-432 | /3nm:3vpn-ntw/3nm...m:vpn-id='Bert-432'] | 432 | 432 | 432 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> Bert-678 | /3nm:3vpn-ntw/3nm...m:vpn-id='Bert-678'] | Bert | Bert | 678 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> Bert222 | - | - | - | - | - | - | vpn- |
| <input type="checkbox"/> Bert2345 | /3nm:3vpn-ntw/3nm...m:vpn-id='Bert2345'] | 2345 | 2345 | 1 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> Bert7654 | /3nm:3vpn-ntw/3nm...m:vpn-id='Bert7654'] | Bert7654 | Bert7654 | 1 | - | vpn-common:3vpn | vpn- |
| <input type="checkbox"/> L3VPN01-multi-instance-2120_New | /3nm:3vpn-ntw/3nm...-instance-2120_New'] | L3VPN01-multi-instance-2120_New | L3VPN01-multi-instance-2120_New | 1 | - | vpn-common:3vpn | vpn- |

6. Click the **vpn service**.

Configuration editor

NSO VERSION: 6.1.3.0.0.22 15084422 106467768

Edit config Config Operdata Actions

None Containers admin

/3nm:3vpn-ntw/vpn-services/vpn-service/Bert222/

See 'Bert222' in Service manager

vpn-id Bert222

customer-name

vpn-service-topology (any-to-any)

vpn-name

parent-service-id

nsp-controller

vpn-description

vpn-type Select...

status

vpn-instance-profiles

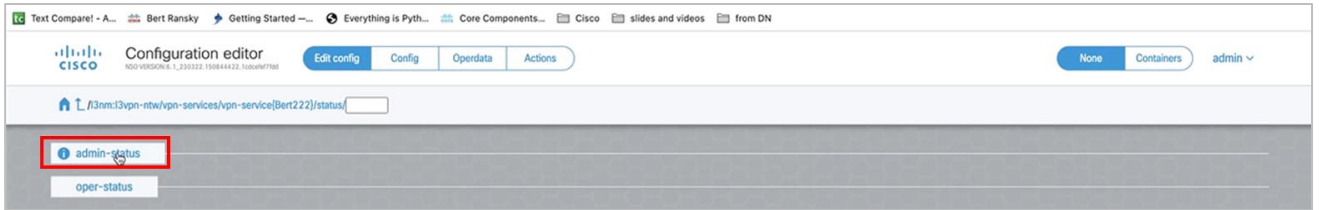
underlay-transport

external-connectivity

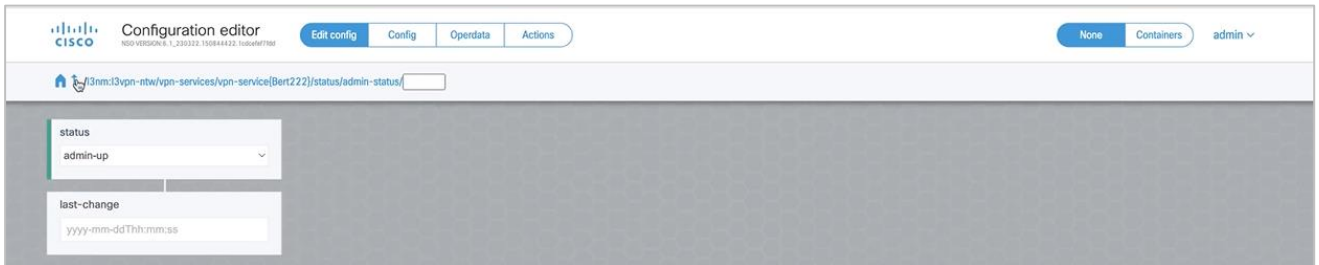
vpn-nodes

7. Enter the **customer-name** exactly as configured in the NSP controller (this is an integer and not a string).
8. Enter the **vpn-name** as a string.
9. Enter the **vpn-description** as a string.
10. Set the **vpn-type** to **I3vpn**.
11. Set the **vpn-service-topology** to **hub-spoke** or **any-to-any**.

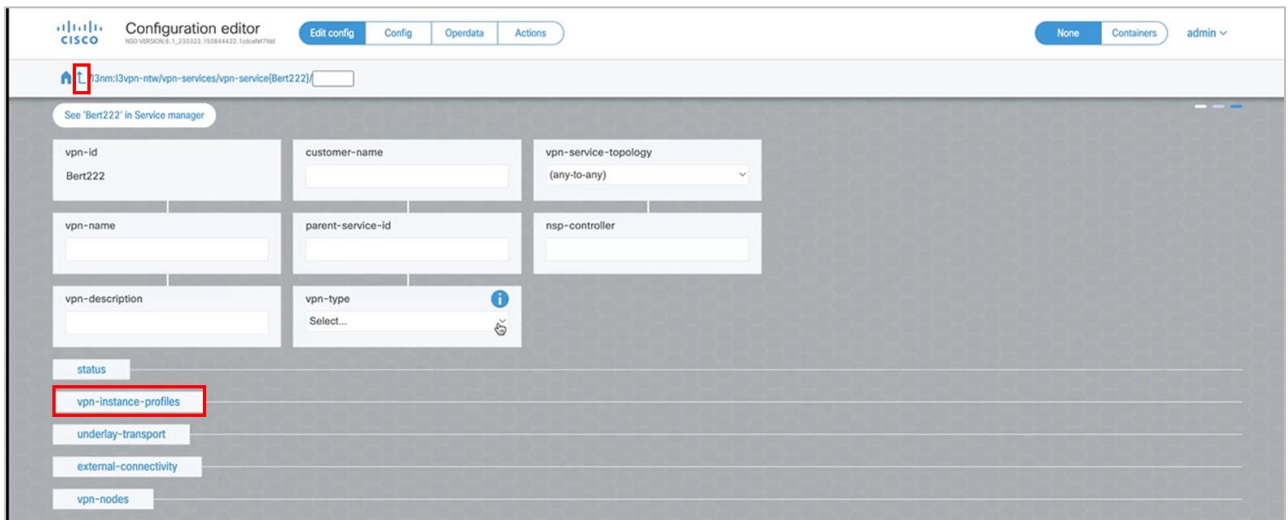
- Select the **nsp-controller** (if there is a default nsp-controller, then you can skip this).
- Click **status**.



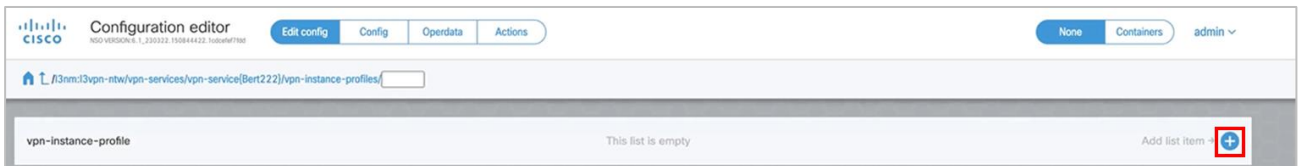
- Click **admin-status**, and then set the **status** to **admin-up**.



- Return to the vpn (using the breadcrumbs at the top of the page).



- Click **vpn-instance-profiles**.



- Click **+**.

Add new list item

profile-id

profile-id

cancel confirm

18. Enter a **profile-id** and then click **confirm**.

Configuration editor

None Containers admin

See "Bert222" in Service manager

| profile-id | role |
|------------|----------------------------|
| profile_1 | vpn-common:any-to-any-role |

19. Click on the profile.

Configuration editor

None Containers admin

See "Bert222" in Service manager

profile-id

profile_1

role

(any-to-any-role)

local-as

rd-choice

directly-assigned directly-assigned-suffix auto-assigned auto-assigned-suffix no-rd

rd

address-family

This list is empty Add list item +

multicast

20. Enter the **rd** in the **directly-assigned** tab.

21. Click **+** in the **address-family**.

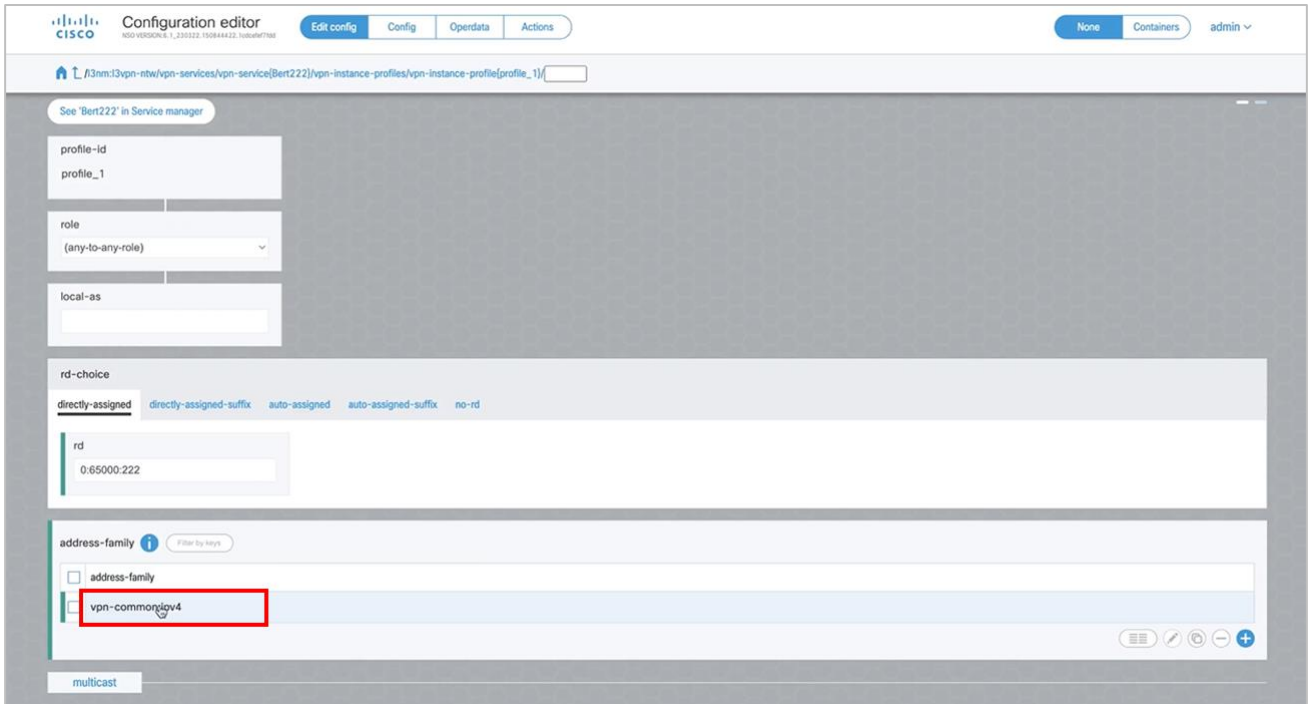
Add new list item

address-family

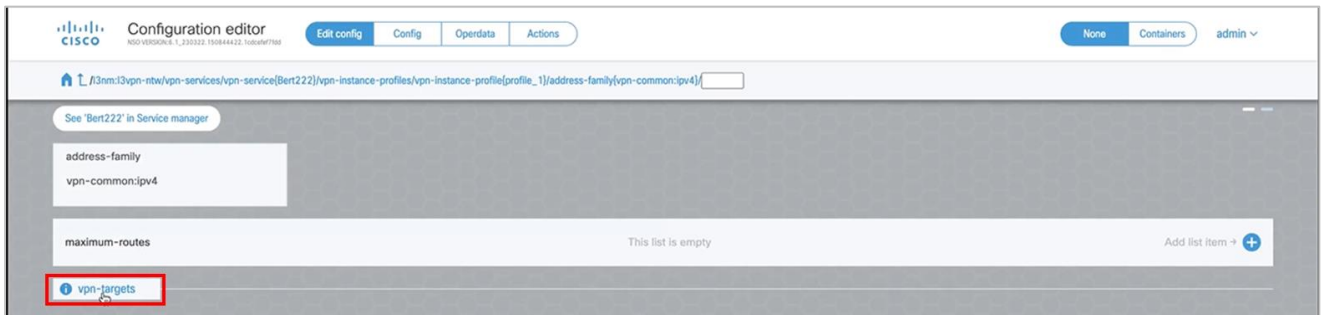
ipv4

cancel confirm

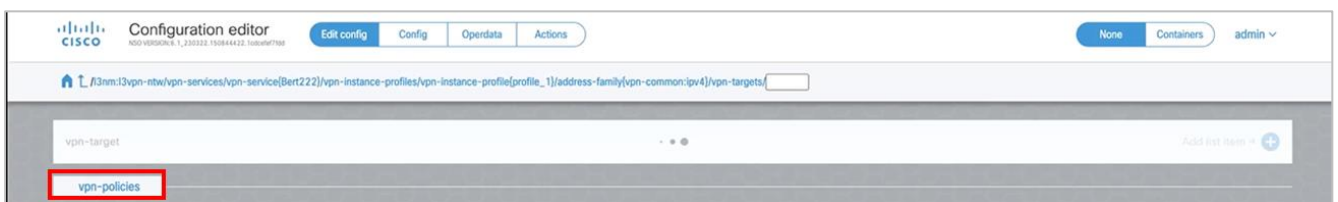
22. Select **ipv4** and click **confirm**.



23. Click on the address-family.



24. Click **vpn-targets**.



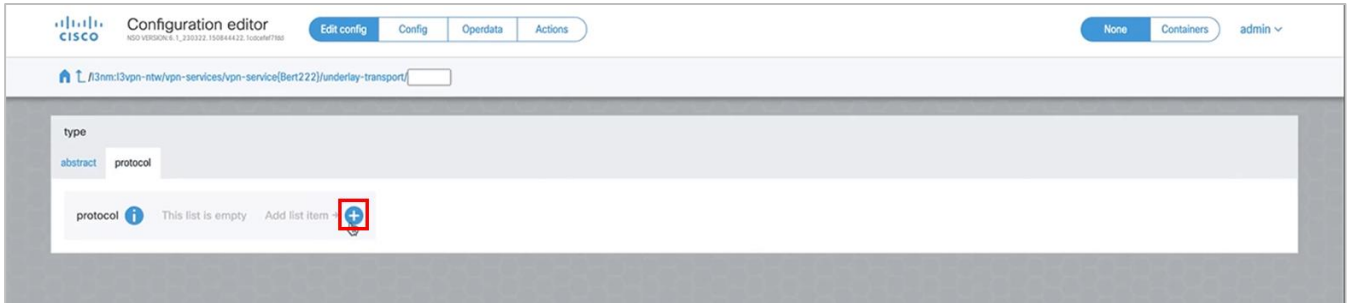
25. Click **vpn-policies**.



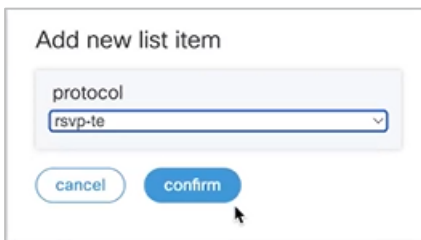
26. Specify the **import-policy** and **export-policy**.

27. Navigate back to the L3VPN service page and click **underlay-transport**.

28. Select the **protocol** tab.

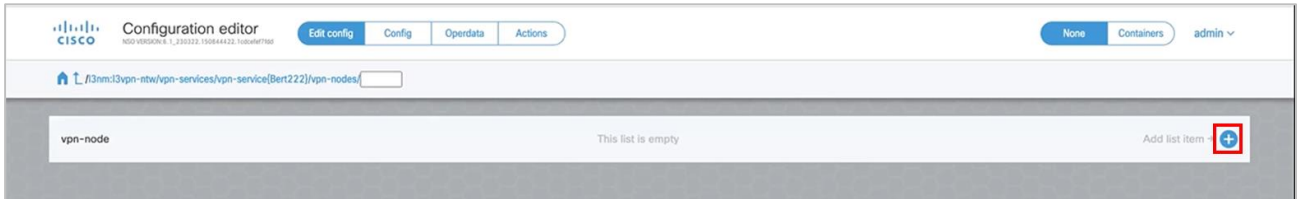


29. Click **+**.

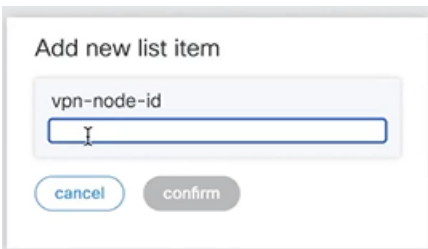


30. Select **rsvp-te** and click **confirm**.

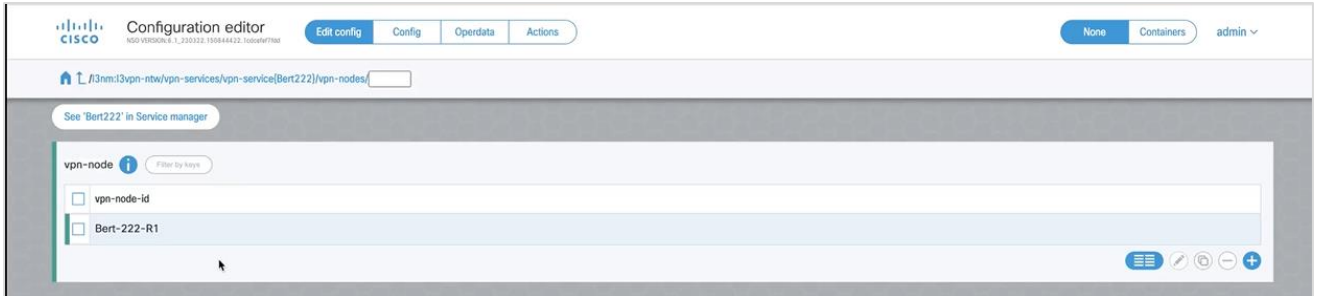
31. Navigate back to the L3VPN service page and click **vpn-nodes** (**external-connectivity** is not required).



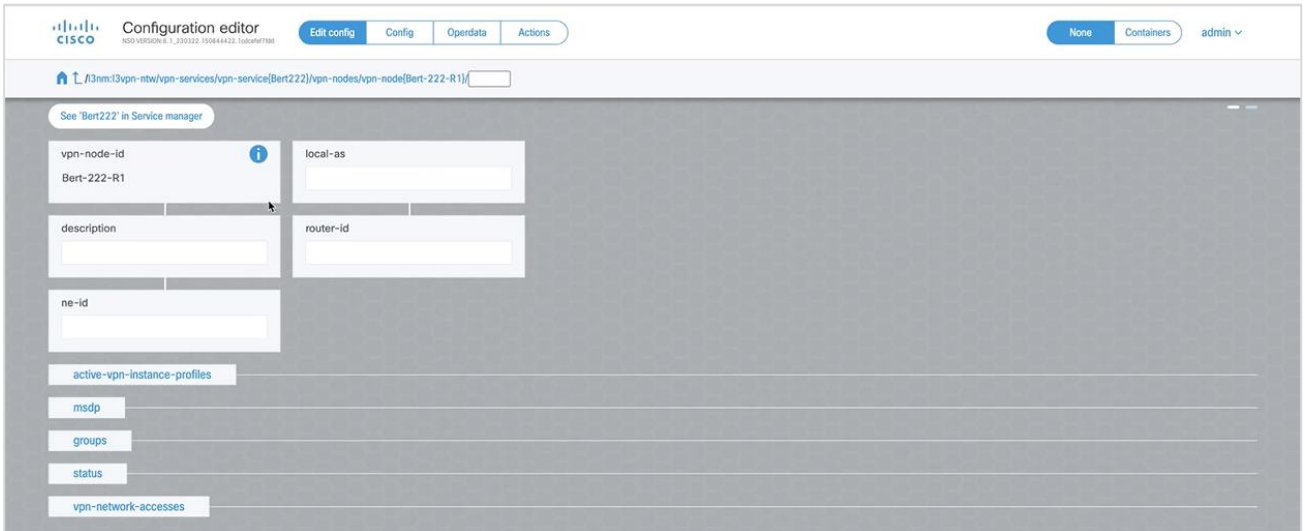
32. Click **+**. The vpn=node is a router participating in the VPN. For example, R1 and R5 in this topology.



33. Enter the **vpn-node-id** and click **confirm**. This will appear on the router as the endpoint of the tunnel.



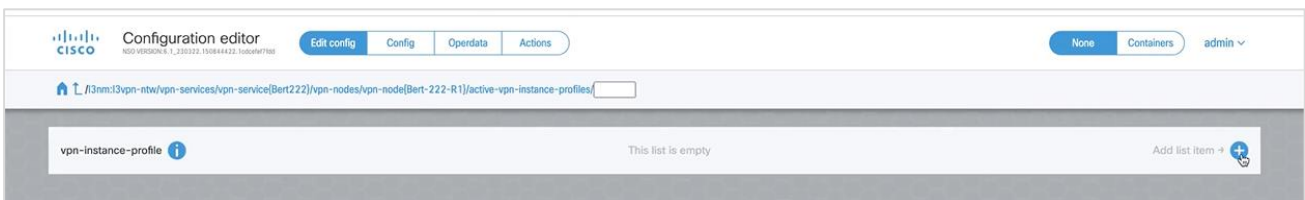
34. Click on the **vpn-node**.



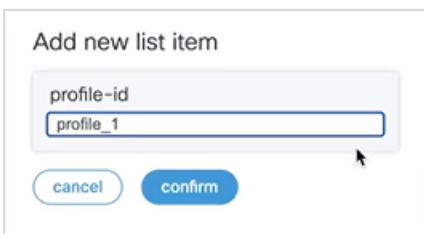
35. Enter a **description**.

36. Specify the **router-id** and the **ne-id**.

37. Click **active-vpn-instance-profiles**.



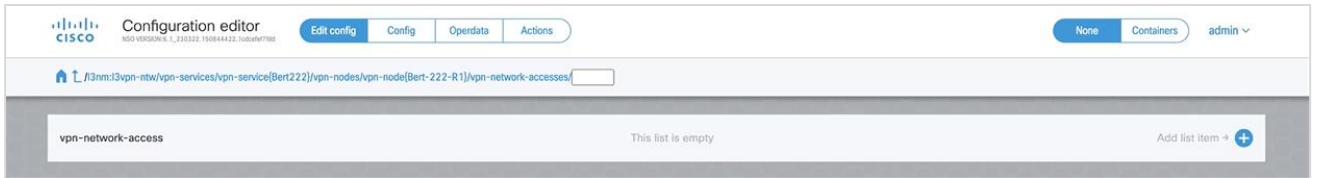
38. Click **+**.



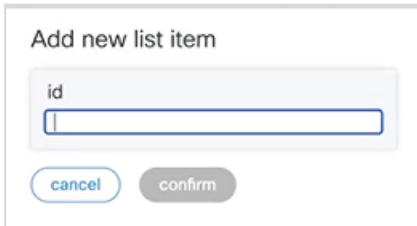
39. Enter a **profile-id** and click **confirm**.

40. Navigate back to the **vpn-node** page and click **status**. And as done previously, set this to **admin-up**.

41. Navigate back to the **vpn-node** page and click **vpn-network-accesses**.

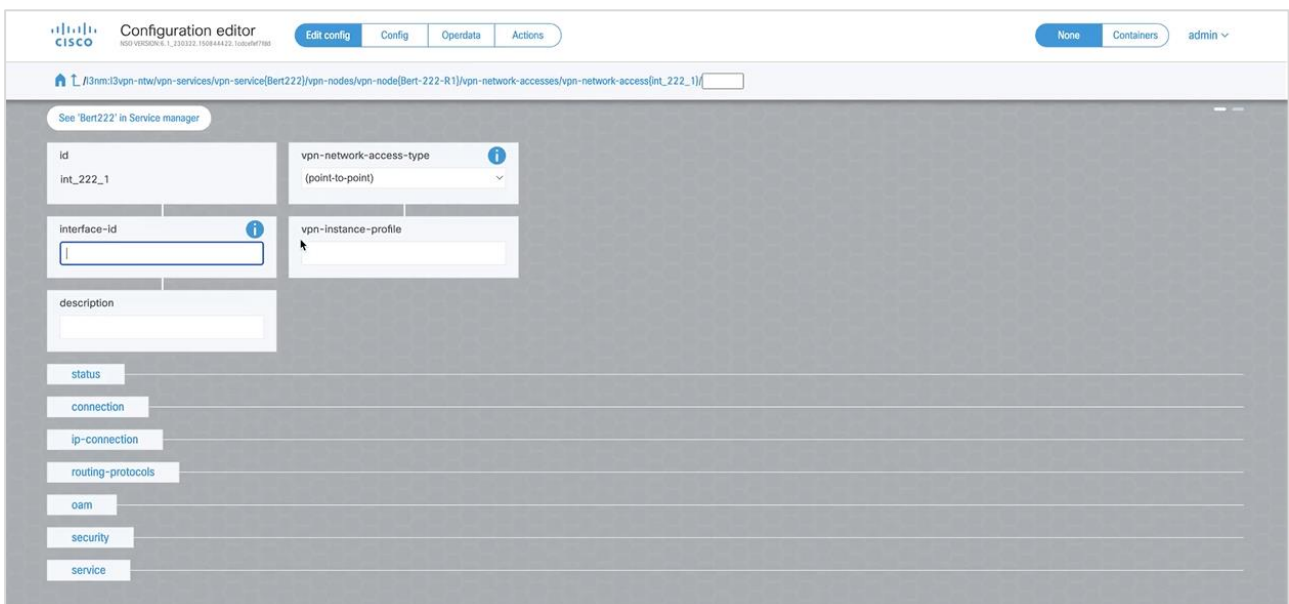


42. Click +. This defines the interfaces participating in the VPN.



43. Specify the interface **id** and click **confirm**. This is in the format **int_<number>**, for example, **int_222_1**.

44. Click on the interface.



45. Enter the **interface_id**. This is the interface name, for example, from R1

46. Enter the **description** as a string.

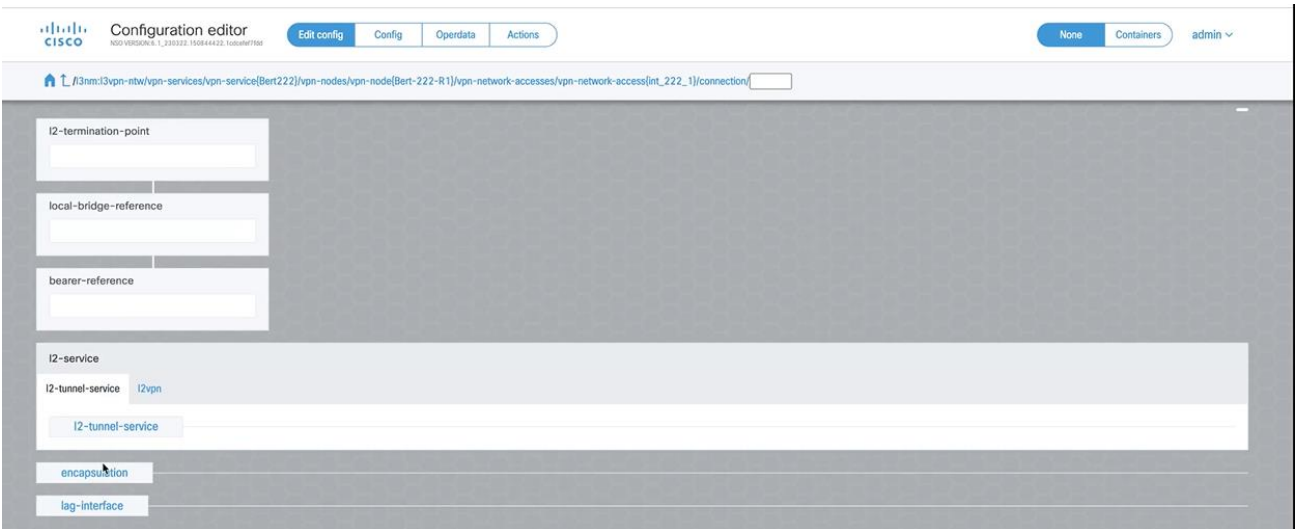
47. Select the **vpn-instance-profile**.

48. Click **status**.

49. Click **admin-status**, and then set the **status** to **admin-up**.

50. Navigate back to the interface page.

51. Click **Connection**.

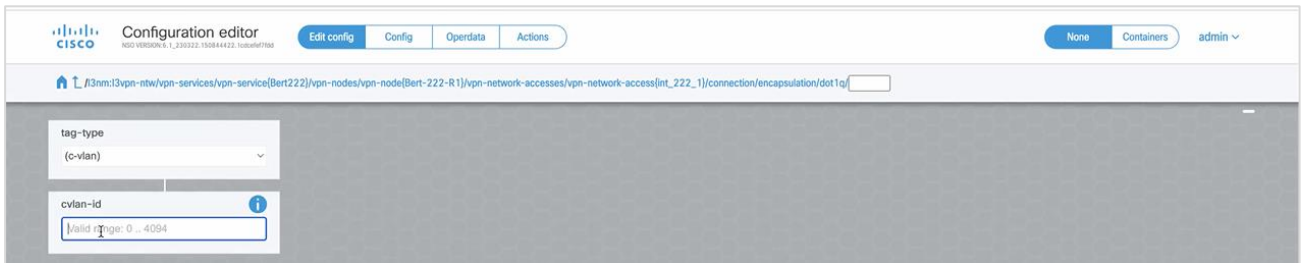


52. Click **encapsulation**.



53. Set the **type** to **dot1q**.

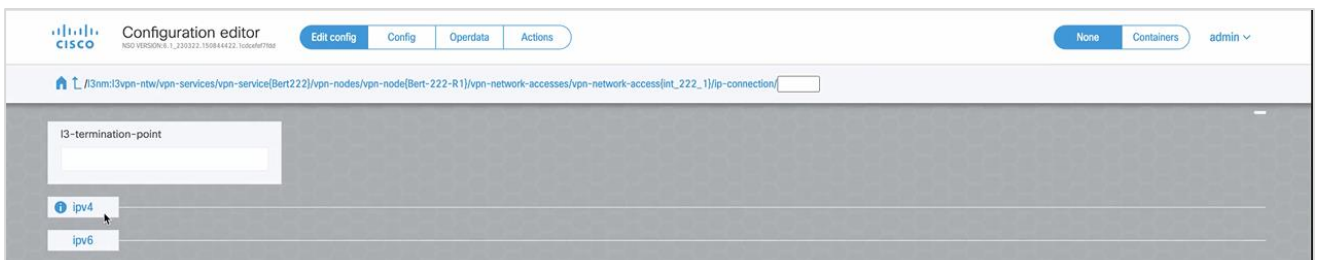
54. Click **dot1q**.



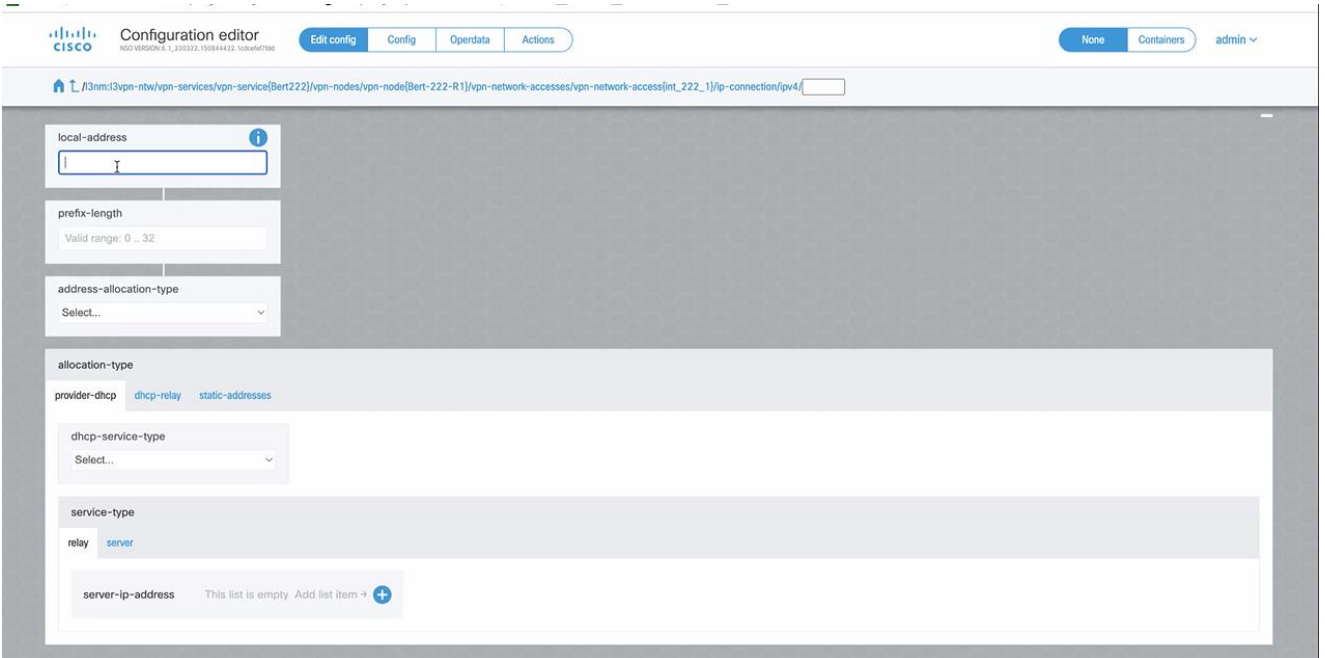
55. Enter the **cvlan-id**.

56. Navigate back to the interface page.

57. Click **ip-connection**.



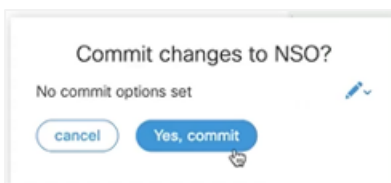
58. Select **ipv4**.



59. Enter the **local-address**.
60. Enter the **prefix-length**.
61. Navigate back to the VPN service page.
62. Add another **vpn-node** following the process previously described to also add an interface.
63. Click Commit Manager (at the bottom of the screen).



64. Review the configuration.
65. Click **Commit**.



66. Click **Yes, commit**.
67. Once it has finished, check the VPN.

```

R5-PE# show service id "Bert-222-R5"
R5-PE>show>service>id# all

-----
Service Detailed Information
-----
Service Id       : 39                Vpn Id           : 0
Service Type    : VPRN
MACSec enabled  : no
Name            : Bert-222-R5
Description     : Bert-222-R5
Customer Id     : 1                Creation Origin  : manual
Last Status Change: 04/05/2023 12:16:51
Last Mgmt Change : 04/05/2023 12:16:51
Admin State     : Up                Oper State       : Up

Router Oper State : Up
Route Dist.      : 65000:222        VPRN Type       : regular
Oper Route Dist  : 65000:222
Oper RD Type     : configured
AS Number       : None             Router Id        : 10.10.10.5
ECMP             : Enabled          ECMP Max Routes : 1
Max IPv4 Routes  : No Limit

Auto Bind Tunnel
Resolution       : filter
Filter Protocol  : rsvp
Weighted ECMP   : Disabled          ECMP Max Routes : 1

Max IPv6 Routes  : No Limit
Ignore NH Metric : Disabled
Hash Label      : Disabled
Entropy Label   : Disabled
Vrf Target      : None
Vrf Import      : Bert-222-Import
Vrf Export      : Bert-222-Export
VPN Vrf Target  : None
VPN Vrf Import  : None
VPN Vrf Export  : None
Car. Sup C-VPN  : Disabled
Label mode      : vrf
MGP VPN Backup  : Disabled
MGP Export Inactv : Disabled
LOG all events  : Disabled

Press any key to continue (Q to quit)

```

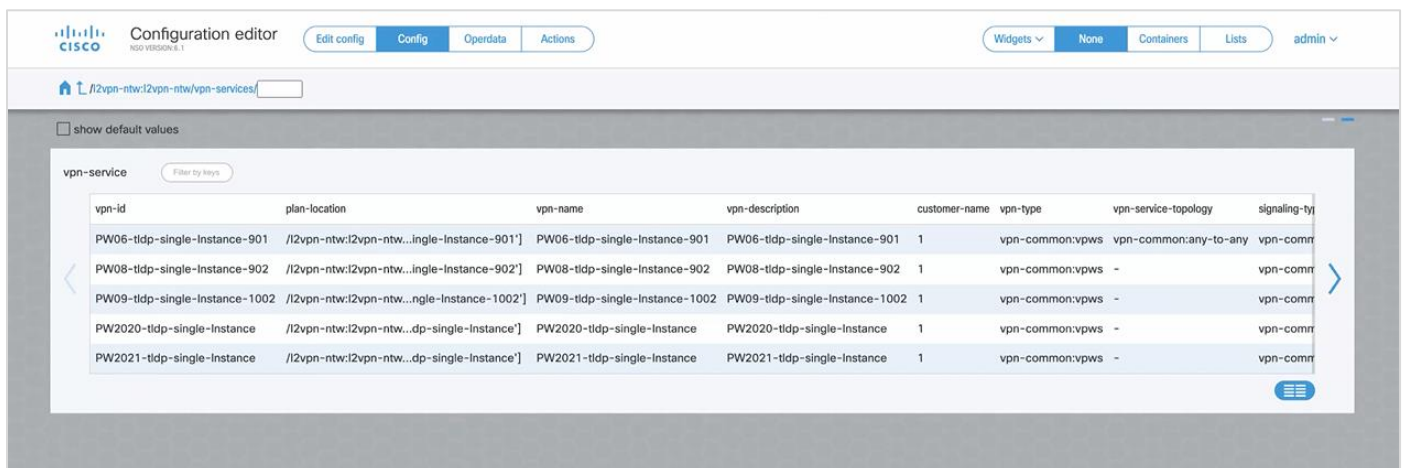
Configure L2-VPN using NSO (JSON)

For full details on L2-VPN service provisioning using NSO, see the *Cisco NSO Crosswork Hierarchical Controller - Function Pack User Guide*.

The L2-VPN JSON requires the following high-level structure.

```
{
  "ietf-l2vpn-ntw:l2vpn-ntw":{
    "vpn-services":{
      "vpn-service":[
        {
          "vpn-id":"Kobi100",
          "vpn-name":"Kobi100",
          "vpn-description":"Kobi100",
          "customer-name":"1",
          "vpn-type":"ietf-vpn-common:vpws",
          "vpn-service-topology":"ietf-vpn-common:any-to-any",
          "signaling-type":"ietf-vpn-common:ldp-signaling",
          "underlay-transport":{},
          "status":{},
          "vpn-nodes":{}
        }
      ]
    }
  }
}
```

This corresponds to the L2-VPN service page in the NSO user interface.



| vpn-id | plan-location | vpn-name | vpn-description | customer-name | vpn-type | vpn-service-topology | signaling-type |
|--------------------------------|--|--------------------------------|--------------------------------|---------------|-----------------|-----------------------|----------------|
| PW06-tldp-single-Instance-901 | /l2vpn-ntw:l2vpn-ntw...ngle-Instance-901] | PW06-tldp-single-Instance-901 | PW06-tldp-single-Instance-901 | 1 | vpn-common:vpws | vpn-common:any-to-any | vpn-comm |
| PW08-tldp-single-Instance-902 | /l2vpn-ntw:l2vpn-ntw...ngle-Instance-902] | PW08-tldp-single-Instance-902 | PW08-tldp-single-Instance-902 | 1 | vpn-common:vpws | - | vpn-comm |
| PW09-tldp-single-Instance-1002 | /l2vpn-ntw:l2vpn-ntw...ngle-Instance-1002] | PW09-tldp-single-Instance-1002 | PW09-tldp-single-Instance-1002 | 1 | vpn-common:vpws | - | vpn-comm |
| PW2020-tldp-single-Instance | /l2vpn-ntw:l2vpn-ntw...dp-single-Instance] | PW2020-tldp-single-Instance | PW2020-tldp-single-Instance | 1 | vpn-common:vpws | - | vpn-comm |
| PW2021-tldp-single-Instance | /l2vpn-ntw:l2vpn-ntw...dp-single-Instance] | PW2021-tldp-single-Instance | PW2021-tldp-single-Instance | 1 | vpn-common:vpws | - | vpn-comm |

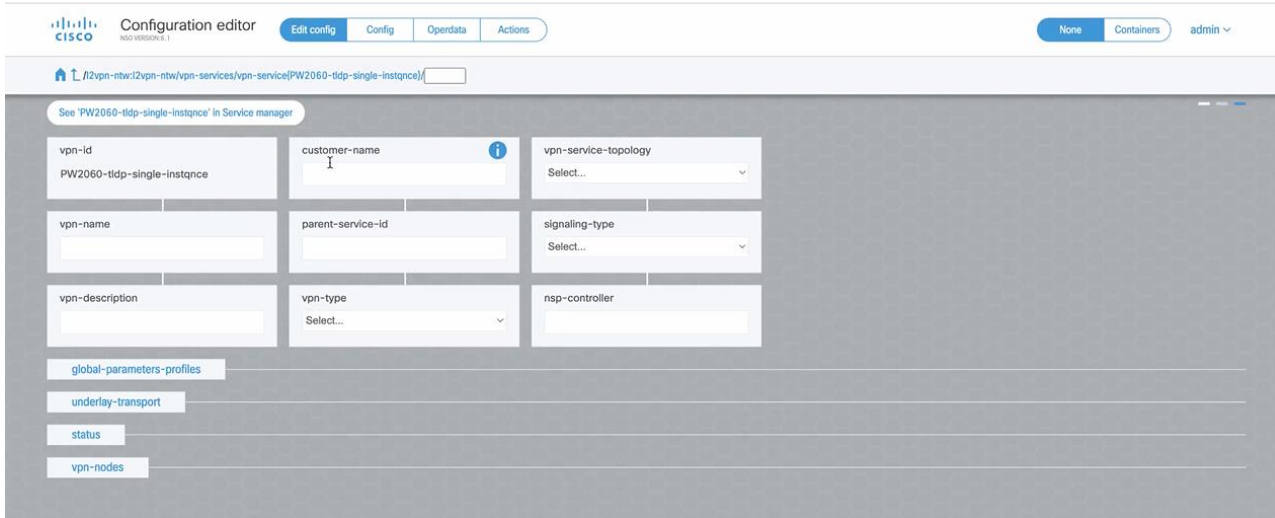


Table 4. Parameters

| Parameter | Description |
|---------------------------|---|
| vpn-service | |
| vpn-id | The VPN ID. |
| vpn-name | The VPN name as a string. |
| vpn-description | The VPN description as a string. |
| customer-name | The customer's name exactly as configured in the NSP controller (this is an integer and not a string) |
| vpn-type | The VPN type: ietf-vpn-common:vpws . |
| vpn-service-topology | The topology: ietf-vpn-common:hub-spoke or any-to-any . |
| signaling-type | The signaling type: ietf-vpn-common:ldp-signaling . |
| underlay-transport | |
| protocol | The underlay-transport: ietf-vpn-common:rsvp-te |
| status | The status of the vpn-service: ietf-vpn-common:admin-up |
| admin-status | |
| status | |
| vpn-nodes | |
| vpn-node | |
| vpn-node-id | The VPN node ID. Use the vpn-id and add -R3 or -R4 as a suffix. |
| description | The VPN node description. |
| ne-id | The NE ID. |
| router-id | The router ID. |
| status | The status of the node: ietf-vpn-common:admin-up |
| admin-status | |

| Parameter | Description |
|------------------------------|---|
| status | |
| signaling-option | |
| signaling-type | The signaling type: ietf-vpn-common:ldp-signaling |
| ldp-or-l2tp | |
| t-ldp-pw-type | The t-ldp-pw-type: ietf-l2vpn-ntw:vpws-type |
| pw-type | The pseudowire type: ietf-l2vpn-ntw:ethernet |
| ac-pw-list | |
| peer-addr | The peer address. When configuring R3, this is R4, and when configuring R4, this is R3. |
| vc-id | The pseudowire id, for example, 2060. |
| pw-priority | The PW priority, for example, 1. |
| vpn-network-accesses | |
| vpn-network-access | |
| id | The VPN network access ID in the format int_<number> , for example, int_223_1 . |
| interface-id | The VPN network access interface ID, for example, Port 1/1/9 . This is the access port and may change according to the router. |
| status | The status of the interface: ietf-vpn-common:admin-up |
| admin-status | |
| status | |
| connection | |
| encapsulation | |
| encap-type | The connection encapsulation type: ietf-vpn-common:dot1q (VLAN) or priority-tagged (port-mode). |
| dot1q/priority-tagged | The CVLAN ID (circuit ID) for the dot1q encapsulation, for example, 2060. |
| cvlan-id | |
| service | |
| mtu | The MTU. |

Detailed JSON Example

```
{
  "ietf-l2vpn-ntw:l2vpn-ntw": {
    "vpn-services": {
      "vpn-service": [
        {
          "vpn-id": "PW2060-tldp-single-instance",

```

```

"vpn-name":"PW2060-tldp-single-instqnce",
"vpn-description":"PW2060-tldp-single-instqnce",
"customer-name":"1",
"vpn-type":"ietf-vpn-common:vpws",
"vpn-service-topology":"ietf-vpn-common:any-to-any",
"signaling-type":"ietf-vpn-common:ldp-signaling",
"underlay-transport":{
  "protocol":[
    "ietf-vpn-common:rsvp-te"
  ]
},
"status":{
  "admin-status":{
    "status":"ietf-vpn-common:admin-up"
  }
},
"vpn-nodes":{
  "vpn-node":[
    {
      "vpn-node-id":"PW2060-tldp-single-instqnce-R3",
      "description":"PW2060-tldp-single-instqnce",
      "ne-id":"10.10.10.3",
      "router-id":"10.10.10.3",
      "status":{
        "admin-status":{
          "status":"ietf-vpn-common:admin-up"
        }
      },
      "signaling-option":{
        "signaling-type":"ietf-vpn-common:ldp-signaling",
        "ldp-or-l2tp":{
          "t-ldp-pw-type":"ietf-l2vpn-ntw:vpws-type",
          "pw-type":"ietf-l2vpn-ntw:ethernet",
          "ac-pw-list":[
            {
              "peer-addr":"10.10.10.4",
              "vc-id":"2060",
              "pw-priority":1
            }
          ]
        }
      }
    }
  ],
},

```

```

"vpn-network-accesses":{
  "vpn-network-access":[
    {
      "id":"1",
      "interface-id":"Port 1/1/9",
      "status":{
        "admin-status":{
          "status":"ietf-vpn-common:admin-up"
        }
      },
      "connection":{
        "encapsulation":{
          "encap-type":"ietf-vpn-common:dot1q",
          "dot1q":{
            "cvlan-id":2060
          }
        }
      },
      "service":{
        "mtu":1492
      }
    }
  ]
},
{
  "vpn-node-id":"PW2060-tldp-single-instance-R4",
  "ne-id":"10.10.10.4",
  "router-id":"10.10.10.4",
  "status":{
    "admin-status":{
      "status":"ietf-vpn-common:admin-up"
    }
  },
  "signaling-option":{
    "signaling-type":"ietf-vpn-common:ldp-signaling",
    "ldp-or-l2tp":{
      "t-ldp-pw-type":"ietf-l2vpn-ntw:vpws-type",
      "pw-type":"ietf-l2vpn-ntw:ethernet",
      "ac-pw-list":[
        {
          "peer-addr":"10.10.10.3",

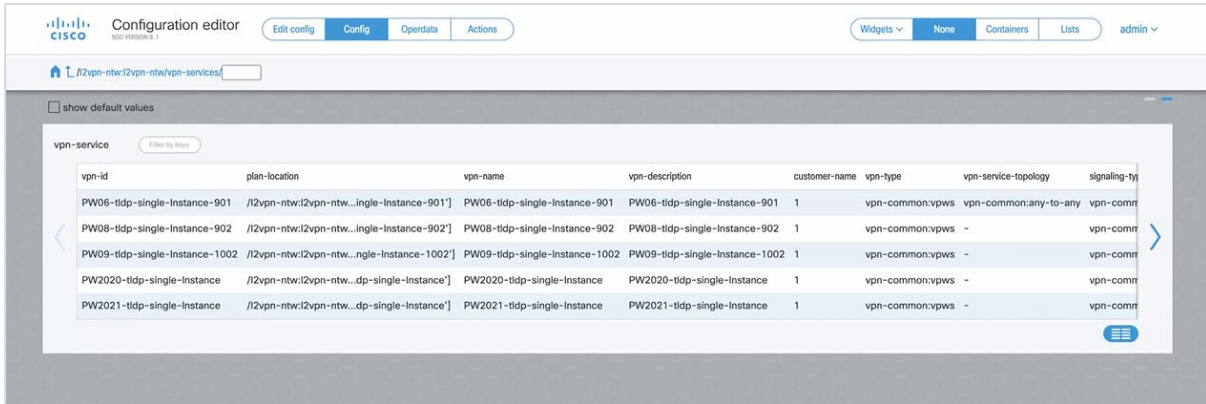
```


Configure L2-VPN using NSO (UI)

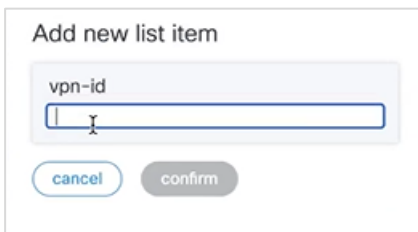
To add an L2-VPN service, add two VPN nodes, each with their interface. This is useful for testing an L2-VPN service.

To add an L2-VPN:

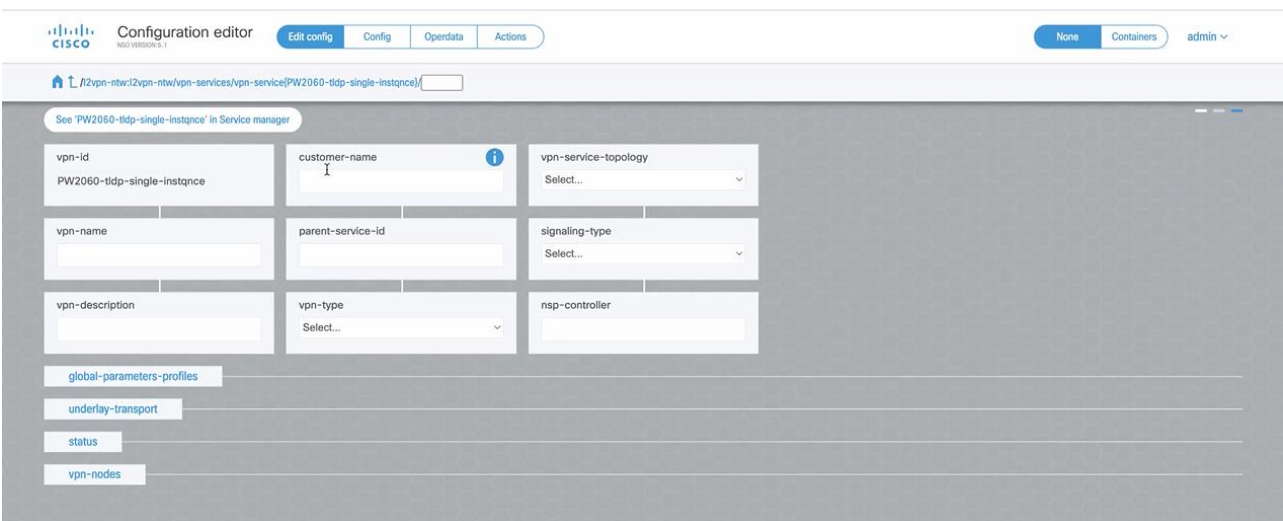
1. Launch NSO.
2. Click **I2vpn:ntw12vpn-ntw**.
3. Click **vpn-services**.



4. Click **+**.

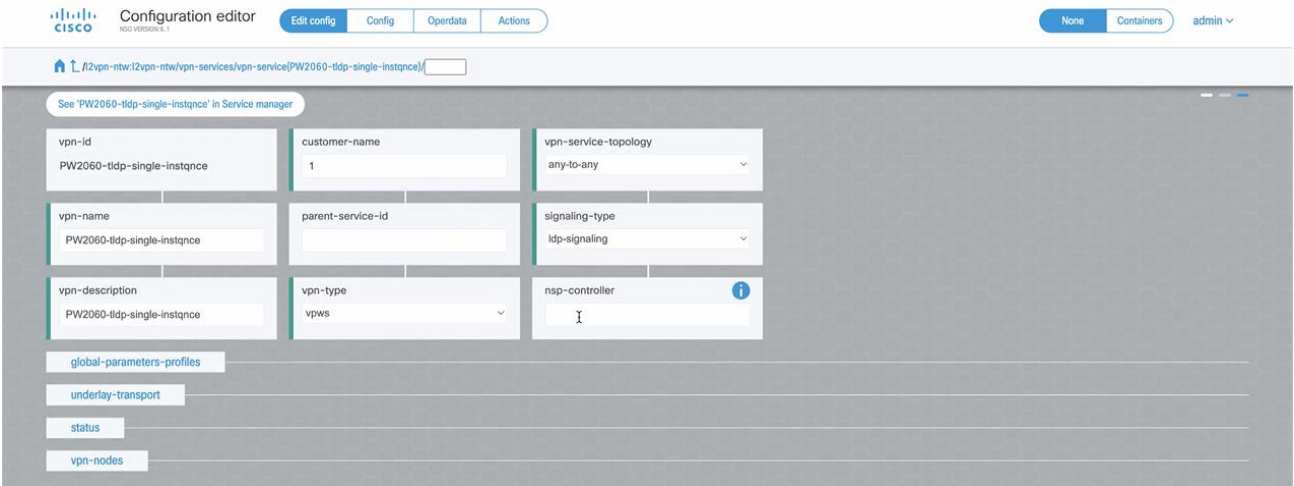


5. Enter a unique **vpn-id**, for example, **PW2060-tldp-single-instance**, and click **confirm**.
6. Click the **vpn service**.

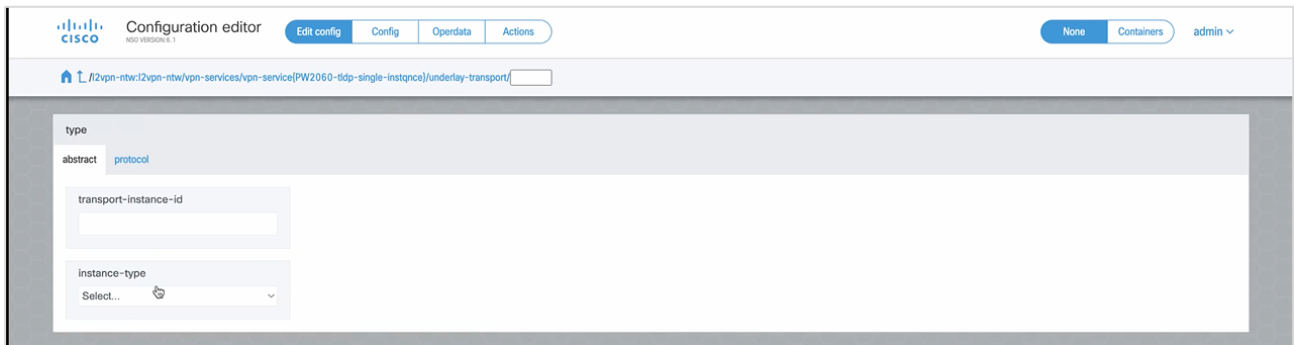


7. Enter the **customer-name** exactly as configured in the NSP controller (this is an integer and not a string).

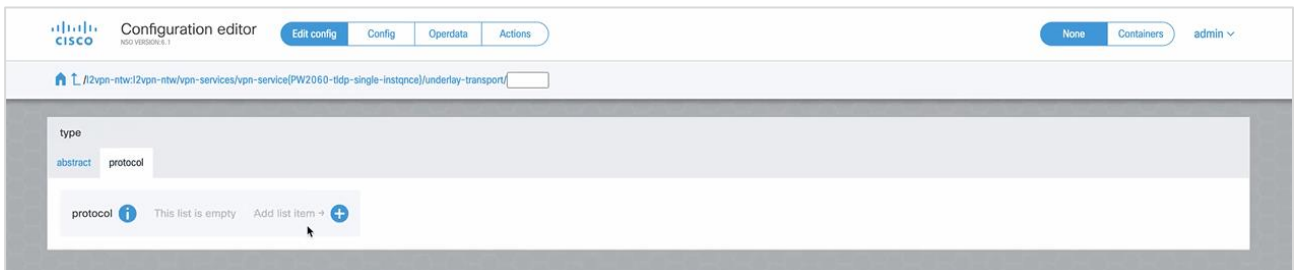
8. Enter the **vpn-name** as a string.
9. Enter the **vpn-description** as a string.
10. Set the **vpn-type** to **vpws**.
11. Set the **vpn-service-topology** to **hub-spoke** or **any-to-any** or **hub-spoke-disjoint**.
12. Set the **signaling-type** to **idp-signaling**.
13. Select the **nsp-controller** (if there is a default nsp-controller, then you can skip this).



14. Click **underlay-transport**.



15. Click **protocol**.



16. Click **+**.

Add new list item

protocol

Select

cancel confirm

17. Select **rsvp-te** and click **confirm**.

18. Return to the vpn (using the breadcrumbs at the top of the page) and click **status**.

Configuration editor

None Containers admin

/2vpn-ntw:2vpn-ntw/vpn-services/vpn-service[PW2060-tdp-single-instance]/status

admin-status

oper-status

19. Click **admin-status**, and then set the **status** to **admin-up**.

status

admin-up

last-change

yyyy-mm-ddThh:mm:ss

20. Return to the vpn (using the breadcrumbs at the top of the page).

Configuration editor

None Containers admin

/2vpn-ntw:2vpn-ntw/vpn-services/vpn-service[PW2060-tdp-single-instance]

See 'PW2060-tdp-single-instance' in Service manager

| | | |
|---|--------------------|------------------------------------|
| vpn-id PW2060-tdp-single-instqnce | customer-name 1 | vpn-service-topology any-to-any |
| vpn-name PW2060-tdp-single-instqnce | parent-service-id | signaling-type ldp-signaling |
| vpn-description PW2060-tdp-single-instqnce | vpn-type vpws | nsp-controller |

global-parameters-profiles

underlay-transport

status

vpn-nodes

21. Click **vpn-nodes**.

Configuration editor

None Containers admin

/2vpn-ntw:2vpn-ntw/vpn-services/vpn-service[PW2060-tdp-single-instance]/vpn-nodes

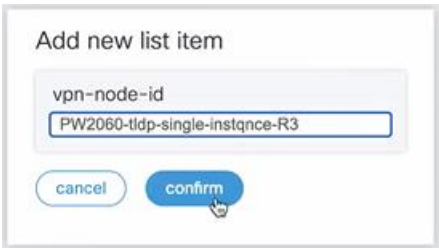
vpn-node

This list is empty

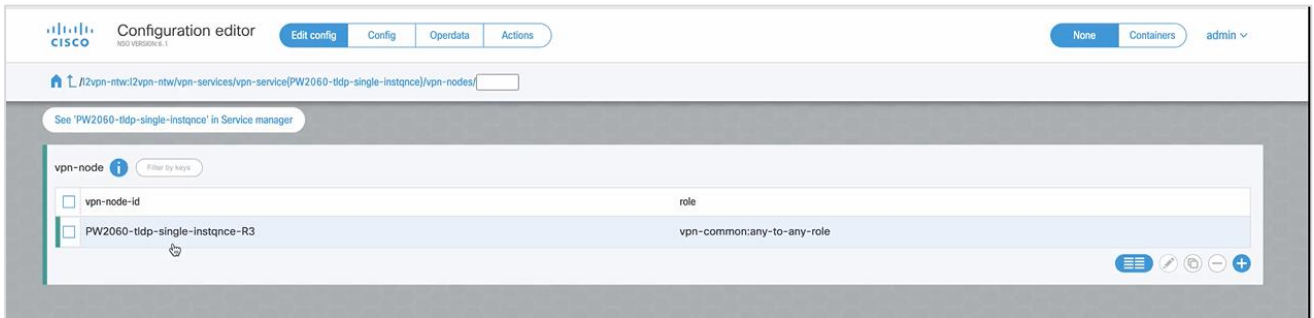
Add list item +

22. Click **+**.

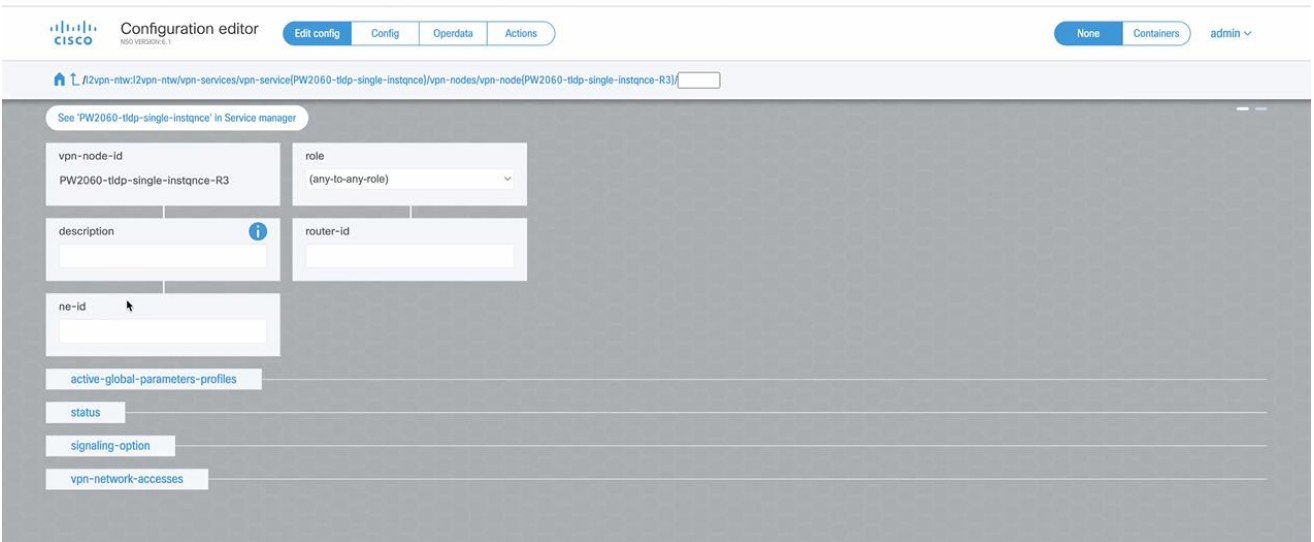
23. Use the vpn-id and add **-R3** as a suffix (when you configure the second node use **-R4**).



24. Click **confirm**.



25. Click on the vpn-node.

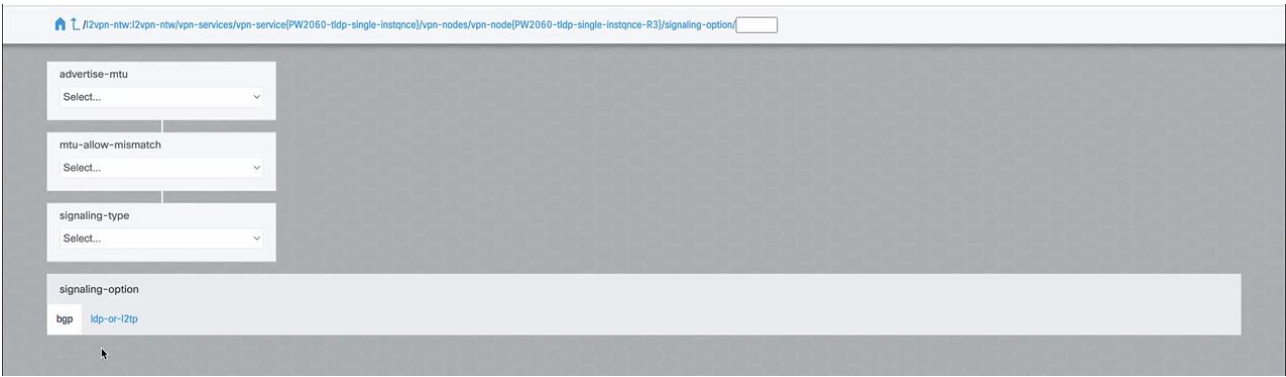


26. Enter a **description**.

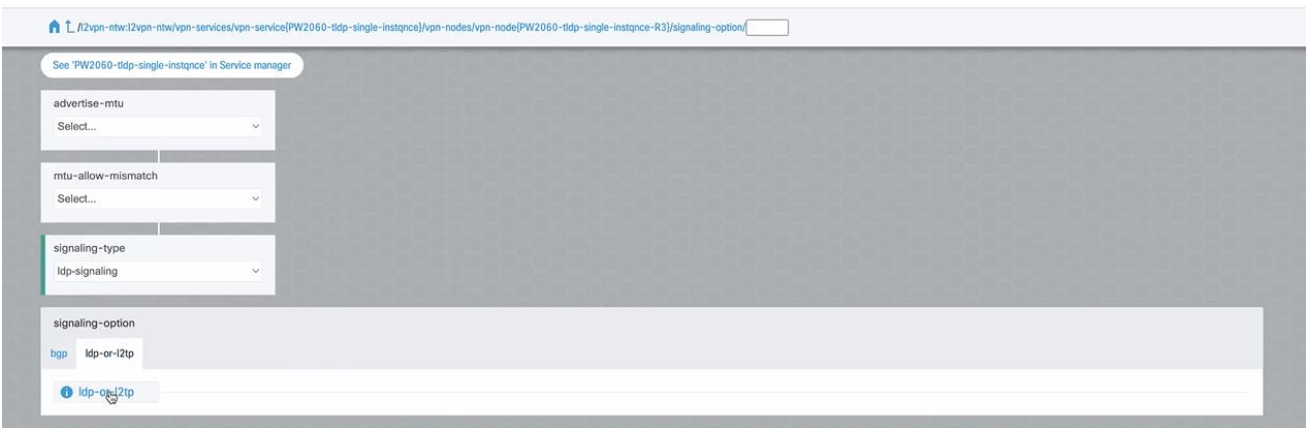
27. Specify the **router-id** and the **ne-id**.

28. Click **status**. And as done previously, set this to **admin-up**.

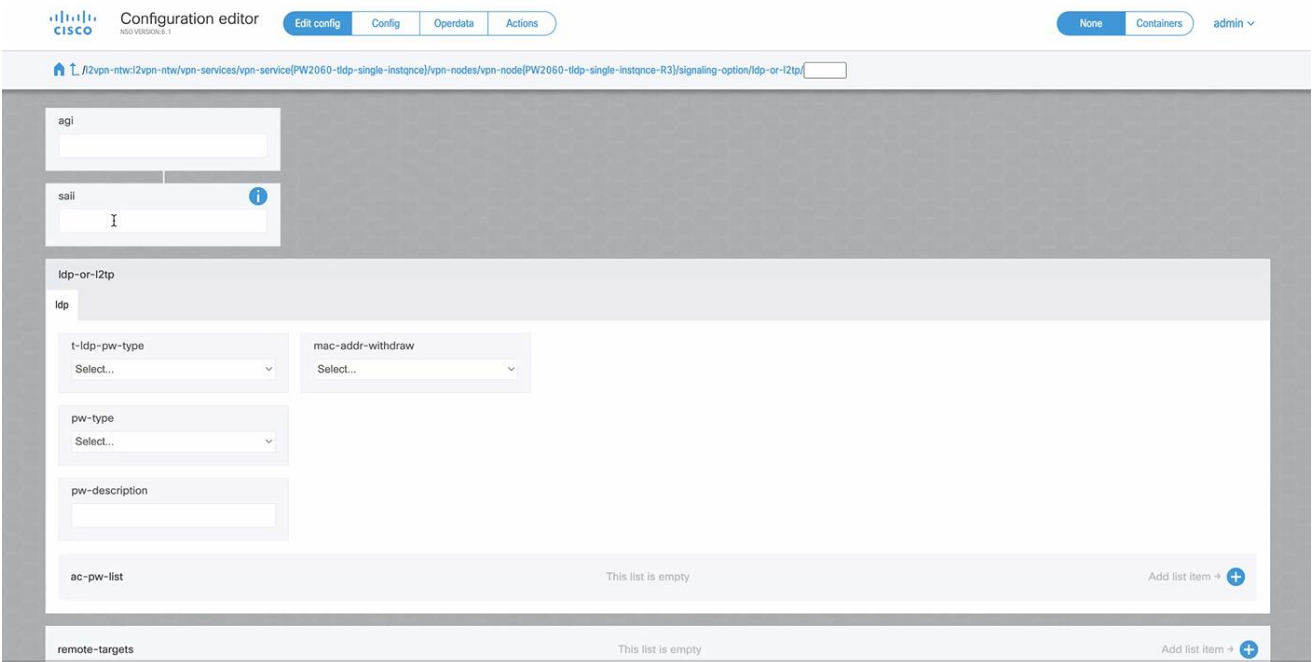
29. In the vpn-node, click **signaling-option**.



30. Click **signaling-type** and select **ldp-signaling**.



31. Select the **ldp-or-l2tp** tab and then click **ldp-or-l2tp**.



32. Click **t-ldp-pw-type** and select **vpws-type**.

33. Click **pw-type** and select **ethernet**.
34. In the **ac-pw-list**, click **+**.

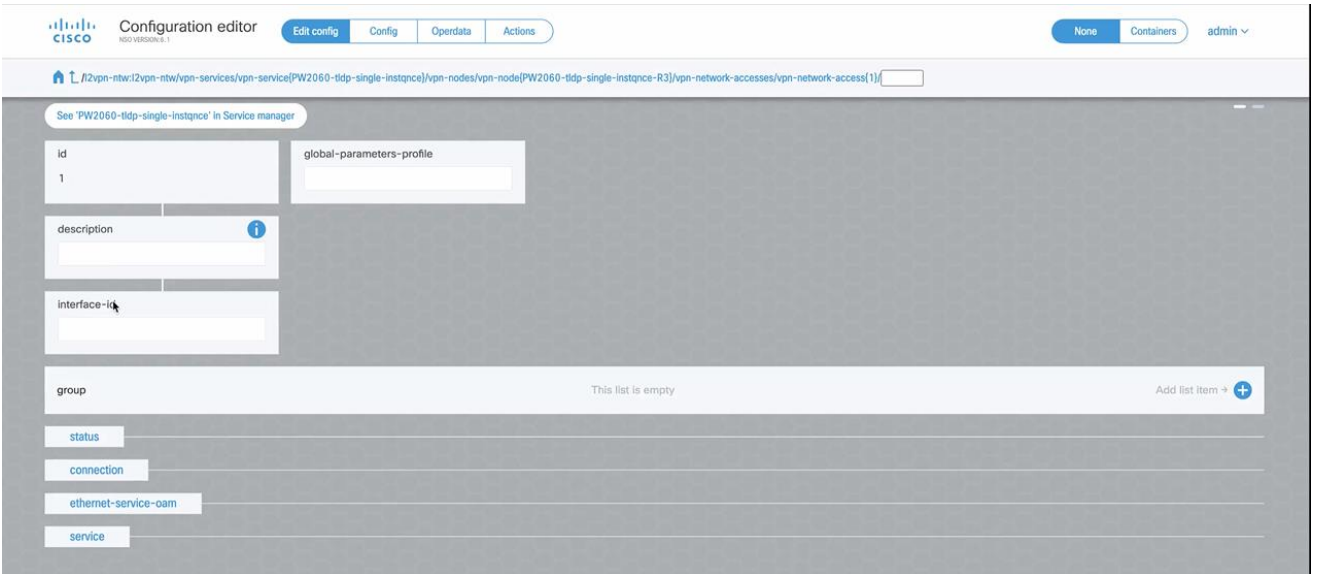
35. Enter a **peer-addr** (of the router).
36. Enter the **vc-id**, for example, **2060**, and click **confirm**.

| peer-addr | vc-id |
|------------|-------|
| 10.10.10.4 | 2060 |

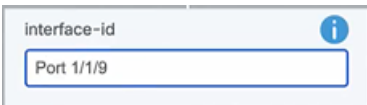
37. Navigate back to the **vpn-node** page and click **vpn-network-accesses**.

38. Click **+**. This defines the interfaces participating in the VPN.

39. Specify the interface **id** and click **confirm**. This is in the format **int_<number>**, for example, **int_222_1**. In this example it is set to 1.
40. Click on the interface.



41. Enter the **interface_id** as **Port 1/1/9** (this is the access port and may vary according to the router).

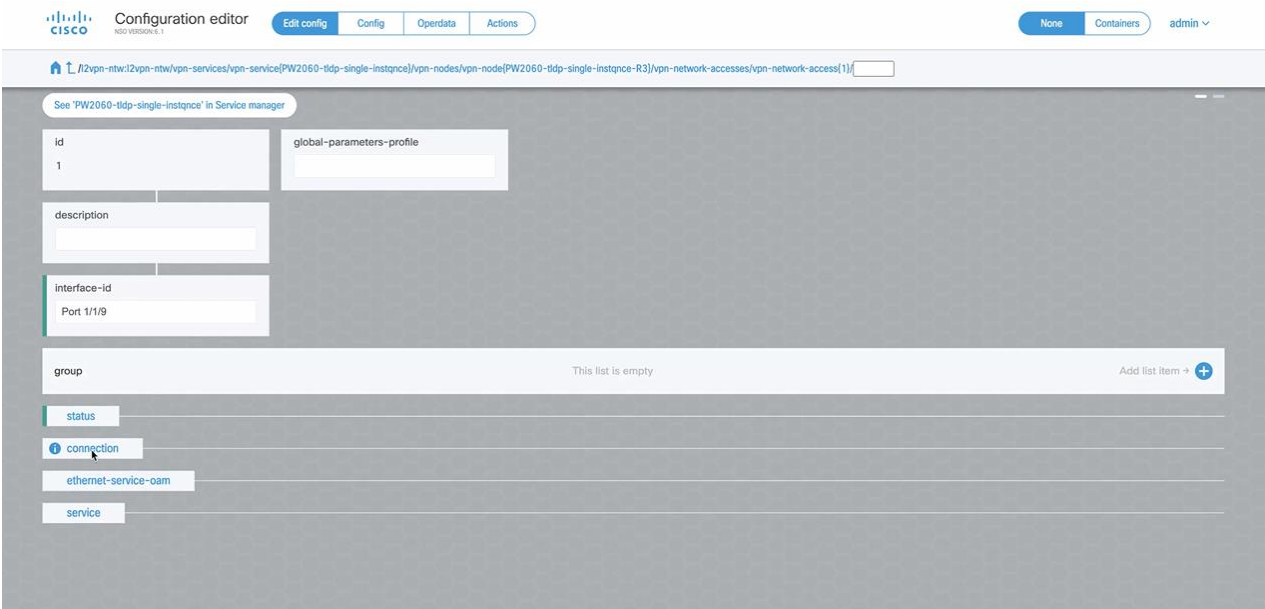


42. Enter the **description** as a string.

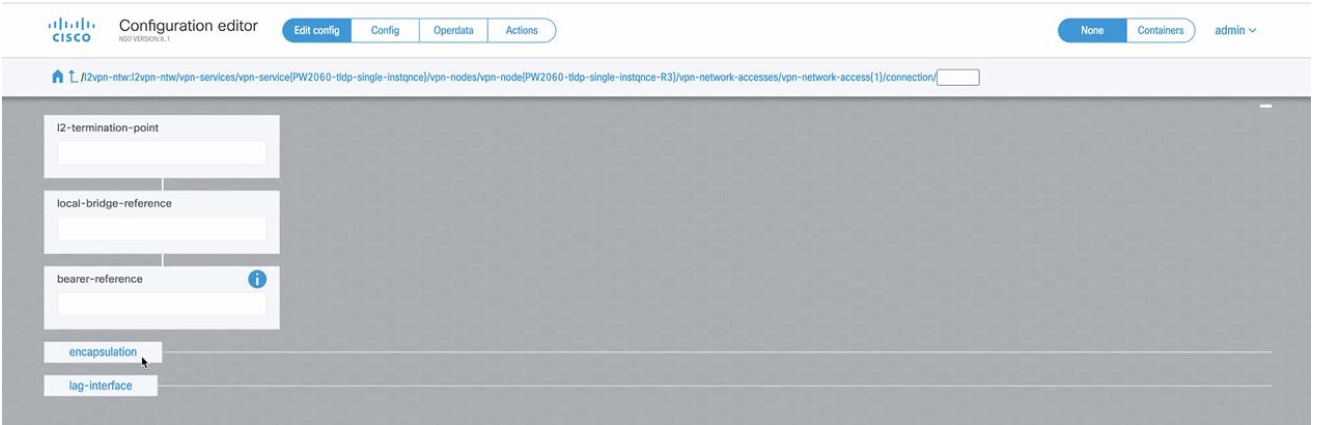
43. Click **status**.

44. Click **admin-status**, and then set the **status** to **admin-up**.

45. Navigate back to the interface page.



46. Click **Connection**.

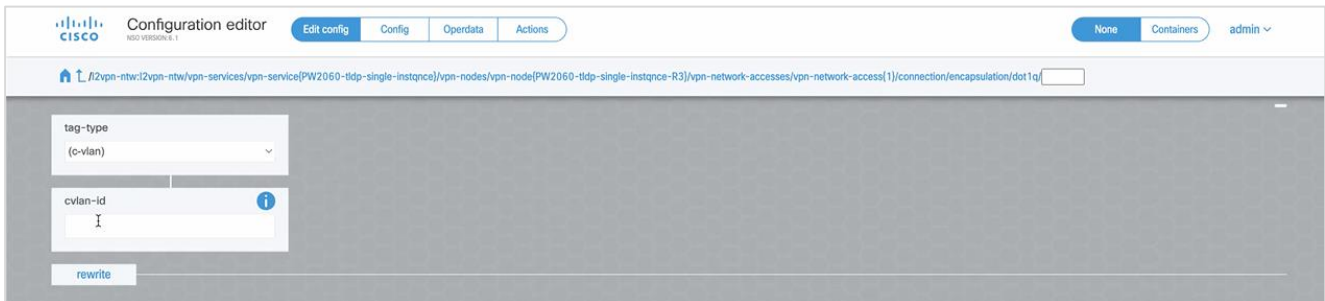


47. Click **encapsulation**.



48. Set the **encap-type** to **dot1q**.

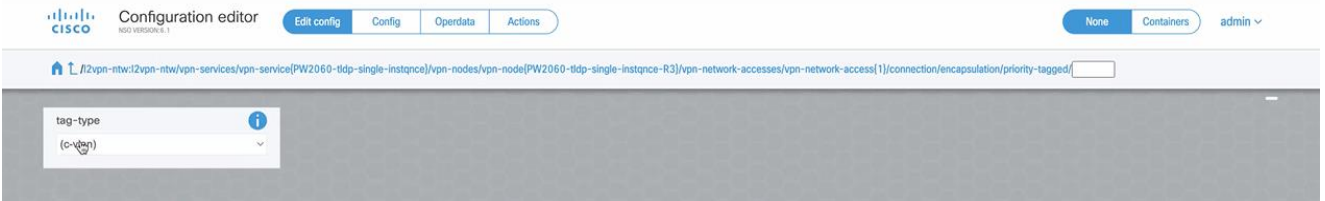
49. Click **dot1q**.



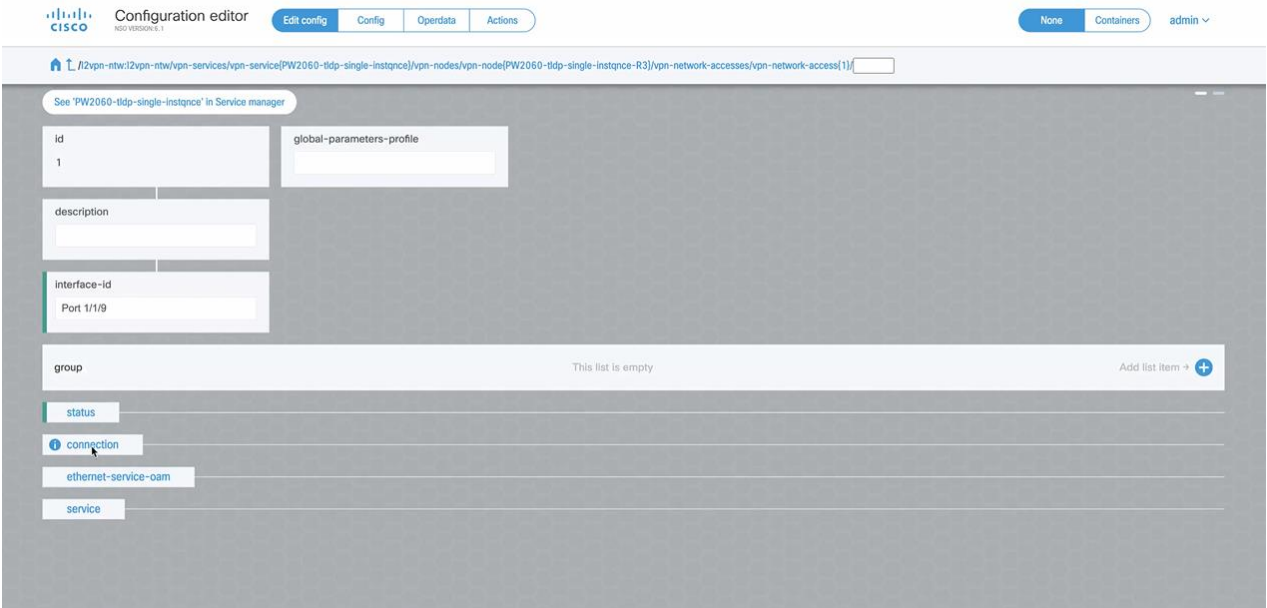
50. Enter the **cvlan-id**.

51. Alternatively, you can set the **encap-type** to **priority-tagged**, and then click **priority-tagged** and select the **tag-type (c-vlan)**.

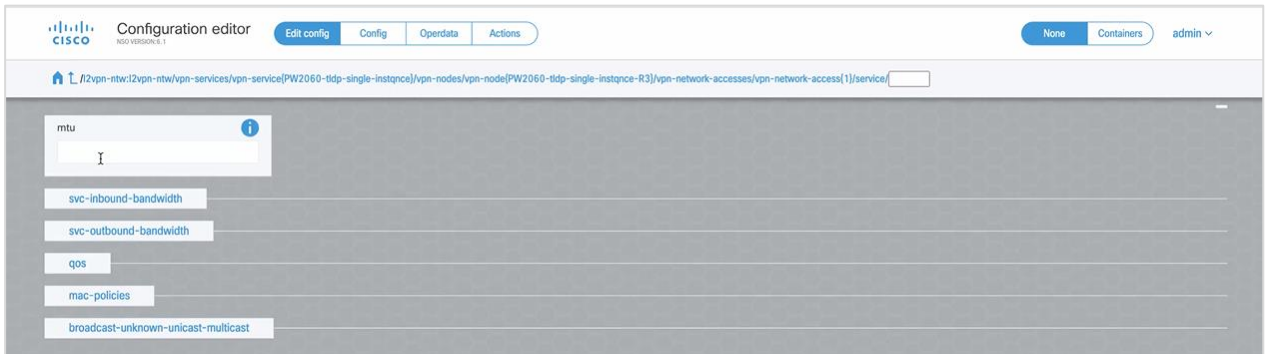




52. Navigate back to the interface page.



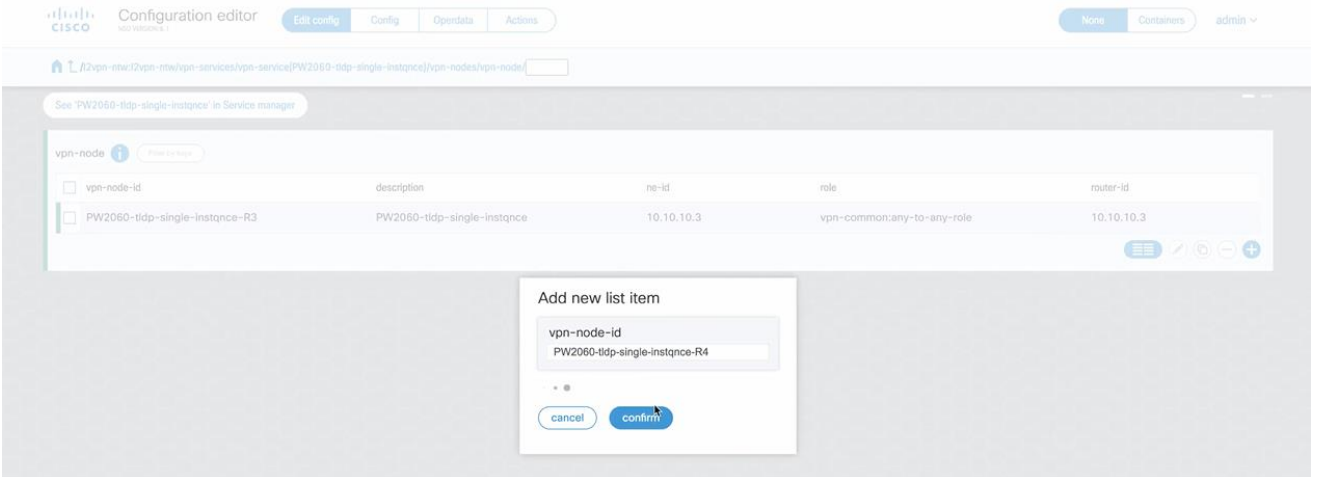
53. Click **ethernet-service-oam**.



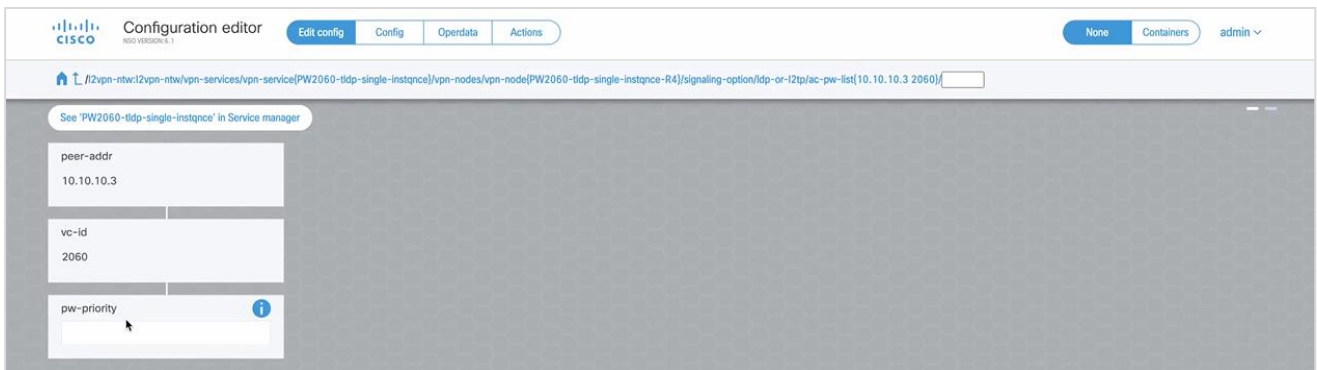
54. Enter the **mtu**.

55. Navigate back to the VPN service page.

56. Add another **vpn-node** following the process previously described, adding the suffix **-R4** to the name.



57. Follow the procedure above, but when you specify the **peer-addr**, you should also specify the **pw-priority**.

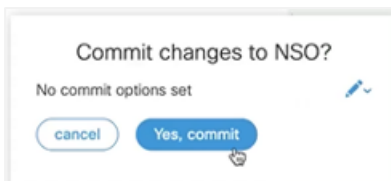


58. Once you have finished setting up the second vpn node, click Commit Manager (at the bottom of the screen).



59. Review the configuration.

60. Click **Commit**.



61. Click **Yes, commit**.

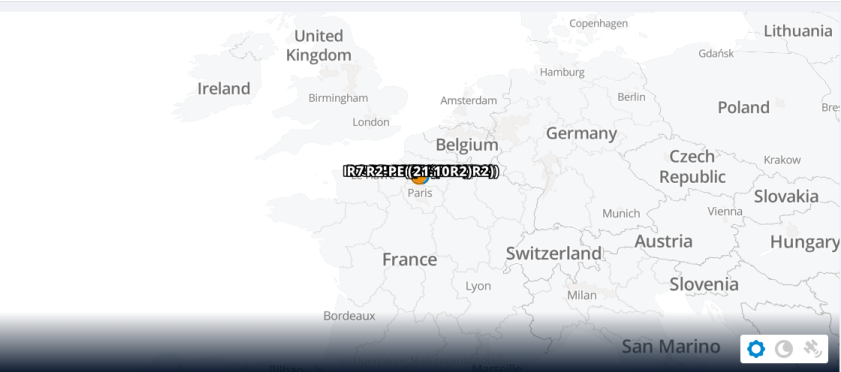
62. Once it has finished, check the VPN.

View L3-VPN in Service Assurance

The services provisioned using NSO can be viewed in the Service Assurance application.

Service Assurance
Multi Point Point to Point Dashboard
Records fetched at: 07:31:34 04-11-2023 UTC

| Service Name | Service Type | Number Of Sites | Number Of Down Sites | Origin | Status | Service Health |
|----------------|--------------|-----------------|----------------------|---------|---------|----------------|
| 9 ITEMS | | | | | | |
| L3VPN... | Any to ... | 1 | 0 | Network | UNKN... | UNKN... |
| VPRN... | Any to ... | 2 | 2 | Network | DOWN | UNKN... |
| L3VPN... | Any to ... | 1 | 0 | Network | UP | UNKN... |
| L3VPN... | Any to ... | 1 | 0 | Network | UNKN... | UNKN... |
| L3VPN... | Hub an... | 1 | 0 | Network | UNKN... | UNKN... |
| L3VPN... | Hub an... | 1 | 0 | Network | UNKN... | UNKN... |
| L3VPN... | Any to ... | 1 | 0 | Network | UNKN... | UNKN... |
| L3VPN... | Any to ... | 1 | 0 | Network | UNKN... | UNKN... |
| L3VPN... | Hub an... | 1 | 0 | Network | UNKN... | UNKN... |



Summary

SERVICE NAME
L3VPN_NonAutoBind_single_instance_4020

NUMBER OF SITES
1

ROUTE TARGETS
N/A

Endpoints

SERVICE TYPE
Any to any

NUMBER OF DOWN SITES
0

ROUTE DISTINGUISHERS
N/A

Underlay Paths

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:

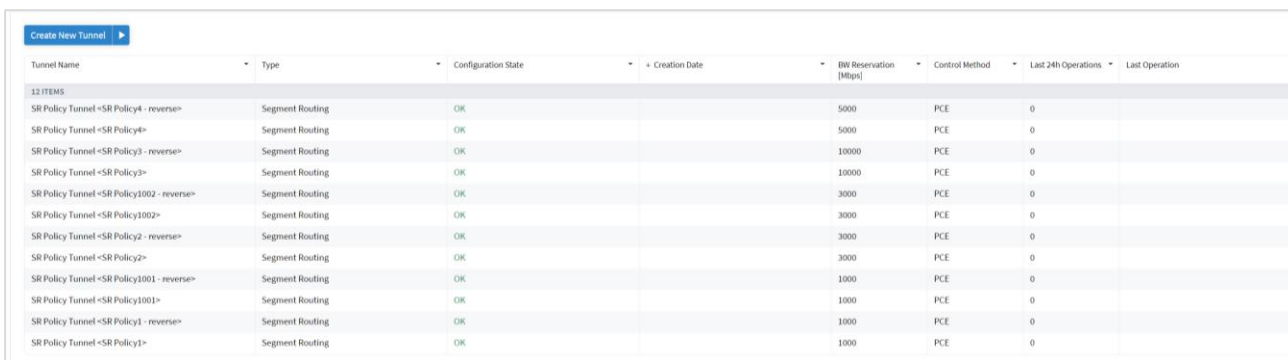
- RSVP
- SR Policy

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: 5f/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**.
2. Click **Create New Tunnel**.
3. Select **RSVP**.

The screenshot shows the 'RSVP Tunnel Creation' form. The 'GENERAL' tab is active, showing fields for Tunnel name, Tunnel description, BW reservation [Mbps], Control method (PCC), Virtual Network, and Template (default-template). Navigation buttons for Back and Next are visible at the bottom.

4. 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**).

5. 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'.

6. 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.

7. 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

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.

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

9. Click **Next**.

RSVP Tunnel Creation



1 GENERAL 2 ADVANCED 3 LIMITATIONS 4 ENDPOINTS 5 SUMMARY

Source Endpoint*

Destination Endpoint*

× Cancel < Back > 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 a configuration wizard titled "RSVP Tunnel Creation" with five steps: GENERAL, ADVANCED, LIMITATIONS, ENDPOINTS, and 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".

13. 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. At the top, there is a blue header with the title 'SR Policy Creation'. Below the header is a navigation bar with five tabs: '1 GENERAL', '2 ADVANCED', '3 LIMITATIONS', '4 ENDPOINTS', and '5 SUMMARY'. The 'GENERAL' tab is active. The form contains the following fields:

- Name***: A text input field with a red asterisk indicating it is required.
- Description**: A text input field.
- BW reservation [Mbps]**: A text input field.
- Control method**: A dropdown menu with 'PCC' 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 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**.

SR Policy Creation



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

Source Endpoint*

Destination Endpoint*

X Cancel < Back > 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 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).

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:

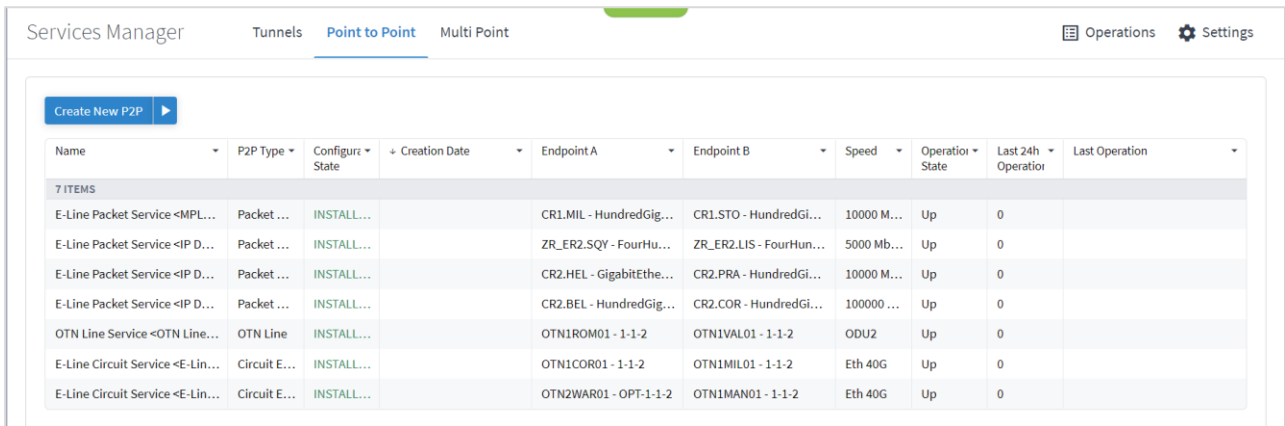
- IP Link
- OCH Link
- OCH-NC Link
- OTN-Line
- SDH-Line
- Circuit E-Line
- Packet E-Line

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, Operatiol State, Last 24h Operator, and Last Operation.

| Name | P2P Type | Configurz State | Creation Date | Endpoint A | Endpoint B | Speed | Operatiol State | Last 24h Operator | 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, SDH-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 |
|--------------------------------|----------------|---------------------|-------------------------|-------------------------|-------------------------|---------|-------------------|---------------------|-------------------------------|
| 5 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_HCO 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

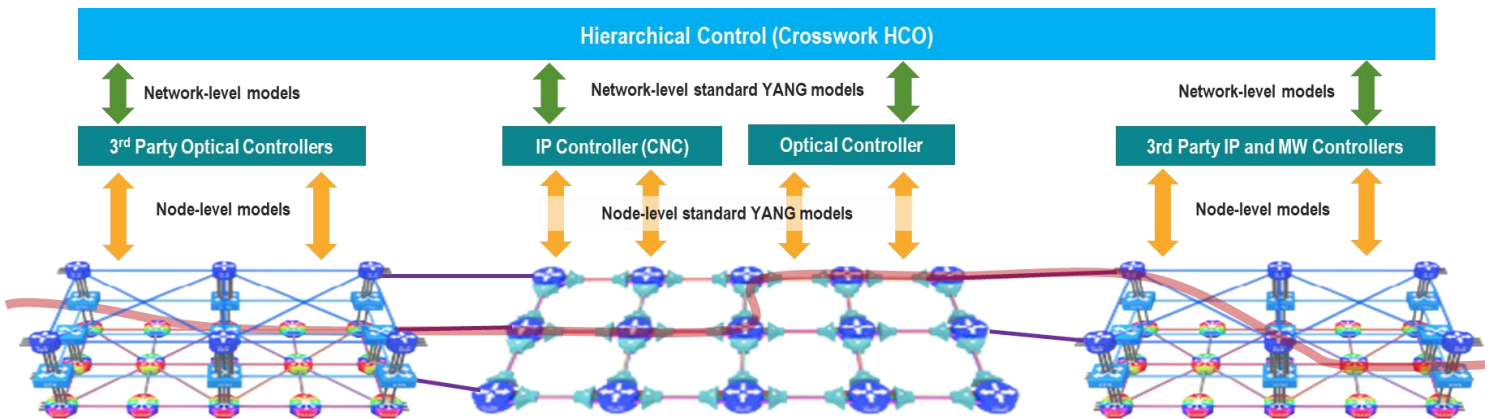
Summary Endpoints Underlay Path Operations Events Actions

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

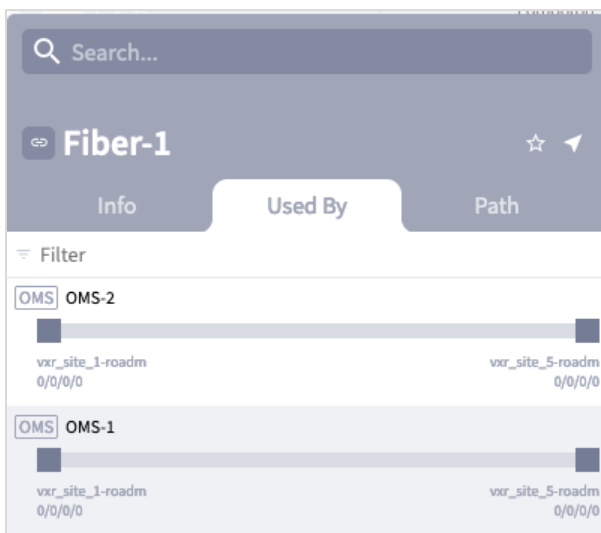
You can create an IP Link between two ZR pluggable components in routers (creating a new link or adding it to a LAG). Various advanced settings and limitations (such as node or link to be included in the path or excluded from the path of the OCH Link) can be added. The end-to-end service between ZR/+ 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)

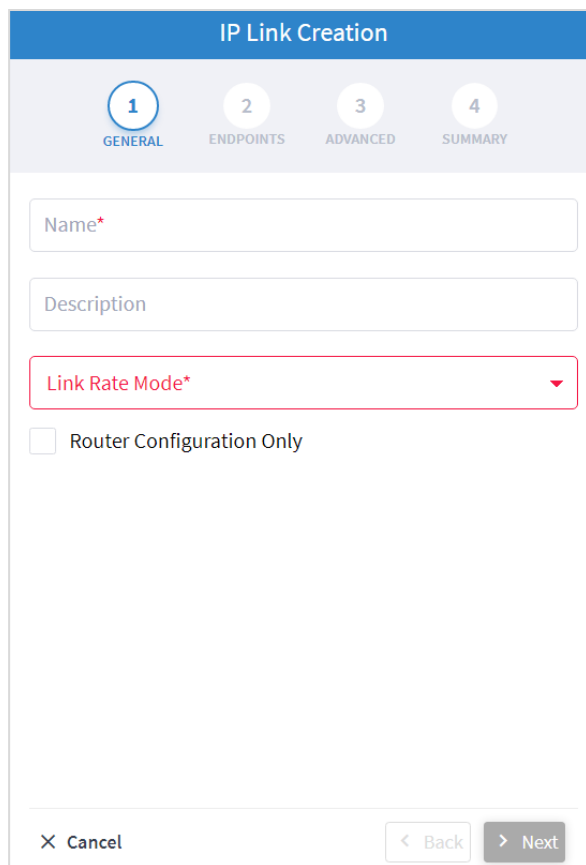
OTS Port (2) **OMS Port (4)**

| 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 with a blue header. Below the header is a progress indicator with four steps: 1. GENERAL (highlighted with a blue circle), 2. ENDPOINTS, 3. ADVANCED, and 4. SUMMARY. The form contains the following fields:

- Name***: A text input field.
- Description**: A text input field.
- Link Rate Mode***: A dropdown menu with a red border and a downward arrow.
- 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' dialog box with the 'ENDPOINTS' tab selected. The dialog has a blue header and a progress indicator at the top with four steps: 1. GENERAL, 2. ENDPOINTS (highlighted), 3. ADVANCED, and 4. SUMMARY. The main area is divided into two sections: 'ENDPOINT A' and 'ENDPOINT B'. Each section contains three input fields: 'Site A' and 'Port A*' for Endpoint A, and 'Site B' and 'Port B*' for Endpoint B. Each of these fields has a search icon to its right. Below the port fields is a 'Transmit Power [dBm]' field. At the bottom of the dialog, there is a 'Cancel' button on the left and 'Back' and 'Next' buttons on the right.

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.

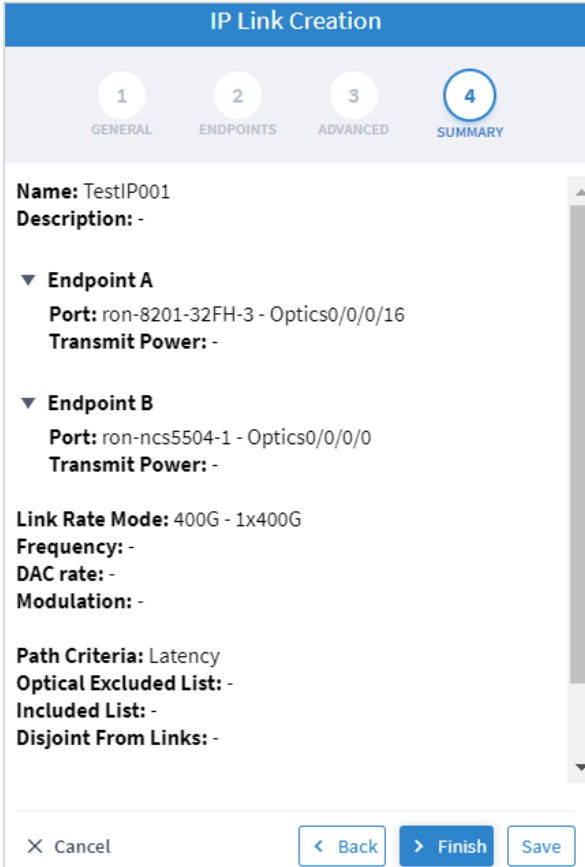
At the bottom of the interface, there are three buttons: 'Cancel' (with a close icon), '< Back', and 'Next >'.

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**.



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: -

X Cancel < Back > **Finish** Save

10. Review the **SUMMARY**.

11. Click **Finish**.

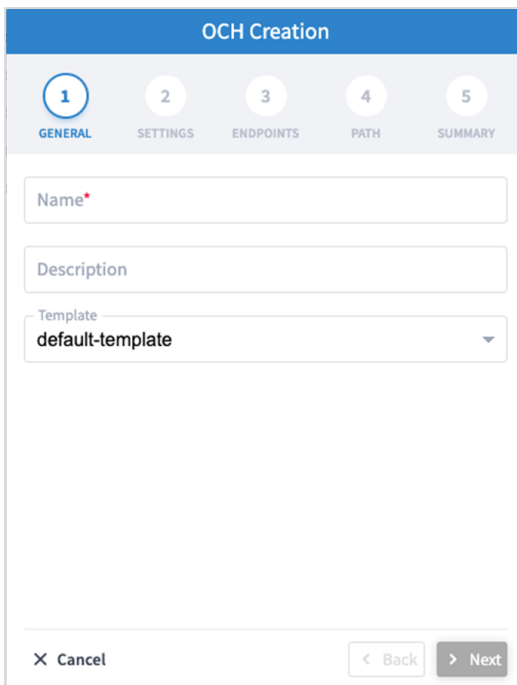
Create OCH Link

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:

- GENERAL** (selected tab)
- SETTINGS**
- ENDPOINTS**
- PATH**
- SUMMARY**
- Name*** (text input field)
- Description** (text input field)
- Template** (dropdown menu, currently showing 'default-template')
- X Cancel** (button)
- < Back** (button)
- > Next** (button)

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).

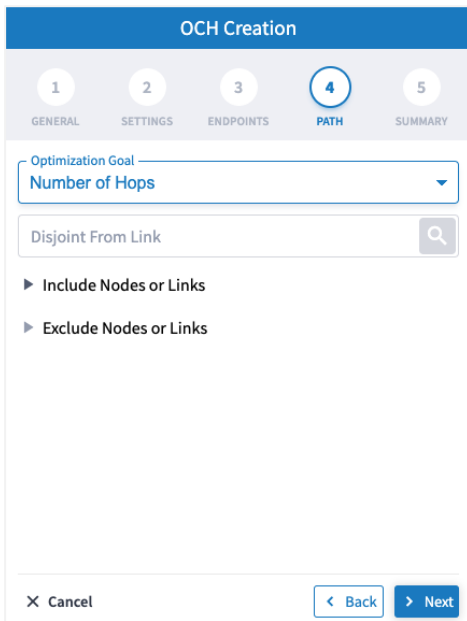
7. Click **Next**.

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*' is set to 'NE13 - 13-1-1' and 'Endpoint B*' is set to '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**.



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 (5). The previous steps are GENERAL (1), SETTINGS (2), ENDPOINTS (3), and PATH (4). 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**.

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.xxxxxx). 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). A 'Reset' button with a left arrow is located below the 'Application Code*' field. At the bottom, there are three buttons: 'Cancel' with a close icon, 'Back' with a left arrow, and 'Next' with a right arrow.

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*

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**.

OCH-NC Creation

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

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: -

× Cancel < Back > Finish

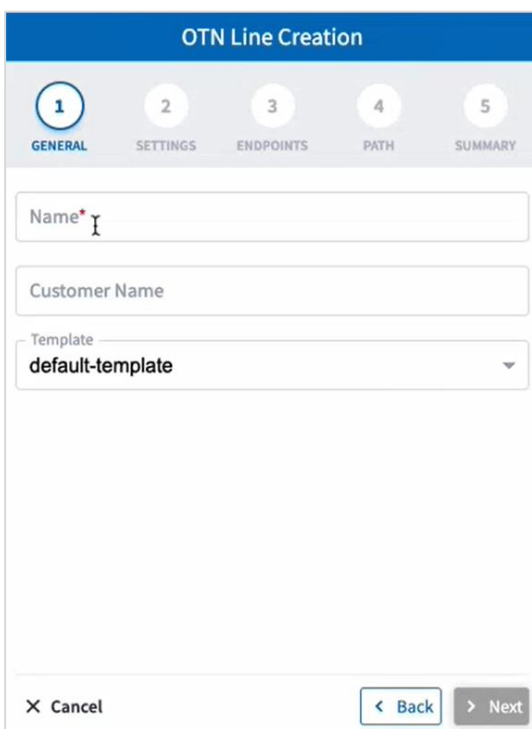
14. Click **Finish**.

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 three input fields: 'Name*' (with a cursor), 'Customer Name', and 'Template' (a dropdown menu showing 'default-template'). At the bottom, 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**).

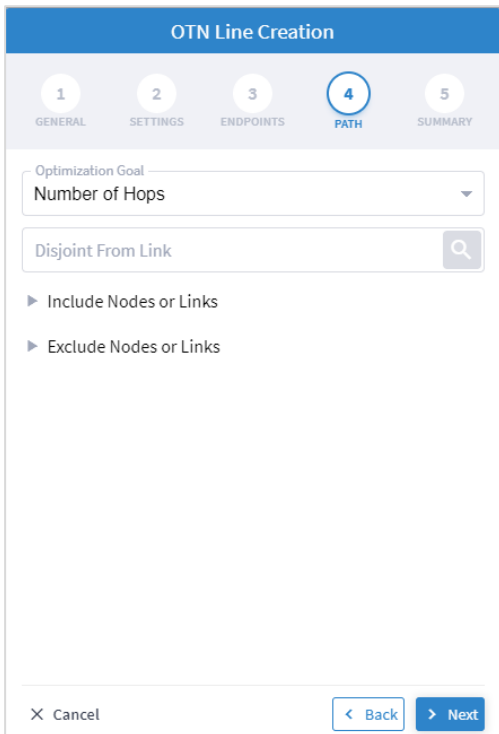
7. Click **Next**.

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).

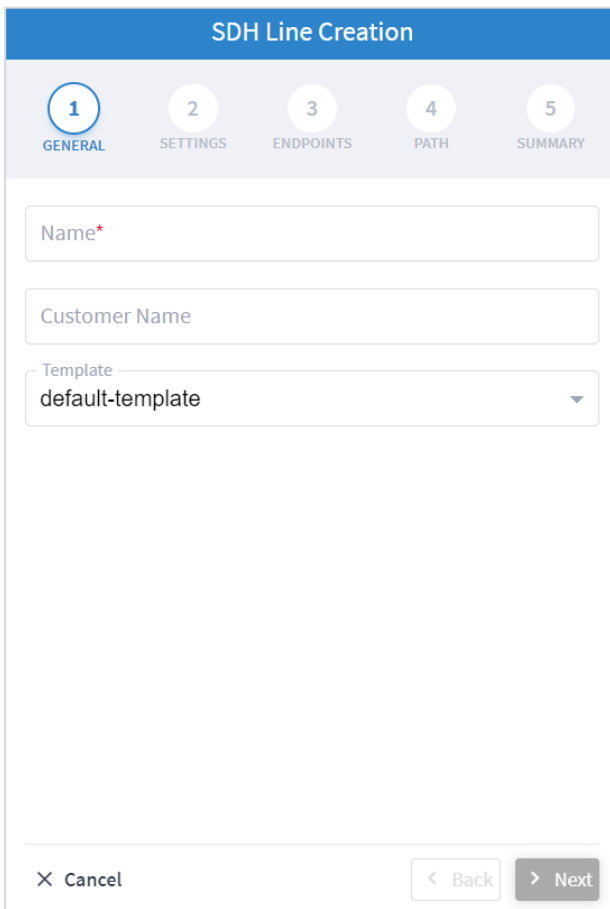
12. Click **Finish**.

Create SDH-Line

You can create an SDH Line service between STM client ports, define its capacity, add 1+1 protection if required, allow the path to be calculated by the Domain Controller or HCO, 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) can be added.

To create an SDH Line:

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



The screenshot shows the 'SDH Line Creation' wizard interface. At the top, there is a blue header with the title 'SDH Line Creation'. Below the header is a progress bar with five steps: 1. GENERAL (highlighted with a blue circle), 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The main content area contains three input fields: 'Name*' (with a red asterisk indicating it is required), 'Customer Name', and a 'Template' dropdown menu currently set to 'default-template'. At the bottom of the form, there are three buttons: 'Cancel' (with a close icon), 'Back' (with a left arrow), and 'Next' (with a right arrow).

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

5. Click **Next**.



The screenshot shows the 'SDH Line Creation' wizard at the 'SETTINGS' step. The wizard has five steps: 1. GENERAL, 2. SETTINGS (current), 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The 'Service Capacity*' field is highlighted with a red border and a dropdown arrow. The 'Protection' field is set to 'No Protection' with a dropdown arrow. At the bottom, there are three buttons: 'X Cancel', '< Back', and '> Next'.

6. Specify the following **SETTINGS**:

- **Service Capacity:** The capacity for this SDH Line, for example, **STM64** or **STM256**.
- **Protection:** The service protection (**No Protection** or **Protection 1+1**).

7. Click **Next**.

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

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

| Name | Device | Type | Capability | Description | Admin Status |
|---------|----------------|----------------|------------------------------------|-------------|--------------|
| 1-2-1P2 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-3-1P1 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-5-1P2 | PTHLAB-WG4-103 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-3-1P2 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-14-4 | PTHLAB-WG4-102 | OPTICAL_CLIENT | STM64 | | UP |
| 1-4-1P2 | PTHLAB-WG4-103 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-2-1P1 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-2-1P2 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-4-1P1 | PTHLAB-WG4-103 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-3-1P2 | PTHLAB-Y30-106 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-4-1P2 | PTHLAB-WG4-103 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |
| 1-5-1P1 | PTHLAB-WG4-103 | OPTICAL_CLIENT | STM16,Eth100Gig,Eth40Gig,Eth1Gi... | | UP |

9. Click **Next**.

SDH Line Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 PATH 5 SUMMARY

Optimization Goal
Number of Hops





Disjoint From Link

▶ Include Nodes or Links

▶ Exclude Nodes or Links

× Cancel < Back > 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 SDH line. This means that the new SDH 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 SDH link, or click on the **3D Explorer** tab to select a node or SDH 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 'SDH Line Creation' interface. At the top, there is a blue header with the title 'SDH Line Creation'. Below the header is a progress 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:** Test-1-SDH
- Customer Name:** None
- Template:** default-template
- Service Capacity:** STM64
- Protection Policy:** No Protection
- Computation Provider:** Domain Controller
- Path Criteria:** Number of Hops
- Disjoint From Link:** -
- Excluded List:** -
- Included List:** -
- Endpoint A:** PTHLAB-WG4-103 - 1-5-1P2
- Endpoint B:** PTHLAB-Y30-106 - 1-3-1P1

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).

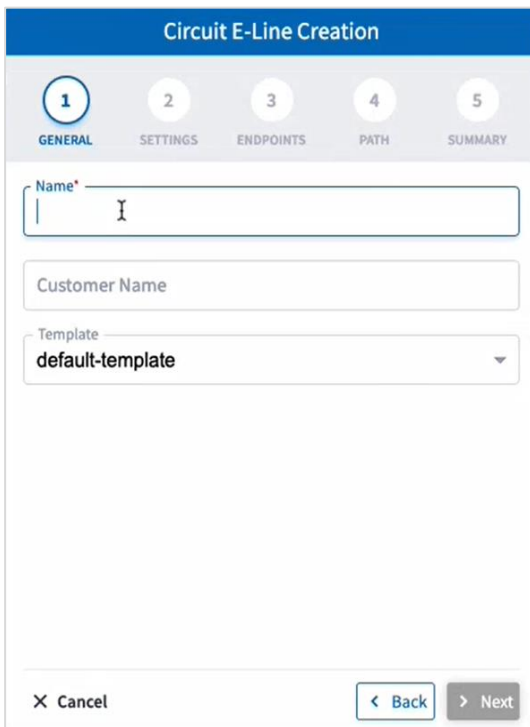
12. Click **Finish**.

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' 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 steps: 1. GENERAL, 2. SETTINGS (highlighted with a blue circle), 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 of the form, there are three buttons: 'X 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**).

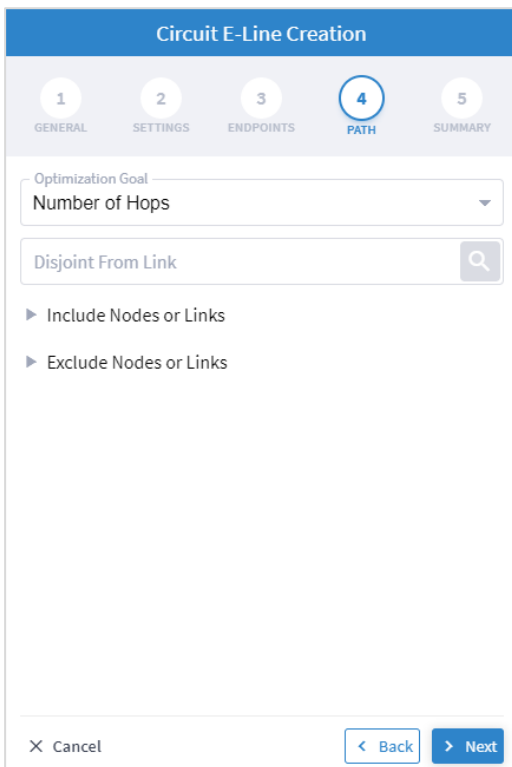
7. Click **Next**.

The screenshot shows the 'Circuit E-Line Creation' interface at the 'ENDPOINTS' step. The navigation bar now has step 3, 'ENDPOINTS', highlighted with a blue circle. The main content area contains two search input fields: 'Endpoint A*' and 'Endpoint B*', each with a magnifying glass icon to its right. Below these fields is a dropdown menu labeled 'Path Calculation By' with the value '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 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**.



The screenshot shows the 'Circuit E-Line Creation' wizard at the 'PATH' step. The 'Optimization Goal' is set to 'Number of Hops'. There is a search field for 'Disjoint From Link'. Below it are two expandable sections: 'Include Nodes or Links' and 'Exclude Nodes or Links'. At the bottom, there are 'Cancel', 'Back', and 'Next' buttons.

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**

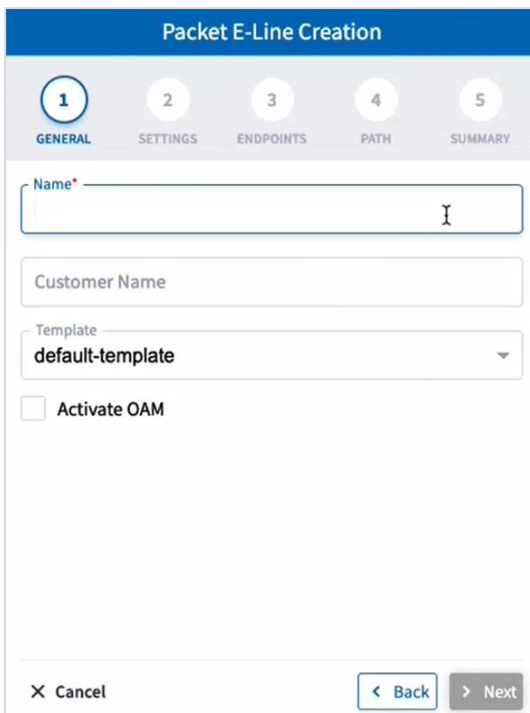
12. Click **Finish**.

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' interface. At the top, there is a blue header with the title 'Packet E-Line Creation'. Below the header is a progress bar with five steps: 1. GENERAL (highlighted with a blue circle), 2. SETTINGS, 3. ENDPOINTS, 4. PATH, and 5. SUMMARY. The main form area 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**: At the bottom, there is 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'. It features two sections for 'Endpoint A' and 'Endpoint B'. Each section contains a 'Port*' field with a search icon, a 'VLAN ID (format: 2,5-7)' field, and five optional bandwidth fields: 'CIR [Mbps]*', 'EIR [Mbps]', 'CBS [KBytes]', 'EBS [KBytes]', and 'Local AC'. The wizard's progress bar at the top shows steps 1 (GENERAL), 2 (SETTINGS), 3 (ENDPOINTS), 4 (PATH), and 5 (SUMMARY). Navigation buttons include '< Back', '> Next', and 'X Cancel'.

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)

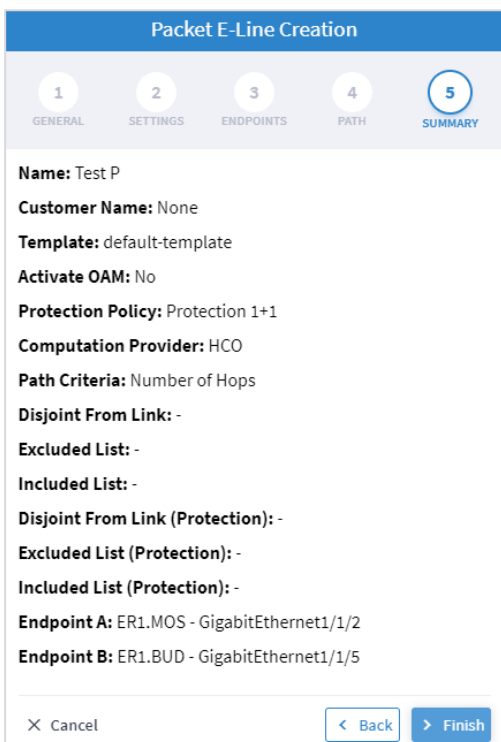
X Cancel < Back > Next

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**.



Packet E-Line Creation

1 GENERAL 2 SETTINGS 3 ENDPOINTS 4 PATH 5 SUMMARY

Name: Test P
Customer Name: None
Template: default-template
Activate OAM: No
Protection Policy: Protection 1+1
Computation Provider: HCO
Path Criteria: Number of Hops
Disjoint From Link: -
Excluded List: -
Included List: -
Disjoint From Link (Protection): -
Excluded List (Protection): -
Included List (Protection): -
Endpoint A: ER1.MOS - GigabitEthernet1/1/2
Endpoint B: ER1.BUD - GigabitEthernet1/1/5

× Cancel < Back > Finish

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.

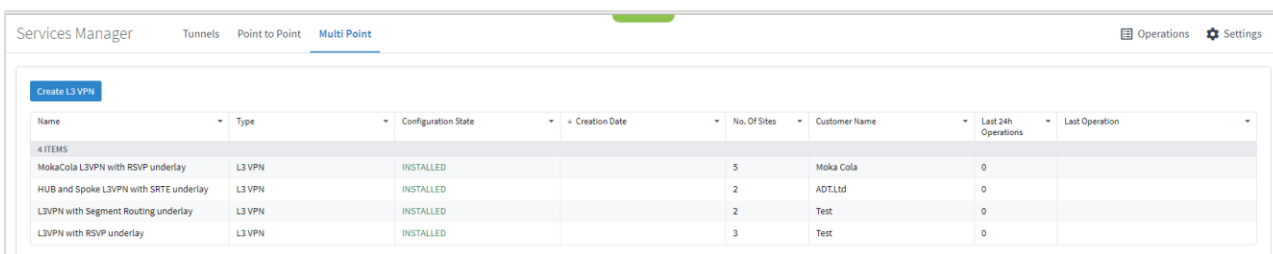
Multi Point

You can view and add L3-VPN.

View L3 VPN

To view L3 VPNs:

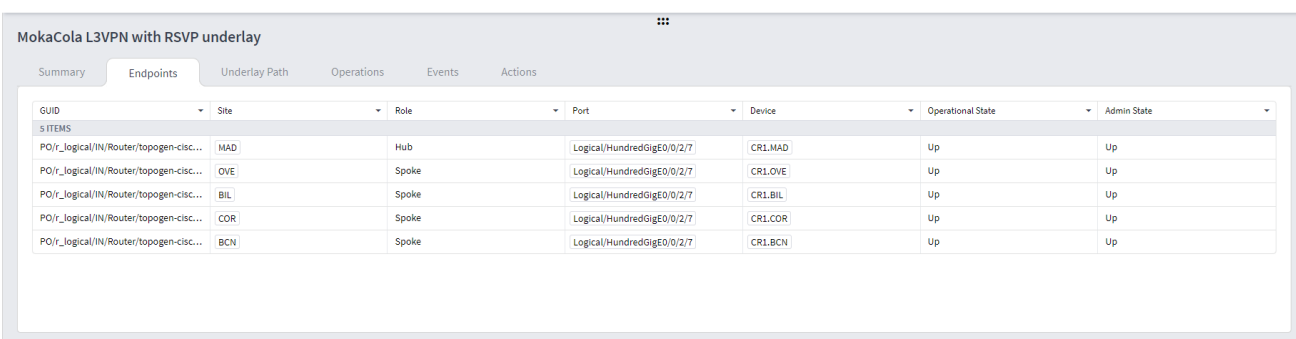
1. In the applications bar in Crosswork Hierarchical Controller, select **Services > Services Manager > Multi Point**. A list of the L3VPNs appears in the **Multi Point** pane.



The screenshot shows the 'Multi Point' view in the Services Manager. It features a 'Create L3 VPN' button and a table with the following data:

| 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 view. The 'Endpoints' tab is selected, displaying a table with the following data:

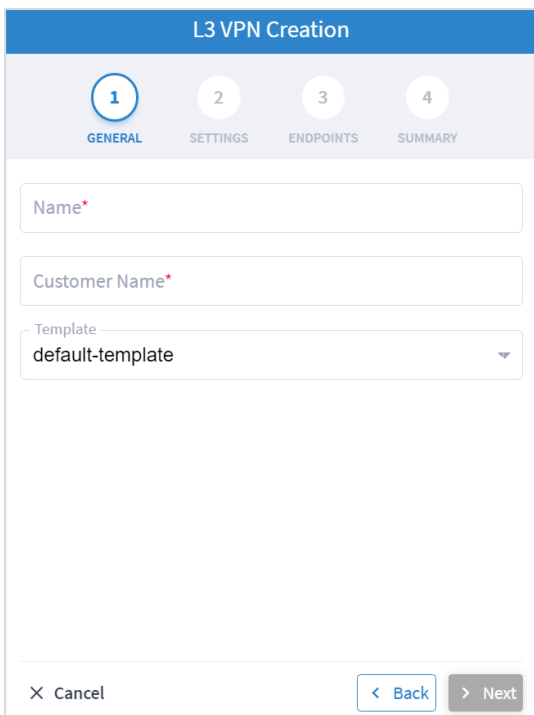
| GUID | Site | Role | Port | Device | Operational State | Admin State |
|---|------|-------|----------------------------|---------|-------------------|-------------|
| 5 ITEMS | | | | | | |
| PO/r_logical/IN/Router/topogen-clisc... | MAD | Hub | Logical/HundredGigE0/0/2/7 | CRI.MAD | Up | Up |
| PO/r_logical/IN/Router/topogen-clisc... | OVE | Spoke | Logical/HundredGigE0/0/2/7 | CRI.OVE | Up | Up |
| PO/r_logical/IN/Router/topogen-clisc... | BIL | Spoke | Logical/HundredGigE0/0/2/7 | CRI.BIL | Up | Up |
| PO/r_logical/IN/Router/topogen-clisc... | COR | Spoke | Logical/HundredGigE0/0/2/7 | CRI.COR | Up | Up |
| PO/r_logical/IN/Router/topogen-clisc... | BCN | Spoke | Logical/HundredGigE0/0/2/7 | CRI.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 progress bar with four steps: 1. GENERAL (highlighted with a blue circle), 2. SETTINGS, 3. ENDPOINTS, and 4. SUMMARY. The form contains three input fields: 'Name*' (text input), 'Customer Name*' (text input), and 'Template' (dropdown menu with 'default-template' selected). At the bottom, there are three buttons: 'X Cancel', '< Back', and '> Next'.

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 set to '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

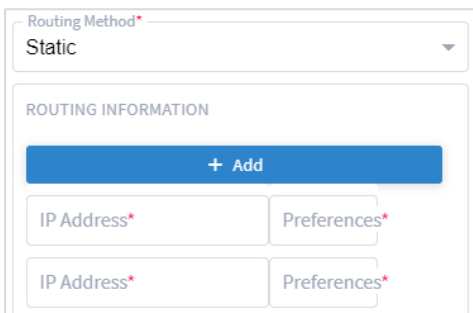
X Cancel < Back > Next

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).



Routing Method*
Static

ROUTING INFORMATION

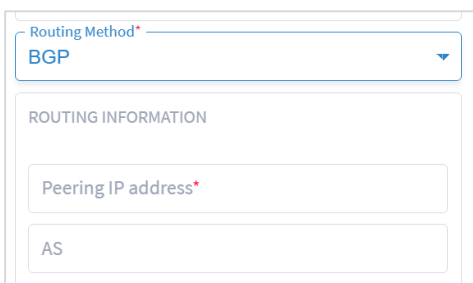
+ Add

IP Address* Preferences*

IP Address* Preferences*

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).



Routing Method*
BGP

ROUTING INFORMATION

Peering IP address*

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).

The screenshot shows a configuration form with a dropdown menu for 'Routing Method' set to 'OSPF'. Below this is a section titled 'ROUTING INFORMATION' containing two input fields: 'OSPF Metric' and 'OSPF Area ID'.

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

14. Click **Next**.

15. Review the **SUMMARY**.

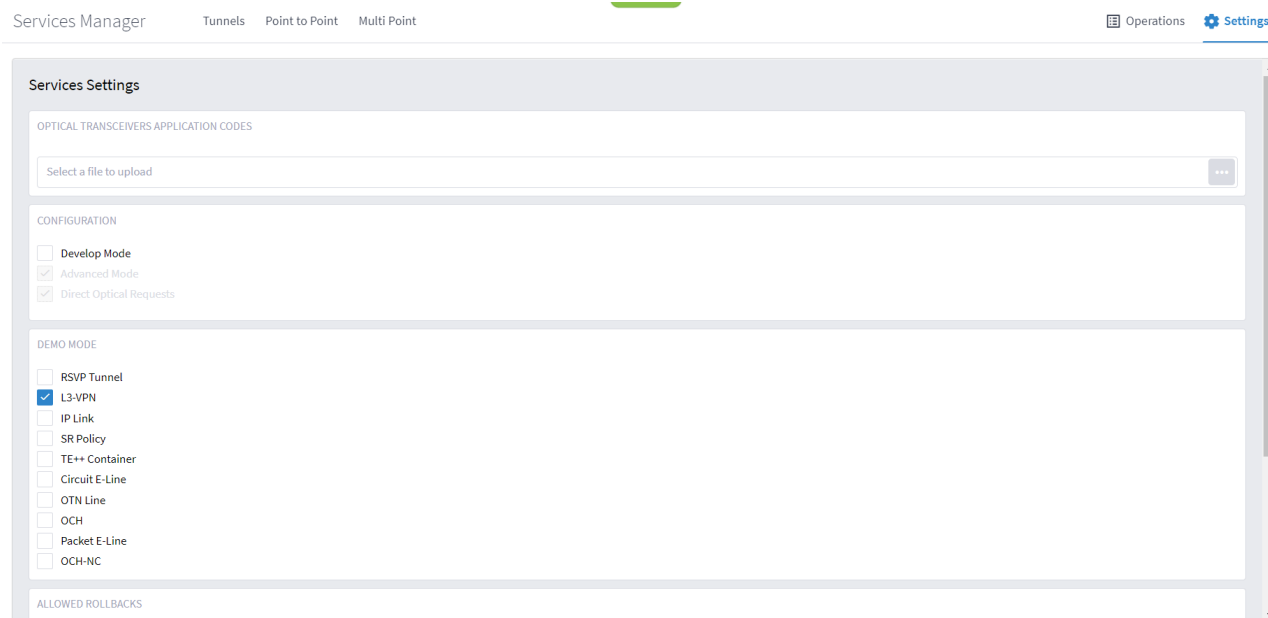
16. Click **Finish**.


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.



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/fe7458965a2c4730bd0ab7837aa86f42 | 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/34d6ec53f9a24cd19187f12edbd1a0f | 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/34d6ec53f9a24cd19187f12edbd1a0f | 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/2b710e7145c04ddc9d26f8d8a82d233 | 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/92df4395ce3e49d9adeda89b0b08e8d36 | 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/d328da9758342a490010c9f5b056be2 | 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/c73e1cf0b0e4fdcb5036f8bb3138582 | 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/c73e1cf0b0e4fdcb5036f8bb3138582 | 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/32cea215f7de4f813eaf634d06c532334 | 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/ef6a878e9c54a2db183263306ecbbfe | 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/ef6a878e9c54a2db183263306ecbbfe | 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/1ac17bdc9c4c46e5aa2d2e3ea1559b33 | 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/bd328da9758342a490010c9f5b056be2 | 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/e50697abfd2e4c37888e3d99c64639f8 | 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.

f20d24b06b3449e0b1756d492cbd965c

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.

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

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