Cisco Crosswork Hierarchical Controller 7.0

Assurance and Performance Guide

April 2023

Introduction

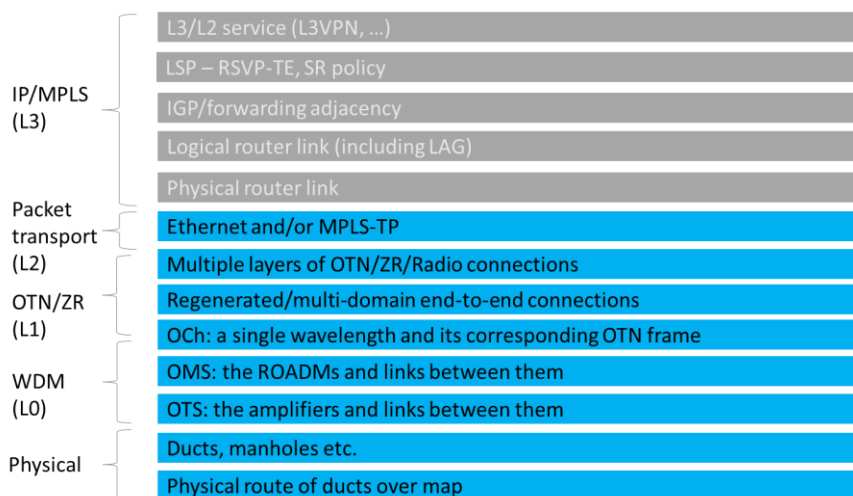This document is a how-to-use guide for Cisco Crosswork Hierarchical Controller assurance.

The following table lists the assurance applications. The Legend column indicates if the application falls into one of the following categories:

- **Common**: Common to all layers and multi-layer
- **IP**: Relevant to IP links and services
- **Optical**: Relevant to fibers, optical links, OTN/ETH connections

Table 1.   Assurance Applications

Category	Application name	Legend	Description
Assurance	Performance	IP	Traffic utilization and OAM PM of port, links, tunnels and VPNs, group links by topology context (all LAG members, between router A to B), prediction of packet traffic utilization.
		Optical	L0-L1 performance, show correlation between photonic to L1 layer. Show power level across a span of ROADMs and Amplifiers.
	Service Assurance	Common	Visualize L1-L2-L3 service configuration and underlay paths, with UNIs performance and events history.
	Link Assurance	Optical	Visualize RON links across ZR and OLS with performance in all layers.
	Path Analysis	IP	Calculate, on demand, an IGP path between two routers, visualize path and show performance of IP links across the path.
	RCA	Common	Show which services and links in the upper layers were impacted by a lower layer link failure, especially in the case of a multi-layer where an optical link failure impacted IP links and services.

Layers

Terminology

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.
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).
L3 physical	L3 physical is the physical link connecting two router ports. It may ride on top of an ETH link if the IP link is carried over the optical layer.
L3-VPN	A virtual private network based on L3 routing for control and forwarding.
Logical link, IGP, LSP	Logical link connects VLANs on two IP ports.
LSP	Label Switched Path, used to carry MPLS traffic over a label-based path. LSP is the MPLS tunnel created between two routers over IGP links, with or without TE options.
NMC (OCH-NC, OTSiMC)	NMC is the link between the xPonder facing ports on two ROADMs. This link is the underlay for OCH and it is an overlay on top of OMS links. This is relevant only for disaggregation cases where the ROADM and OT box are separated.
NMS	Network Management System.
OC/OCG	SONET/SDH links that span from one optical device to another and carry SONET/SDH lower bandwidth services, the links ride on top of OCH links and terminate in TDM client ports.
OCH	OCH is a wavelength connection spanning between the client port one OT device (transponder,

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

Performance

The Performance application provides statistical information on both packet-based traffic and optical (layer 0 and layer 1) performance:

- For layer 0 (OCH, NMC, OMS and OTS), provides Rx and Tx power data (minimum, average, and maximum).

- For layer 1 (ZR Media), provides Pre-FEC (Forwarding Error Correction), Post-FEC, Q Margin and Q Factor.

- For packet-based bandwidth traffic, the application provides statistical information on packet-based bandwidth/traffic usage of ports, links and LSPs over the selected time period. The information is calculated based on collected intervals/bins (15 minutes or 1 hour) of Rx and Tx octets and displayed in tables and in graphs.

You can run a query by selecting resources and the time duration. This returns the Performance for the selected resources for a specified period and time window each day. A Performance test can be run explicitly on up to ten ports, links or LSPs by selecting the specific resources. The test can run on more ports and links by querying for ports, links or LSPs by tags or devices.

The displayed results include the resource capacity/speed and the statistical utilization info. Information on utilization is displayed for the selected resource and for the lower, upper, and adjacent resource, for example: logical ports on top of selected physical port, physical links lower to aggregation (LAG) link.

Resources can be selected explicitly by their type. After selecting the type, the user can use the model selector to select a resource (port, link or LSP). Ports, links or LSPs can also be selected by their tags, and routers (devices) can be selected using the model selector or by tag.

Utilization data is collected on IP links, for both physical and logical links. When links are selected, the user can select to view utilization for specific links/underlay (lower) links. If for example, an underlay link is selected, the application returns the utilization for both the underlay link itself and all the links above it that have utilization data.

It is also possible to view utilization data for links with devices in a single endpoint or links with devices in two endpoints. These endpoints can be defined by specific devices or by tags. For example, this allows the user to select a router and get the utilization data for all the links that end in this router or select two routers and get the utilization data for all the links between the two routers.

Using tags, means that the user can view utilization data for all links between devices with, for example, tag A, and devices with, for example, tag B.

Similarly, it is possible to select specific LSP/underlay links, as well as LSPs by devices in one or two endpoints.

The capacity appears for ports and links, and the reserved bandwidth for LSPs. For all resources, the average utilization, peak utilization, various percentiles (98, 95 and 75), and standard deviation are shown. For ports, lower and upper port capacity and average utilization also appears, and for links the lower physical links, upper aggregate link, and upper logical links names are listed (if they exist).

You can select the following types of resources:

- **Ports:** Packet Ports, Optical Port, and ZR Ports

- **Links:** IP Links, Optical Links, and ZR Links

- **LSPs:** RSVP-TE tunnels and SR Policies.

Traffic Utilization Tab

The Traffic Utilization fields that appear vary according to the type of utilization being viewed.

Note: When selecting optical (layer 0 and 1) links, the **Traffic Utilization** tab appears with the information for the related L3 physical or logical layer.

For ports:

- Device
- Port
- Capacity [Gbps]
- In Link (if this exists)
- Average [%]
- Peak [%]
- Percentile 98[%]
- Percentile 95[%]
- Percentile 75[%]
- St. Deviation
- Lower Ports (only for logical port; aggregate or physical port name)
- Lower Ports Capacity [Gbps]
- Lower Ports Average [%]
- Upper Ports (only for physical port; the logical or aggregate port name, if exists)
- Upper Ports Average (%) (only for physical port)

For Ethernet and IP Links:

- Link
- Layer
- Capacity [Gbps]
- Average [%]
- Peak [%]
- Percentile 98[%]
- Percentile 95[%]
- Percentile 75[%]
- St. Deviation
- Lower Physical Links (link name of one layer lower, if exists)
- Upper Aggregate Link (link name, if exists)

- Upper Logical Links (link name, if exists)

For LSP Tunnels and LSP Policy Links:

- Link (full LSP name including site/device)
- Reserved BW [Mbps]
- Services (Traversing Over This LSP)
- Average Rate [Mbps]
- Peak Rate [Mbps]
- Percentile 98[Mbps]
- Percentile 95[Mbps]
- Percentile 75[Mbps]
- St. Deviation

Note: The export file includes extended information. The **Average** column appears in the UI, but in the export, there are two columns: **Average IN** and **Average OUT**. The UI shows the greater value of these two values.

Performance (OAM) Tab

The following Performance fields appear for Ethernet and IP links:

- Link
- Layer
- Jitter Average (USec)
- Maximal Round Trip Time Average (Usec)
- Minimal Round Trip Time Average (Usec)
- Delay Average (Usec)

The Performance application has the option to predict the behavior of packet traffic utilization for the next 14 days based on the historical collection of performance monitoring counters. It is possible to view a prediction of packet traffic behavior assuming that you have at least 7 days of data available to base the prediction on.

The utilization graph can be opened per selected packet port or link (Ethernet or IP), and you can view the prediction as a linear line on the graph. The prediction is based on an algorithm that creates traffic patterns based on time of day, weekdays vs. weekends, and seasonal events in the local area where the system is deployed. The graph displays the linear utilization prediction line, as well as lower and upper bounds, indicating the prediction confidence interval. The prediction takes seasonal events into account.

Optical Power Tab

The Optical Power tab appears for layer 0 links (OTS, OMS, and OCH) and includes the following fields:

- Link
- Layer
- A to Z Average Power (DBm)
- A to Z Minimum Power (DBm)
- A to Z Maximum Power (DBm)
- Z to A Average Power (DBm)
- Z to A Minimum Power (DBm)
- Z to A Maximum Power (DBm)

ZR Tab

The ZR tab appears for layer 1 links (ZR Links) and includes the following fields:

- Link
- Layer
- A to Z Pre FEC BER (Q)
- A to Z Post FEC BER (Q)
- A to Z Q Factor (DBq)
- A to Z Q Margin (DBq)

Ports Traffic Utilization and Performance

You can view performance for Ethernet and IP ports:

- Specific ports
- Ports that are tagged with specific tags and tag values
- Ports on specific devices
- Ports by L3VPN Services

To configure performance for ports:

1. In the applications bar, select **Performance**.
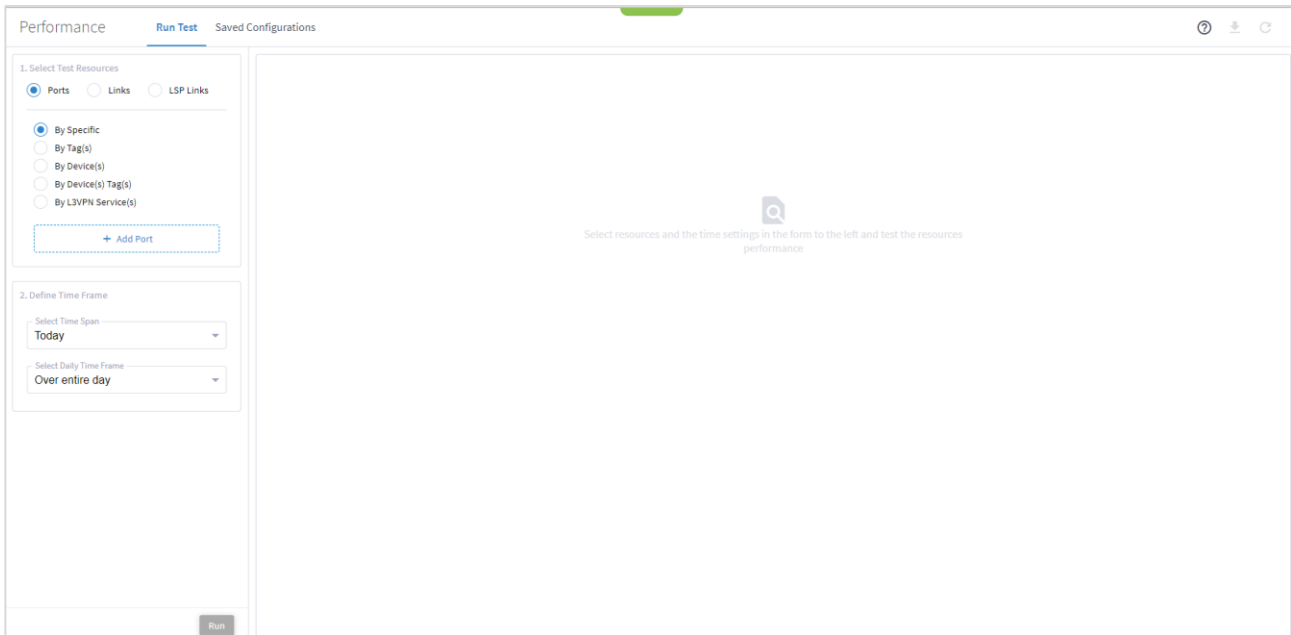
2. Ensure that **Ports** is selected.

3. To check the performance for specific ports, select **By Specific**, and then click **Add Port**. In the **Advanced** tab, select from the **Packet Ports**, **Optical Ports** or **ZR Ports** tabs, or click on the **3D Explorer** tab to select a port. Click **OK**. You can add up to 10 items.

Note: For more information on 3D Explorer, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

4. To check the performance for ports by tag, select **By Tags(s)**, click **Add Tag,** and then select the tags and click **OK**.
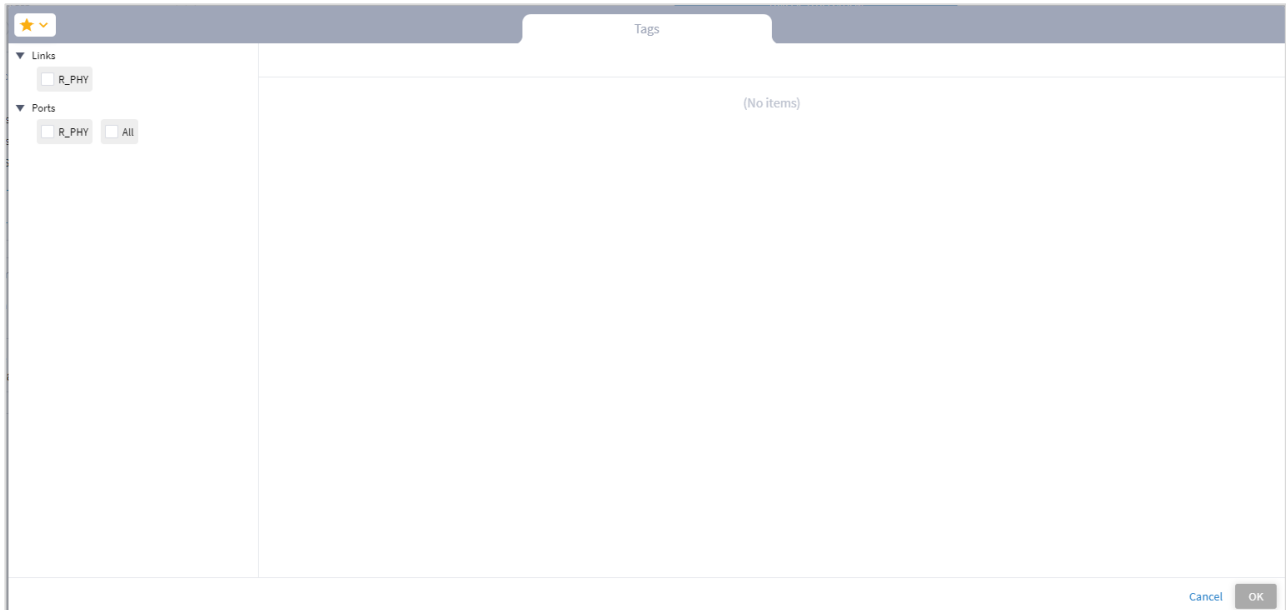
5. To check the performance for ports by device, select **By Device(s),** and then click **Add Device**. In the **Advanced** tab, select from the **Router**, **Optical Node** or **Radio** tabs, or click on the **3D Explorer** tab to select a device. Click **OK**. You can add up to 10 items.
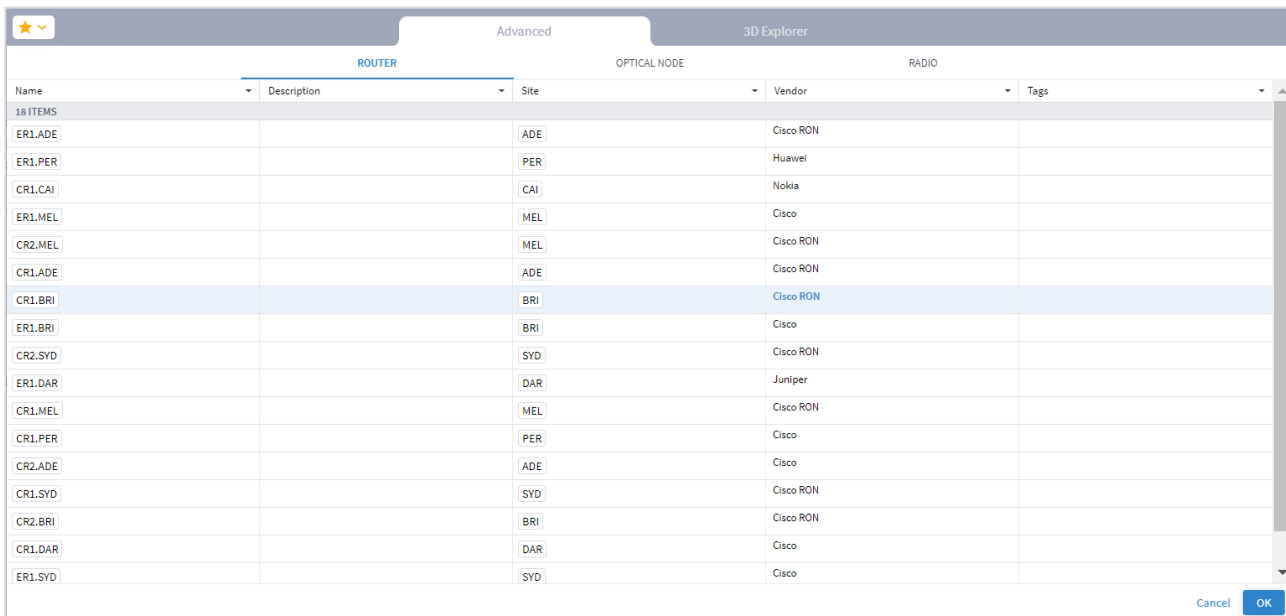
6. To check the performance for ports by device tag, select **By Device(s) Tags(s)**, click **Add Tag,** and then select the tags and click **OK**.

7. To check the performance for ports by L3VPN services, select **By L3VPN Services(s)**, and then click **Add L3VPN Service**. In the **Advanced** tab, select an L3VPN service, or click on the **3D Explorer** tab to select a L3VPN service. Click **OK**. You can add up to 10 items.

8. Continue to View Utilization and Performance.

Links Traffic Utilization and Performance

You can view performance for:

- Specific and underlay links

- Links that are tagged with specific tags and tag values

- Links that include a device in a specific endpoint

- Links that include devices that are tagged with specific tags and tag values

- Links that include devices in two endpoints

To configure performance for links:

1. In the applications bar, select **Performance**.

2. Select **Links.**

3. To check the performance for specific links, select **By Specific And Underlay Lower Link(s)**, click **Add Link**, and then select a link. In the **Advanced** tab, select from the **IP LINKS**, **OPTICAL LINKS** or **ZR LINKS** tabs, or click on the **3D Explorer** tab to select a link. Click **OK**. You can add up to 10 items.

Note: For more information on 3D Explorer, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
SD1ADE02/1-6-4 to SD1ME...	ETH	SD1ADE02	1-6-4	SD1MEL02	1-4-2	UP	REGULAR
CR2.MEL/HundredGigE0/0...	R_PHYSICAL	CR2.MEL	HundredGigE0/0/2/9	ER1.MEL	HundredGigE0/0/1/9	UP	CROSS_LINK
10.40.0.73 to 10.40.0.74	R_LOGICAL	ER1.SYD	Bundle-Ether1	CR2.SYD	Bundle-Ether0	UP	REGULAR
CR1.ADE/HundredGigE0/0...	R_PHYSICAL	CR1.ADE	HundredGigE0/0/1/10	CR1.DAR	HundredGigE0/0/1/6	UP	REGULAR
CR2.BRI/HundredGigE0/0/...	R_PHYSICAL	CR2.BRI	HundredGigE0/0/2/6	ER1.BRI	HundredGigE0/0/1/8	UP	CROSS_LINK
CR2.MEL/FourHundredGig...	R_PHYSICAL	CR2.MEL	FourHundredGigE0/0/1/7	CR2.SYD	FourHundredGigE0/0/1/7	UP	REGULAR
LAG Bundle-Ether1<=>Bu...	R_AGGREGATE	CR2.ADE	Bundle-Ether1	CR2.MEL	Bundle-Ether0	UP	REGULAR
CR1.MEL/FourHundredGig...	ETH	CR1.MEL	FourHundredGigE0/0/1/6	CR1.SYD	FourHundredGigE0/0/1/6	UP	REGULAR
CR1.SYD/FourHundredGig...	R_PHYSICAL	CR1.SYD	FourHundredGigE0/0/1/7	CR2.SYD	FourHundredGigE0/0/1/6	UP	REGULAR
HundredGigE0/0/1/7 to 1-...	ETH	CR1.DAR	HundredGigE0/0/1/7	SD1DAR02	1-2-2	UP	CROSS_LINK
LAG Bundle-Ether1<=>Bu...	R_AGGREGATE	ER1.MEL	Bundle-Ether1	CR2.MEL	Bundle-Ether1	UP	REGULAR
10.40.0.89 to 10.40.0.90	R_LOGICAL	ER1.PER	100GE1/1/1	CR1.PER	HundredGigE0/0/1/9	UP	REGULAR
10.40.0.78 to 10.40.0.77	R_LOGICAL	CR1.BRI	Bundle-Ether0	ER1.BRI	Bundle-Ether0	UP	REGULAR
CR1.PER/HundredGigE0/0...	R_PHYSICAL	CR1.PER	HundredGigE0/0/1/9	ER1.PER	100GE1/1/1	UP	CROSS_LINK
CR1.SYD/HundredGigE0/0...	R_PHYSICAL	CR1.SYD	HundredGigE0/0/2/9	ER1.SYD	HundredGigE0/0/1/7	UP	CROSS_LINK
CR1.ADE/HundredGigE0/0...	R_PHYSICAL	CR1.ADE	HundredGigE0/0/1/9	CR1.PER	HundredGigE0/0/1/7	UP	REGULAR
CR1.SYD/HundredGigE0/0...	R_PHYSICAL	CR1.SYD	HundredGigE0/0/2/8	ER1.SYD	HundredGigE0/0/1/6	UP	CROSS_LINK

4. To check the performance for links by tag, select **By Tags(s)**, click **Add Tag**, and then select the tags and click **OK**.

5. To check the performance by devices in an endpoint, select By Device(s) In Some Endpoint, and then click **Add Device**. In the **Advanced** tab, select from the **Router**, **Optical Node** or **Radio** tabs, or click on the **3D Explorer** tab to select a device. Click **OK**. You can add up to 10 items.

Name	Description	Site	Vendor	Tags
18 ITEMS				
ER1.ADE		ADE	Cisco RON	
ER1.PER		PER	Huawei	
CR1.CAI		CAI	Nokia	
ER1.MEL		MEL	Cisco	
CR2.MEL		MEL	Cisco RON	
CR1.ADE		ADE	Cisco RON	
CR1.BRI		BRI	Cisco RON	
ER1.BRI		BRI	Cisco	
CR2.SYD		SYD	Cisco RON	
ER1.DAR		DAR	Juniper	
CR1.MEL		MEL	Cisco RON	
CR1.PER		PER	Cisco	
CR2.ADE		ADE	Cisco	
CR1.SYD		SYD	Cisco RON	
CR2.BRI		BRI	Cisco RON	
CR1.DAR		DAR	Cisco	
ER1.SYD		SYD	Cisco	

Advanced / 3D Explorer / ROUTER / OPTICAL NODE / RADIO

Cancel   OK

6. To check the performance for by device tag, select **By Device(s) Tag(s) In Some Endpoint**, click **Add Tag**, and then select the tags and click **OK**.

7. To check the performance for links with devices in two endpoints, select **By Device(s) In 2 Endpoints** and then select one of the following for **Endpoint 1** and **Endpoint 2.**

1. Select Test Resources
   ○ Ports   ● Links   ○ LSP Links

   ○ By Specific And Underlay Link(s)
   ○ By Tag(s)
   ○ By Device(s) In Some Endpoint
   ○ By Device(s) Tags(s) In Some Endpoint
   ● By Device(s) In 2 Endpoints

   Endpoint 1
   ● Specific Device(s)
   ○ Device(s) By Tag(s)
   + Add Device

   Endpoint 2
   ● Specific Device(s)
   ○ Device(s) By Tag(s)
   + Add Device

   ◦ Specific Device(s): Click Add Device and then select a device In the Advanced tab, select from the Router, Optical Node or Radio tabs, or click on the 3D Explorer tab to select a device. Click OK. You can add up to 10 items.

   ◦ Device(s) By Tag(s): Click Add Tag and then select the tags and click OK.

8. Continue to .

LSP Links Traffic Utilization and Performance

You can view performance for:

- Specific LSP links

- LSP links that are tagged with specific tags and tag values

- LSP links that include a device in a specific endpoint

- LSP links that include devices that are tagged with specific tags and tag values

- LSP links that include devices in two endpoints

To configure performance for LSP links:

1. In the applications bar, select **Performance**.

2. Select **LSP Links**.

3. To check the performance for specific LSP links, select **By Specific And Related Lower Link(s)**, click **Add Link**, and then select a link. In the **Advanced** tab, select from the **LSP**, **IGP**, **IP Links**, **Optical Links** or **FIBER** tabs, or click on the **3D Explorer** tab to select a link. Click **OK**. You can add up to 10 items.

Note: For more information on 3D Explorer, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

4. To check the performance for links by tag, select **By Tags(s)**, click **Add Tag**, and then select the tags and click **OK**.

5. To check the performance by devices in an endpoint, select **By Device(s) In Some Endpoint**, and then click **Add Device**. In the **Advanced** tab, select from the **ROUTER**, **OPTICAL NODE** or **RADIO** tabs, or click on the **3D Explorer** tab to select a device. Click **OK**. You can add up to 10 items.

6. To check the performance for by device tag, select **By Device(s) Tag(s) In Some Endpoint**, click **Add Tag**, and then select the tags and click **OK**.

7. To check the performance for links with devices in two endpoints, select **By Device(s) In 2 Endpoints**, and then select one of the following for **Endpoint 1** and **Endpoint 2**.

◦ Specific Device(s): Click Add Device and then select a device In the Advanced tab, select from the Router, Optical Node or Radio tabs, or click on the 3D Explorer tab to select a device. Click OK. You can add up to 10 items.

- Device(s) By Tag(s): Click Add Tag and then select the tags and click OK.

8. Continue to [View Utilization and Performance](#).

View Traffic Utilization and Performance

After specifying the ports, links or LSP links, you must configure the time frame and window. You can then view the results in table and graph form.

To view performance:

1. In the **Select time** area, specify the period to report on:

   - Select Time Span: Select the required period, either Today, Past 24 hours, Past 7 days, Past 14 days, Past 30 days, Past 60 days, or Custom. If you select Custom, then click From and To and select a date and specify a time.

   2. Define Time Frame

   Select Time Span
   Custom   ▼

   From   ▾

   To   ▾

   Select Daily Time Frame
   Over entire day   ▼

   - In the Select Daily Time Frame area either select Over entire day or Specific time span per day. If you select Specific time span per day, then click From and Until to specify a time.

   2. Define Time Frame

   Select Time Span
   Past 14 days   ▾

   Select Daily Time Frame
   Specific time span per day ▾

   From   ▾

   To   ▾

2. Click **Run**. If there are no relevant results, a **Utilization information is not available for the selected resources** message appears.

Note: When selecting optical (layer 0 and 1) links, the **Traffic Utilization** tab appears with the information for the related L3 physical, logical, or aggregate layers.

TRAFFIC UTILIZATION															
Device	Port	Type	Capacity [Gbps]	In Link	Average [%]	Peak [%]	Percentile 98[%]	Percentile 95[%]	Percentile 75[%]	St. Deviation	Lower Ports	Lower Ports Capacity [Gbps]	Lower Ports: Average [%]	Upper Ports	Upper Ports: Average [%]
3 ITEMS															
CR1.CAI	10ge-0/1/1	L3 Logical	10.0	N/A	80.291	99.234	97.53	91.261	84.627	11.055	10ge-...	67.376	10.0		
CR1.DAR	Hundred...	L3 Logical	100.0	10.40.0.9...	79.239	97.452	94.626	89.608	84.673	7.785	Hundr...	77.795	100.0		
CR1.PER	Hundred...	L3 Physical	100.0	CR1.ADE/...	78.647	99.754	97.992	89.283	83.752	7.552				Bundl... Bundl...	78.221 77.443

3. Select an item to see more details on the **INBOUND TRAFFIC** and **OUTBOUND TRAFFIC**.

TRAFFIC UTILIZATION															
Device	Port	Type	Capacity [Gbps]	In Link	Average [%]	Peak [%]	Percentile 98[%]	Percentile 95[%]	Percentile 75[%]	St. Deviation	Lower Ports	Lower Ports Capacity [Gbps]	Lower Ports: Average [%]	Upper Ports	Upper Ports: Average [%]
3 ITEMS															
CR1.CAI	10ge-0/1/1	L3 Logical	10.0	N/A	80.291	99.234	97.53	91.261	84.627	11.055	10ge-...	67.376	10.0		
CR1.DAR	Hundred...	L3 Logical	100.0	10.40.0.9...	79.239	97.452	94.626	89.608	84.673	7.785	Hundr...	77.795	100.0		
CR1.PER	Hundred...	L3 Physical	100.0	CR1.ADE/...	78.647	99.754	97.992	89.283	83.752	7.552				Bundl... Bundl...	78.221 77.443

CR1.CAI —— L3 Logical 10ge-0/1/1   [BANDWIDTH] [UTILIZATION]   Show Prediction   Reference Series

▼ INBOUND TRAFFIC

▼ OUTBOUND TRAFFIC

4. To filter the table, click ☰ and select the required options:

   ◦ In numerical fields, the filter is numerical, and you can specify expressions including =, >, <, >=, <=, !=.

   ◦ In textual fields, the filter is character-based (regular expression).

St.
Deviation

Filter

✓ Select All   ✕ Clear All

☑ 7.16   2
☑ 7.44   1
☑ 7.03   1

5. To sort the table, click on a column heading.

↓ Capacity ☰   ↑ Capacity ☰
[Gbps]   [Gbps]

6. In the **TRAFFIC UTILIZATION** tab, to change the y-axis scaling, click **BANDWIDTH** or **UTILIZATION**.

7. To view the prediction, select **Show Prediction**.
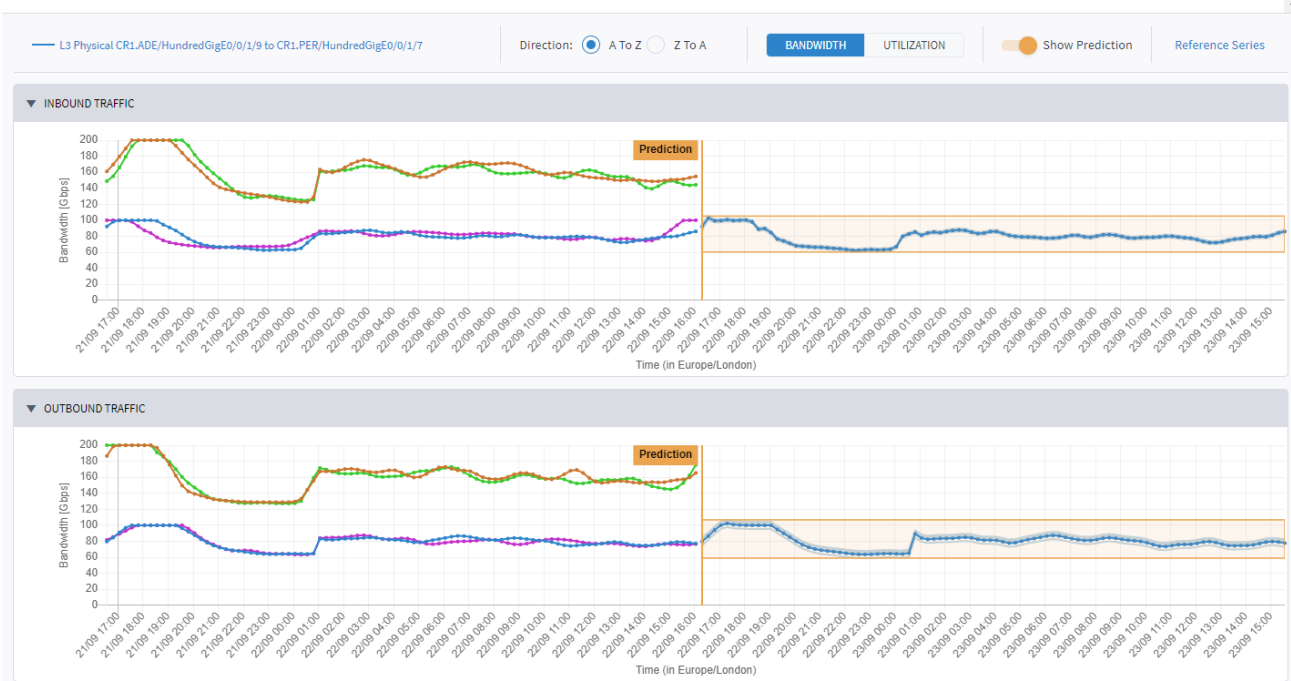
8. Hover over a data point on the graph to see the date, time, element name and utilization value.
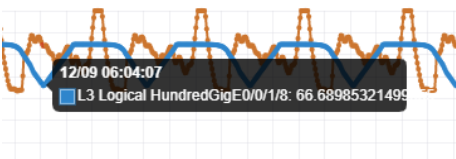
9. To change the date range of the graph and zoom in or out, click on a graph and then using the mouse wheel, scroll up (to zoom in) or scroll down (to zoom out).

10. If you select to view the data over more than one day, for a specific time of day, for example, for the past 7 days between 13:00 and 15:00, the utilization graph appears with the values for the selected time window.

11. To view the reference series toggle, select **Reference Series**.

12. To remove a reference series, click on the series description.
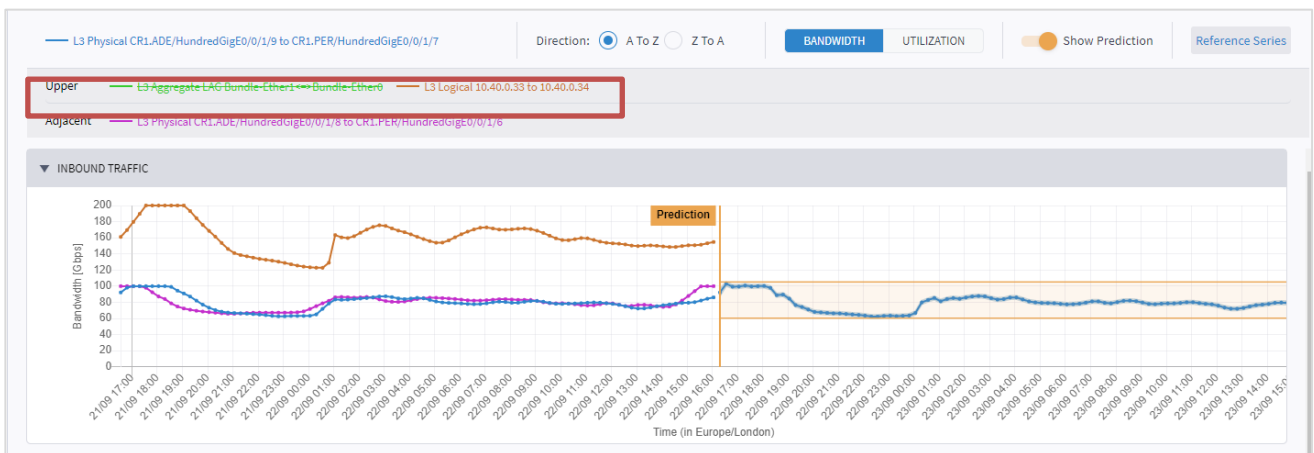
13. To change the direction, select **A to Z** or **Z to A**.

14. To view the OAM data (if relevant), click the **PERFORMANCE (OAM)** tab.

| | | TRAFFIC UTILIZATION | PERFORMANCE (OAM) | | | |

Link	Layer	Jitter Average [USec]	Maximal Round Trip Time Average [USec]	Minimal Round Trip Time Average [USec]	Delay Average [USec]
18 ITEMS					
CR1.MEL/FourHundredGigE0/0/1/7 to CR2.MEL/FourHundredGigE0/0/1/6	L3 Physical	4773.845	2353.843	4569.303	3429.28
CR1.ADE/HundredGigE0/0/1/9 to CR1.PER/HundredGigE0/0/1/7	L3 Physical	4446.235	1999.178	4213.782	3035.84
CR2.ADE/HundredGigE0/0/1/8 to CR2.MEL/HundredGigE0/0/2/6	L3 Physical	3931.215	2046.172	4396.224	2946.475
CR1.ADE/HundredGigE0/0/1/10 to CR1.DAR/HundredGigE0/0/1/6	L3 Physical	4704.44	2431.859	4536.792	3469.373
CR1.MEL/FourHundredGigE0/0/1/8 to CR1.BRI/FourHundredGigE0/0/1/6	L3 Physical	4190.033	2179.715	4229.106	3124.64
CR2.SYD/FourHundredGigE0/0/1/8 to CR2.BRI/FourHundredGigE0/0/1/6	L3 Physical	4917.803	2217.877	4233.33	3208.933
CR2.MEL/FourHundredGigE0/0/1/7 to CR2.SYD/FourHundredGigE0/0/1/7	L3 Physical	4301.153	2328.121	4313.07	3308.909
CR1.SYD/FourHundredGigE0/0/1/7 to CR2.SYD/FourHundredGigE0/0/1/6	L3 Physical	4698.631	1972.953	4042.561	3002.009
CR1.SYD/FourHundredGigE0/0/1/8 to CR1.BRI/FourHundredGigE0/0/1/7	L3 Physical	4047.538	2384.987	4653.397	3365.912
CR1.ADE/HundredGigE0/0/1/6 to CR1.MEL/HundredGigE0/0/2/6	L3 Physical	4501.58	2108.263	4724.52	3458.121
CR1.ADE/HundredGigE0/0/1/12 to CR1.SYD/HundredGigE0/0/2/7	L3 Physical	3957.105	2089.483	4408.032	3179.302
CR2.ADE/HundredGigE0/0/1/9 to CR2.MEL/HundredGigE0/0/2/7	L3 Physical	4805.431	1916.372	4248.698	3239.325
CR1.MEL/FourHundredGigE0/0/1/6 to CR1.SYD/FourHundredGigE0/0/1/6	L3 Physical	4145.374	2100.352	4748.385	3381.403
CR1.ADE/HundredGigE0/0/1/8 to CR1.PER/HundredGigE0/0/1/6	L3 Physical	3977.8	2027.184	4354.035	3223.713
CR1.DAR/HundredGigE0/0/1/7 to CR1.PER/HundredGigE0/0/1/8	L3 Physical	4373.257	2355.717	4737.333	3571.675
CR1.ADE/HundredGigE0/0/1/7 to CR1.MEL/HundredGigE0/0/2/7	L3 Physical	4547.57	1964.507	4217.899	3290.365
CR1.BRI/TenGigE0/0/2/6 to CR1.CAI/10ge-0/1/1	L3 Physical	4645.89	2047.15	4627.032	3192.799
CR1.ADE/HundredGigE0/0/1/11 to CR1.SYD/HundredGigE0/0/2/6	L3 Physical	4174.743	1972.574	4477.83	3384.236

15. Select an item to see more details on **JITTER**, **MIN RTT**, **MAX RTT**, **DELAY**, and **OUTBOUND TRAFFIC**.

| | | TRAFFIC UTILIZATION | PERFORMANCE (OAM) | | | |

Link	Layer	Jitter Average [USec]	Maximal Round Trip Time Average [USec]	Minimal Round Trip Time Average [USec]	Delay Average [USec]
4 ITEMS					
LAG Bundle-Ether1<=>Bundle-Ether1	L3 Aggregate	4744.061	2312.015	4944.607	3560.295
10.40.0.10 to 10.40.0.9	L3 Logical	4486.288	2541.507	4661.591	3707.596
CR1.MEL/FourHundredGigE0/0/1/8 to CR1.BRI/FourHundredGigE0/0/1/6	L3 Physical	4041.74	2072.411	4140.077	3073.259
10.40.0.65 to 10.40.0.66	L3 Logical	4363.623	2192.703	4297.929	3177.105

— L3 Aggregate LAG Bundle-Ether1<=>Bundle-Ether1   Direction: ● A To Z ○ Z To A   Reference Series

▼ JITTER

MIN RTT

MAX RTT

DELAY

16. To view the optical data (if relevant), click the **OPTICAL POWER** tab. Select an item to see **Power** details.

Link	Layer	A To Z Average Power [DBm]	A To Z Minimum Power [DBm]	A To Z Maximum Power [DBm]	Z To A Average Power [DBm]	Z To A Minimum Power [DBm]	Z To A Maximum Power [DBm]
3 ITEMS							
Optics0/0/0/20 to Optics0/0/0/20	OCH	-10.01 / -3.48	-10.05 / -3.49	-9.98 / -3.47	-10.03 / -3.11	-10.04 / -3.17	-10.02 / -3.06
Optics0/0/0/20 to Optics0/0/3/2	OCH	-11.51 / -40.0	-11.56 / -40.0	-11.48 / -40.0	-40.0 / -10.69	-40.0 / -10.74	-40.0 / -10.63
Fiber-4	OTS	- / 7.37	- / 7.27	- / 7.37	17.69 / -	17.69 / -	17.69 / -

Power
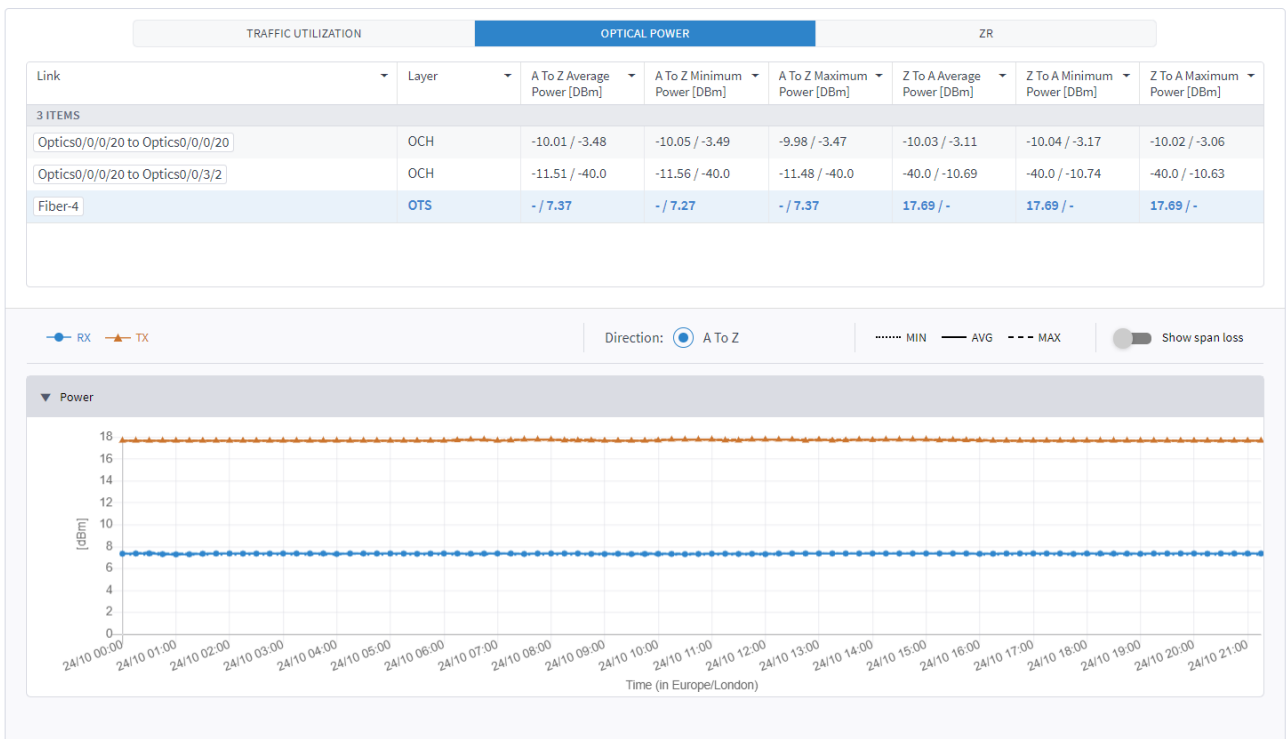
17. To view the ZR media data (if relevant), click the **ZR** tab. Select an item to see **FEC BER** and **Q** details.

Export Test Results

The tabular test results can be exported into a zip file with CSV files for offline analysis.

The export file includes extended information. The **Average** column appears in the UI, but in the export, there are two columns: **Average IN** and Average OUT. The UI shows the greater value of these two values.

To export the test results:

1. In the applications bar, select **Performance**.

2. Run the required test.

3. Click ![download icon]. The file is downloaded automatically.

Manage Configurations

You can save the test configuration and either run the test when required or use it as a basis for a new test. You can also configure a test to run periodically.

To view a saved test result:

1. In the applications bar, select **Performance**.

2. Expand the required test.
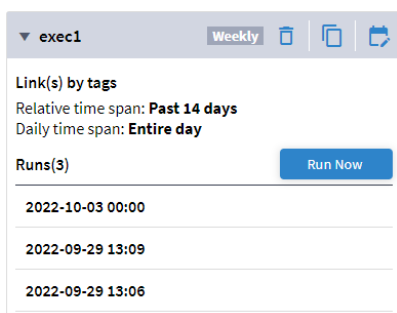
3. Select a run to view the results or click **Run Now** to execute the test.

To save a test configuration:

1. In the applications bar, select **Performance**.

2. Run the required test.

3. Click **Save**.
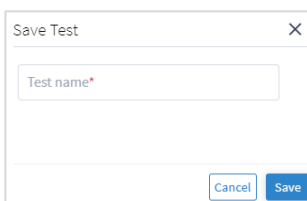
4. Enter a test name.

5. Click **Save**. The configuration is now available to run on the **Saved Configurations** tab.

To run a saved test configuration:

1. In the applications bar, select **Performance**.

2. Select the **Saved Configurations** tab.
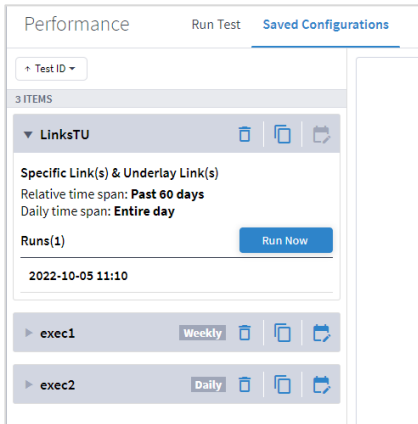
3. To run a test, expand the required test.

4. Click **Run Now** or if you want to edit the test, click ⬚, modify the test as required, and then click **Run**.

To set a test to run periodically:

1. In the applications bar, select **Performance**.

2. Select the **Saved Configurations** tab.

3. For the required test, click ⬚.
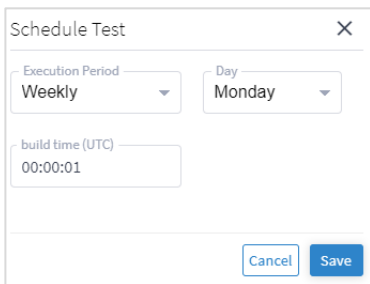
4. Select whether to execute the test **Weekly** (and on which day), or **Daily**.

5. Specify the **build time (UTC)**.

6. Click **Save**.

To delete a test:

1. In the applications bar, select **Performance**.

2. Select the **Saved Configurations** tab.

3. Click 🗑. The test is deleted (there is no confirmation).

Other Ways to See Performance Data

- In Explorer, for a physical or logical port of a router, the **Utilization Over 24h** graph also appears in the Info window (if the port was utilized over latest 24 hours). For links and LSP links no data is presented in the Explorer window.

- In the Service Assurance application, for point to point services. See View the Point to Point Services.

- In the Path Analysis application, for a path. See Analysis a Path.

Service Assurance

The Service Assurance application enables you to visualize the L1-L2-L3 service configuration and underlay paths, with UNIs performance and service-related events history.

For more information on services and service provision, see the *Cisco Crosswork Hierarchical Controller Service Provisioning User Guide*.
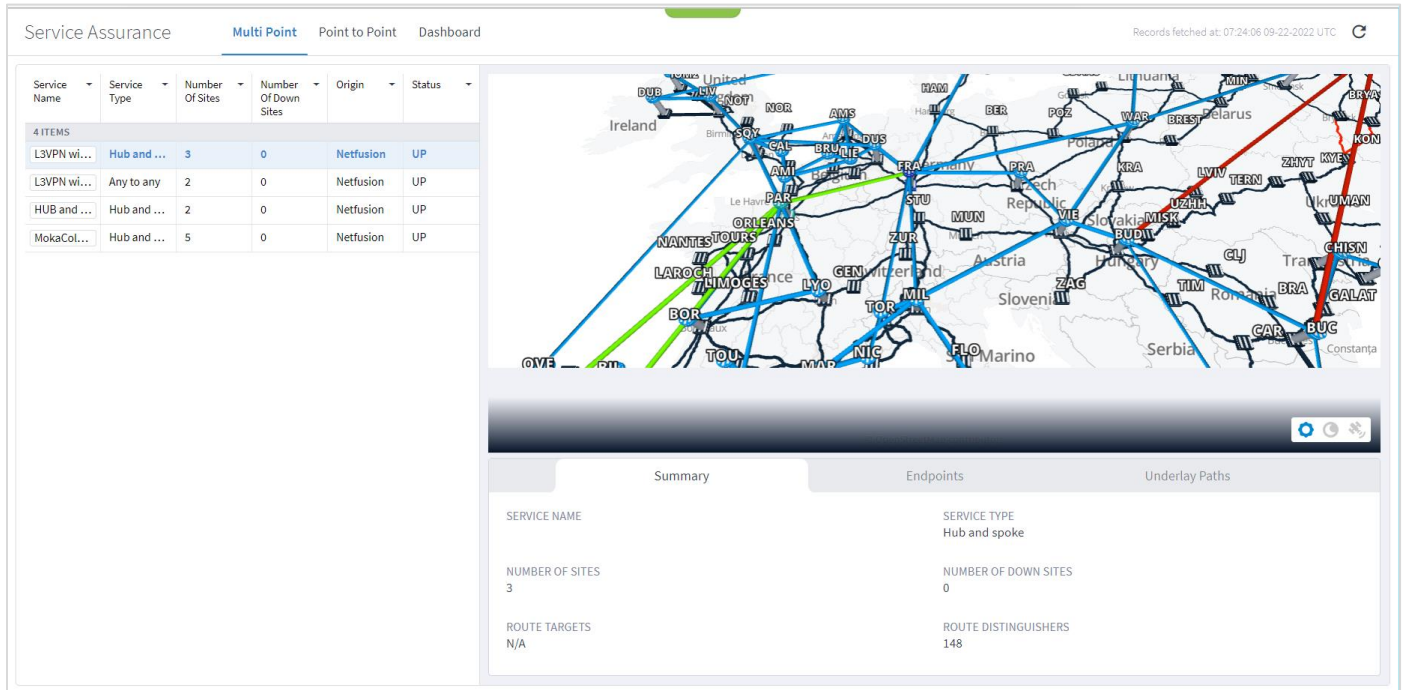
For more information on the 3D Explorer application, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

View the Multi Point Services

Crosswork Hierarchical Controller discovers L3-VPN sites (endpoints), VRFs and underlay paths as LSPs across multiple domains (autonomous systems) and vendors and maps it to the optical network. Discovered VPNs are displayed in the Service Assurance application with their Route Distinguishers (RDs), Route Targets (RTs), type (hub & spoke or any to any/full mesh), sites, underlay LSPs and IGP path visualized on the map. The RD is used to keep all prefixes in the BGP table unique, and the RT is used to transfer routes between VRFs/VPNs.

You can view a list of these Multi Point services and view their endpoints and underlay paths. The Multi Point services can be of type:

- **Any to any:** A full mesh non-hierarchical service where any site can communicate with any site.

- **Hub and spoke:** A hierarchical service where hub sites can communicate with all other sites and spoke sites can only communicate with hub sites.

To view the Multi Point Services:

1. In the applications bar, select **Service Assurance.**

2. Select the **Multi Point** tab. The table on the left lists the multi point services and includes information on:

   ○ **Service Name:** The name of the service as defined in the Services Manager.

   ○ **Service Type**: The service type, **Any to any** or **Hub and spoke**.

   ○ **Number of Sites**: The number of sites in the service.

   ○ **Number of Down Sites**: The number of sites in the service that are DOWN.

   ○ **Origin**: The origin of the service, either **Netfusion** (created by Crosswork Hierarchical Controller) or **Network**.

   ○ **Status**: The service status, either **UP** or **DOWN**.

3. Select the required service. The Explorer map shows all sites and the underlay paths for the selected service.

4. The **Summary** tab includes the following details:

   ○ **Service Name:** The service name.

   ○ **Service Type**: The service type, **Any to any** or **Hub and spoke**.

   ○ **Number of Sites**: The number of sites in the service.

   ○ **Number of Down Sites**: The number of sites in the service that are DOWN.

   ○ **Route Targets:** The number of route targets.

   ○ **Route Distinguishers:** The number of route distinguishers.

	Summary	Endpoints	Underlay Paths
SERVICE NAME		**SERVICE TYPE**	
		Hub and spoke	
NUMBER OF SITES		**NUMBER OF DOWN SITES**	
3		0	
ROUTE TARGETS		**ROUTE DISTINGUISHERS**	
N/A		148	

5. A list of the Endpoints appears below the map with the following details:

   - **Device Name:** The device name.

   - **Port Name:** The interface port name.

   - **Operational State:** The operational status of the port (**UP** or **DOWN**).

   - **Admin State:** The admin status of the port (**UP** or **DOWN**).

   - **VRF Name:** The Virtual Routing and Forwarding (VRF) name.

   - **VRF Description:** The VRF description.

   - **VLAN ID:** The endpoint VLAN ID.

   - **IP Address:** The endpoint IP address.

   - **Role:** The role of the endpoint, **SPOKE** or **HUB**.

   - **Tags:** The endpoint tags.

	Summary		Endpoints		Underlay Paths				
Device Name ▾	Port Name ▾	Operational State ▾	Admin State ▾	VRF Name ▾	VRF Description ▾	VLAN ID ▾	IP Address ▾	Role ▾	Tags ▾
3 ITEMS									
CR1.LIS	L3_VPN port at CR1.LIS, s...	UP	UP		L3 VPN port at service L3VPN with RSVP underlay	1901	10.1.12...	SPOKE	
CR1.PAR	L3_VPN port at CR1.PAR, s...	UP	UP		L3 VPN port at service L3VPN with RSVP underlay	1900	10.1.10...	HUB	
CR1.FRA	L3_VPN port at CR1.FRA, s...	UP	UP		L3 VPN port at service L3VPN with RSVP underlay	1902	10.1.14...	SPOKE	

6. The Underlay Paths tab includes the following details:

   - **RT:** The route target number.

   - **LSP Name**: The LSP name (if RSVP-TE or LDP)**.**

   - **Path Type**: The type of the underlay path, SR Policies or RSVP-TE Tunnels.

   - **Source (Export)**: The source site name (geo site:device:port:vlan).

   - **Destination (Import):** The destination site name (geo site:device:port:vlan).

   - **Underlay Hops:** The number of hops in the underlay path.

   - **Link Layer**: The link layer.

   - **Tags:** The underlay tags.

RT ▼	LSP Name ▼	Path Type ▼	Source (Export) ▼	Destination (Import) ▼	Underlay Hops ▼	Link Layer ▼	Oper ▼ Statu	Tags ▼
2 ITEMS								
N/A	SR_P_600	SR_POLICY	SPB CR1.SPB L3_VPN port at CR1.SPB, ser...	DUB CR1.DUB L3_VPN port at CR1.DUB, se...	11	L3 VPN	N_A	**Tag** All
N/A	SR_P_600_reverse	SR_POLICY	DUB CR1.DUB L3_VPN port at CR1.DUB, se...	SPB CR1.SPB L3_VPN port at CR1.SPB, ser...	11	L3 VPN	N_A	**Tag** All

Note: Underlay paths are not discovered or calculated for sites located in different domains (inter-AS option C).

7. Select a path in the table to display it in the map.

View the Point to Point Services

You can view point to point services of type:

- **Circuit E-Line:** An Ethernet connection between two ETH client ports on Transponder or Muxponder over OTN signal.

- **Packet E-Line:** A point-to-point connection between two routers or transponders/muxponders over MPLS-TP or IP-MPLS.

To view the point to point services:

1. In the applications bar, select **Service Assurance.**

2. Select the **Point to Point** tab. The table on the left lists the multi point services and includes information on:

    ◦   **Service Name:** The name of the service as defined in the Services Manager.

    ◦   **Service Type**: The service type, **Packet e-line** or **Circuit e-line**.

    ◦   **Number of Down Sites**: The number of sites in the service that are DOWN.

    ◦   **Origin**: The origin of the service.

    ◦   **Status**: The service status, either **UP** or **DOWN**.

3. Select the required service. The Explorer map shows the selected service.

4. The **Summary** tab includes the following details:

    ◦   **Service Name:** The service name.

- **Service Type**: The service type, **Packet e-line** or **Circuit e-line**.

- **Status**: The service status, either **UP** or **DOWN**.

- **Origin**: The origin of the service.

- **Creation Date**: The date the service was created.

- **Optimization Goal**: The optimization goal as defined in the service.

- **Include Link**: The IP or optical links that were included in the service intent.

- **Exclude Link**: The IP or optical links that were excluded in the service intent.

- **Disjoint Service Name:** The disjoint service name. This means that the new Packet E-Line or 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).

Summary	Endpoints	Underlay Paths	History

SERVICE NAME
E-Line Packet Service <IP Domain E-Line 1>

SERVICE TYPE
Packet e-line

STATUS
UP

ORIGIN
Netfusion

CREATION DATE
2022-08-25 15:56:01

OPTIMIZATION GOAL
NUMBER_OF_HOPS

INCLUDE LINK
N/A

EXCLUDE LINK
N/A

DISJOINT SERVICE NAME
N/A

5. In the **Endpoint** tab, a list of the Endpoints appears below the map with the following details:

- **Device Name:** The device name.

- **Port Name:** The interface port name.

- **Operational State:** The operational status of the port (**UP** or **DOWN**).

- **Admin State:** The admin status of the port (**UP** or **DOWN**). If **DOWN**, this element constitutes a root cause failure in and of itself (and not simply an affected element).

- **VLAN ID:** The endpoint VLAN ID.

- **BW Eir:** The bandwidth Excess Information Rate (EIR).

- **BW Cir:** The bandwidth Committed Information Rate (CIR).

- **Tags:** The endpoint tags.

6. Select the required endpoint. The performance information appears for the selected service map with the following details:

- **Device Name:** The device name.

- **Port:** The port name.

- ○ **Type:** The port name.

- ○ **Average [%]**

- ○ **Peak [%]**

- ○ **Percentile [98%]**

- ○ **Percentile [95%]**

- ○ **Percentile [75%]**

- **St Deviation**

To view graphs of the performance, click the **Graphs** tab in the lower pane. For additional information on performance, see Performance.

7. Click ⚙ and specify the period to report on:

   ◦ **Select Time Span**: Select the required period, either **Today**, **Past 24 hours**, **Past 7 days**, **Past 14 days**, **Past 30 days**, **Past 60 days**, or **Custom**. If you select **Custom**, then click **From** and **To** and select a date and specify a time.

- In the **Select Daily Time Frame** area either select **Over entire day** or **Specific time span per day**. If you select **Specific time span per day**, then click **From** and **Until** to specify a time.

8. Click **Export** to download the performance statistics.

9. The **Underlay Paths** tab includes the following details:

   - **Link Name**: The link name.

   - **Source (Export)**: The source site name (geo site:device:port:vlan).

   - **Destination (Import):** The destination site name (geo site:device:port:vlan).

   - **Link Layer:** The link layer. For Circuit e-line: **ODU**. For Packet e-line: **MPLS TP**, **SR Policy**, or **LSP**.

   - **Oper Status:** The operational status.

   - **Role:** Either the **main** path or the **protection** path.

   - **Tags:** The underlay tags.

Summary	Endpoints	Underlay Paths	History

Link Name ▼	Source (Export) ▼	Destination (Import) ▼	Link Layer ▼	Oper Status ▼	Role ▼	Tags ▼
2 ITEMS						
SR_P_100_reverse	ZR_ER2.SQY-100.0.0.157 (router-id) loopb…	ZR_ER2.LIS-100.0.0.134 (router-id) loopb…	SR Policy	Up	main	**Tag** All
SR_P_100	ZR_ER2.LIS-100.0.0.134 (router-id) loopb…	ZR_ER2.SQY-100.0.0.157 (router-id) loopb…	SR Policy	Up	main	**Tag** All

10. The **History** tab shows all changes in configuration or in operational status of the service and its underlay path links or tunnels and includes the following details:

   ◦ **Time**: The time of the event.

   ◦ **Object Name**: The object name.

   ◦ **Object Type**: The object type, port, service, or link.

   ◦ **Action Type**: The action type, **UPDATE**, **INSERT** or **DELETE**.

   ◦ **Changed Attributes**: The attributes changed.

Summary	Endpoints	Underlay Paths	History

Time ▼	Object Name ▼	Object Type ▼	Action Type ▼	Changed Attributes ▼
10 ITEMS				
Aug 25 2022 16:02:47 UTC	E-Line Packet Service <IP Domain…	Service	UPDATE	**tags:** {} → {"Tag": ["All"]} View all changes (1)
Aug 25 2022 16:02:47 UTC	SR_P_100_reverse	Link	UPDATE	**tags:** {} → {"Tag": ["All"]} View all changes (1)
Aug 25 2022 16:02:47 UTC	SR_P_100	Link	UPDATE	**tags:** {} → {"Tag": ["All"]} View all changes (1)
Aug 25 2022 16:00:31 UTC	VIRTUAL_UNI port at ZR_ER2.LIS, …	Port	UPDATE	**tags:** {} → {"Tag": ["All"]} View all changes (1)

View the Dashboard

In the Dashboard you can see how many services were discovered and how many services are operationally down.

To view the Dashboard:

1. In the applications bar, select **Service Assurance**.

2. Select the **Dashboard** tab.

Service Assurance	Multi Point	Point to Point	**Dashboard**		Records fetched at: 07:24:06 09-22-2022 UTC ⟳
Discovered Services				**Operationally Down Services**	
	29			0	

View the Services using SHQL

If you have access to SHQL, you can execute a query to view a list of the various services (by type).

To view the services using SHQL:

1. In the applications bar, select **SHQL Query.**

2. Enter service **| add_counters()** and click **RUN**. This shows you the total number of configured services.
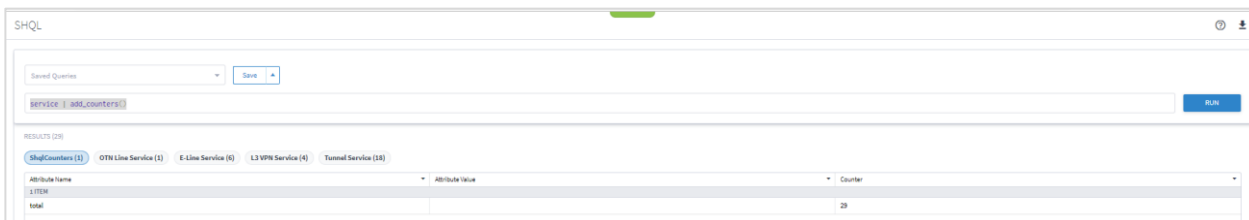
3. Click the required service tab to view a list of the services, for example, OTN Line Services, E–Line Services, L3 VPN Services, or Tunnel Services (RSVP Tunnel and SR Policy).
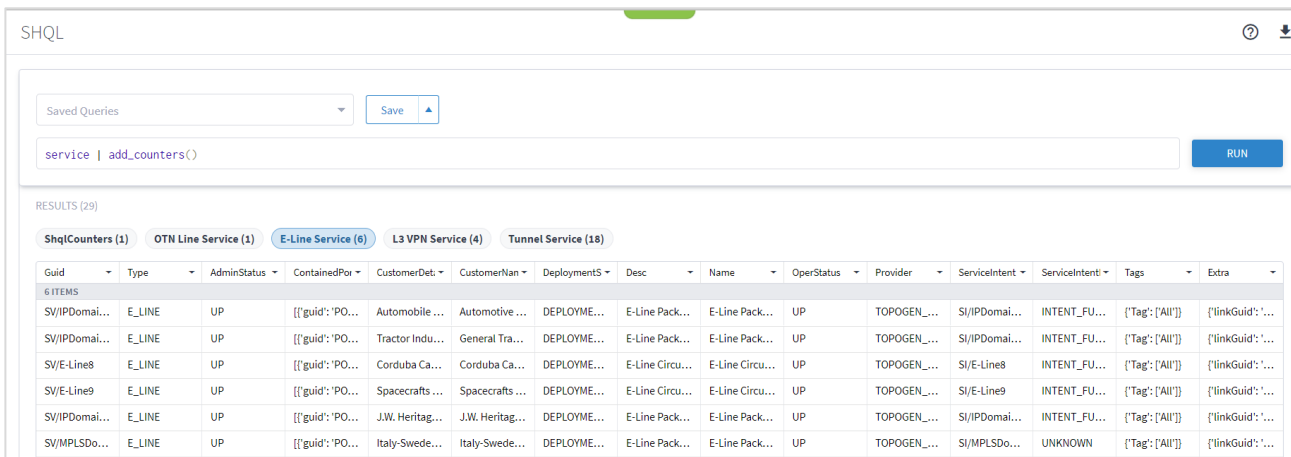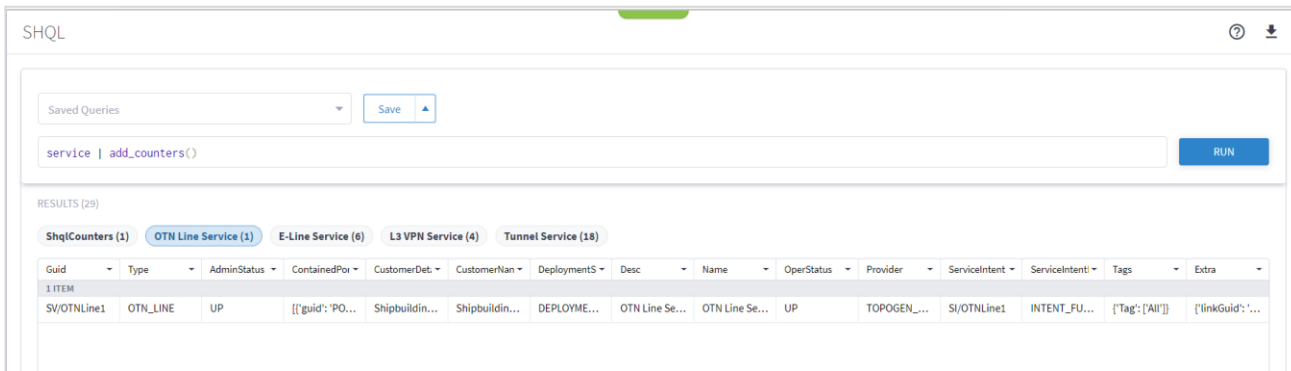
SHQL

Saved Queries | Save ▲

`service | add_counters()` | RUN

RESULTS (29)

| ShqlCounters (1) | OTN Line Service (1) | E-Line Service (6) | L3 VPN Service (4) | Tunnel Service (18) |

Guid ▾	Type ▾	AdminStat ▾	Contained ▾	CustomerI ▾	Customerf ▾	Deployme ▾	Desc ▾	Name ▾	OperStatu ▾	Provider ▾	ServiceInt ▾	ServiceInt ▾	Tags ▾	Extra ▾	AnyToAny ▾	SpokeRou ▾	VpnTopolc ▾
4 ITEMS																	
SV/L3VP...	L3_VPN	UP	[{'guid': '...	Test L3 V...	Test	DEPLOY...	L3 VPN s...	L3VPN wi...	UP	TOPOGE...	SI/L3VPN...	INTENT_...	{'Tag': ['A...	{'linkGui...			HUB_AN...
SV/L3VP...	L3_VPN	UP	[{'guid': '...	Test L3 V...	Test	DEPLOY...	L3 VPN s...	L3VPN wi...	UP	TOPOGE...	SI/L3VPN...	INTENT_...	{'Tag': ['A...	{'linkGui...			ANY_TO_...
SV/HUB_...	L3_VPN	UP	[{'guid': '...	Agile Dev...	ADT.Ltd	DEPLOY...	L3 VPN s...	HUB and ...	UP	TOPOGE...	SI/HUB_...	INTENT_...	{'Tag': ['A...	{'linkGui...	66002	66002	HUB_AN...
SV/Moka...	L3_VPN	UP	[{'guid': '...	Moka Col...	Moka Cola	DEPLOY...	L3 VPN s...	MokaCol...	UP	TOPOGE...	SI/Moka...	INTENT_...	{'Tag': ['A...	{'linkGui...	273	273	HUB_AN...

SHQL

Saved Queries | Save ▲

`service | add_counters()` | RUN

RESULTS (29)

| ShqlCounters (1) | OTN Line Service (1) | E-Line Service (6) | L3 VPN Service (4) | Tunnel Service (18) |

Guid ▾	Type ▾	AdminStatus ▾	CustomerDetails ▾	CustomerName ▾	DeploymentStat ▾	Desc ▾	Name ▾	OperStatus ▾	Provider ▾	ServiceIntent ▾	ServiceIntentRel ▾	Extra ▾
18 ITEMS												
SV/lsp/igp/d16...	TUNNEL	UP	Cisco (Sedona)	SedonaSys	DEPLOYMENT...	RSVP Tunnel <...	RSVP Tunnel <...	UP	TOPOGEN_RS...	SI/RSVP2Rama...	INTENT_FULLY...	{'tunnelGuid': '...
SV/lsp/igp/c8e...	TUNNEL	UP	Automobile In...	Automotive Ltd.	DEPLOYMENT...	RSVP Tunnel <...	RSVP Tunnel <...	UP	TOPOGEN_RS...	SI/RSVP1Belfa...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Botas de traba...	Botas de trabajo	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_500_r...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Putilivsky Zav...	Putilivsky Zavod	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_600_r...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Automobile In...	Automotive Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_100	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Automobile In...	Automotive Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_100_r...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Fashion Indust...	Fashion Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_400	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Military Indust...	Military & Wea...	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_300_r...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Fashion Indust...	Fashion Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_400_r...	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Automobile In...	Automotive Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_101	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Aerospace Ind...	Aerospace Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_201	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Military Indust...	Military & Wea...	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_300	INTENT_FULLY...	{'tunnelGuid': '...
SV/sr_policy/i...	TUNNEL	UP	Aerospace Ind...	Aerospace Ltd.	DEPLOYMENT...	SR Policy Tunn...	SR Policy Tunn...	UP	TOPOGEN_SR...	SI/SR_P_201_r...	INTENT_FULLY...	{'tunnelGuid': '...

View the Services in Services Manager

Services Manager is an application that manages provisioning, modification, and deletion of services of all types. If you have access to Services Manager, you can view a list of the tunnels, point to point services, and multi point services.

Services Manager provides information on configuration of the services. It can help you view the status of user operations and to track mismatches between desired and actual configuration.

To view the services in Services Manager:

1. In the applications bar, select **Services Manager**.

2. Select the required tab.

Link Assurance

The Link Assurance application allows you to visualize any IP or Ethernet links across ZR and OLS with performance in all layers, that is, RON links. This all-in-one app is used for analysis of router-to-router or OT-to-OT link across ZR/+ pluggables and optical line systems and enables you to view aggregated link status as propagated from all layers, and drill down to performance and events history per link.

Inspect Links

To inspect links:

1. In the applications bar, select **Link Assurance**.
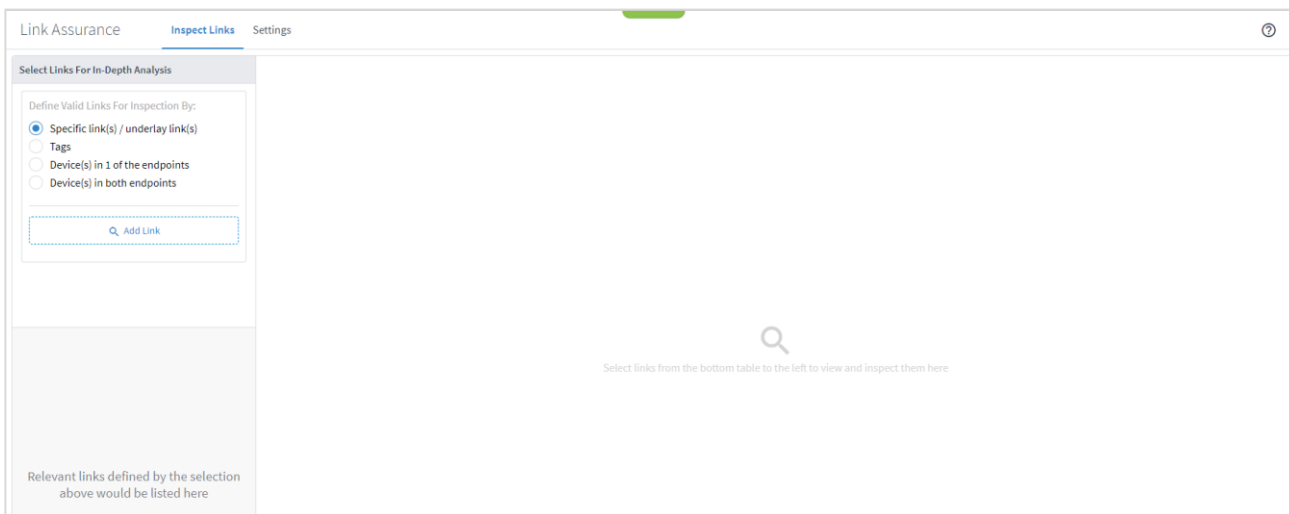
2. To inspect links for specific links/underlay links, select **Specific link(s) / underlay link(s)**, click **Add Link**. In the **Advanced** tab, select a link in the **LINKS** tab, or click on the **3D Explorer** tab to select a link (optical links are in black). Click **OK**. You can add up to 10 items.

Note: For more information on 3D Explorer, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
ILA-SD1EVO01-SD1LIS01-0...	OTS	ILA-SD1EVO01-SD1LIS01-0	1-1-3-8_5	SD1LIS01	1-2-3-8_5	UP	REGULAR
2141748004	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5512734037	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2047682057	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7321748029	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
675963032	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1010617026	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2277890071	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5765253008	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1160392045	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7005042027	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4627150058	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5927468010	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6848239012	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6018374011	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
3387558003	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4013129079	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR

43485 ITEMS

Cancel   OK

1686844004

Info   Used By   Path

Name: 1686844004
Layer: Fiber Segment
Approximated: False
Deployment Type: Buried
Role: Regular
Path Group Type: Single Path
Distance Meters: 1011

show more

Cancel   OK

3. To inspect links by tag, select **Tags**, click **Add Tag**, and then select the tags and click **OK**.

4. To inspect links by endpoint, select **Device(s) in 1 of the endpoints**, and then click **Add Endpoint**. In the **Advanced** tab, select a device in the **DEVICES** tabs, or click on the **3D Explorer** tab to select a device. Click **OK**. You can add up to 10 items.

5. To check the performance for links with devices in two endpoints, select **Device(s) in both endpoints** and then click **Add First Endpoint** and select a device. Repeat for the second endpoint.

6. Continue to View Links and Performance.

View Links and Performance

After specifying the links, you can select one of the links in the list on the left and view the hierarchy of the link layers on the right.
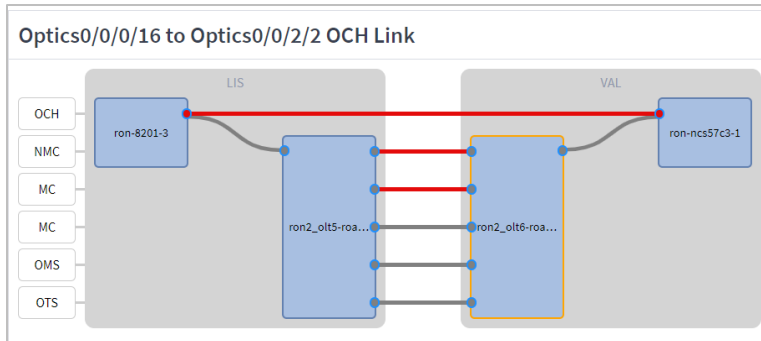
Legend:

- **Blue Filled Rectangle:** Node or router
- **Lines:** Links
- **Circles:** Ports
- **Grey fill:** Up
- **Red fill:** Down
- **Blue Frame:** Not selected
- **Orange Frame**: Selected

To view links:

1. Select one of the link layers. You can scroll left and right to see the full path.
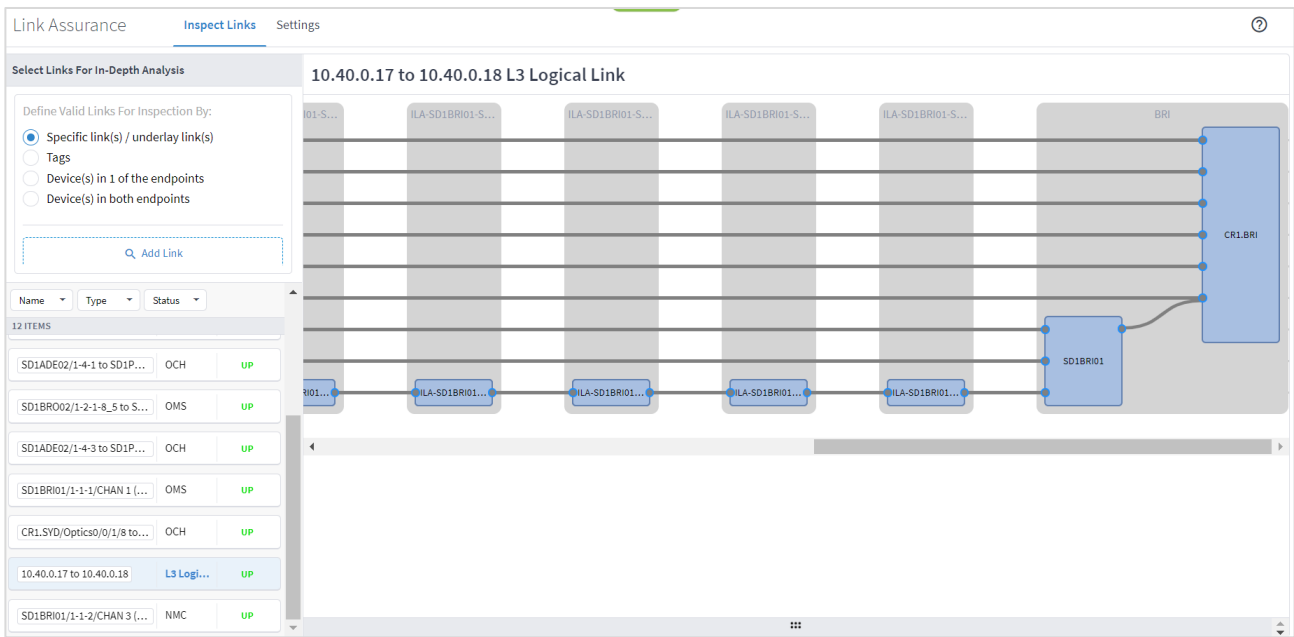
2. Click on a layer name to exclude the layer from the view. For example, click on **OTS**.
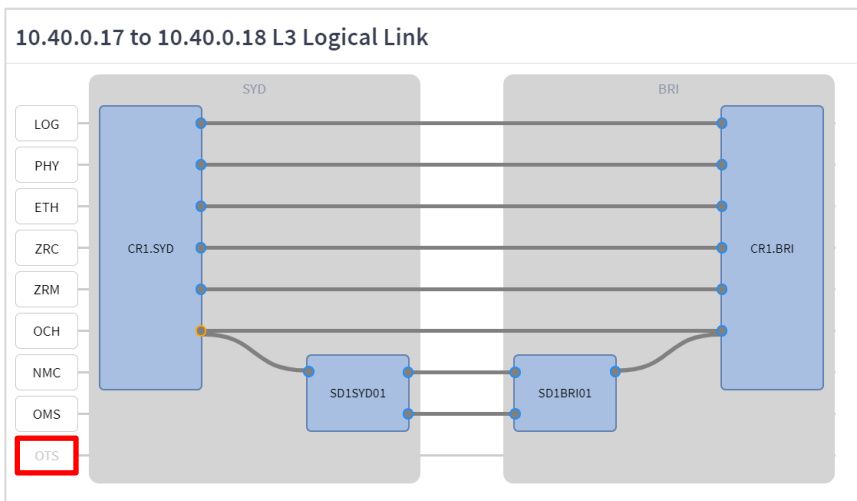
3. Click the blue square representing a router or optical node to view the details for the router or optical node. The router or optical node is framed in orange. The **Summary** tab includes the following details:

   ◦ **Name:** The name of the router or optical mode.

   ◦ **Site**: The site name.

   ◦ **Type**: Router or Optical Node.

   ◦ **SW Version**: The software version on the router.

   ◦ **Serial Number**: The router or optical node serial number.

10.40.0.17 to 10.40.0.18 L3 Logical Link
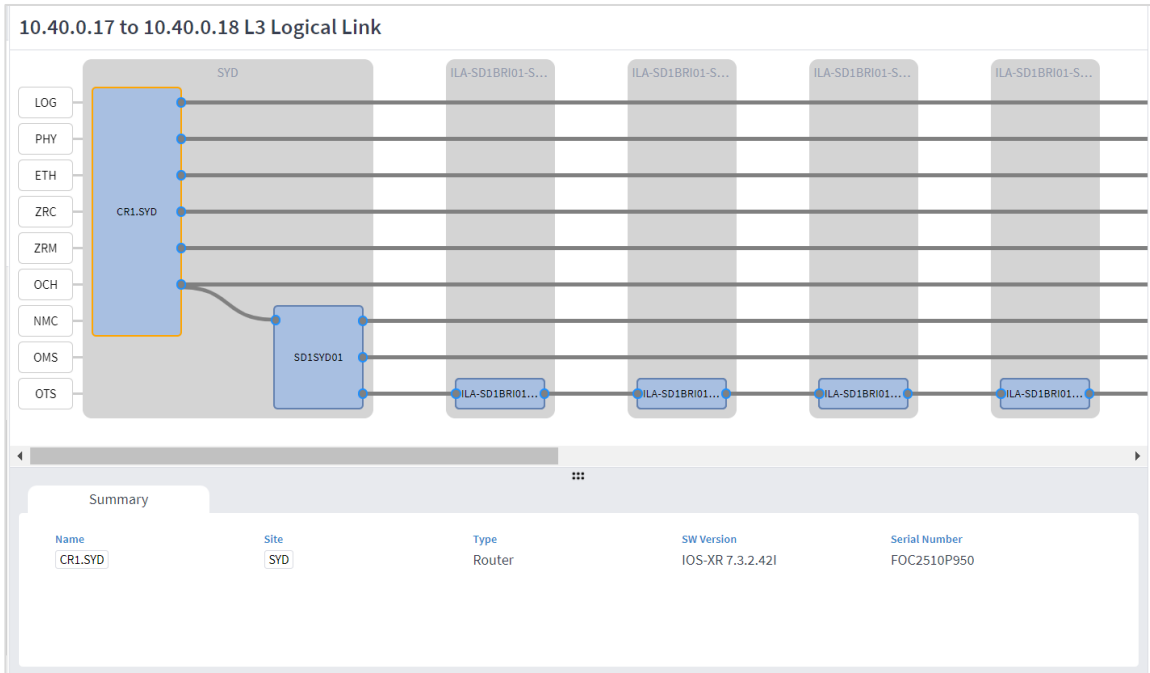
4. Click the line representing the link to view the link details. The selected link is orange. The **Summary** tab includes the following details:

   ◦ **Name:** The name of the link.

   ◦ **Layer**: The layer type: L3 Logical, L3 Physical, Ethernet, ZR Channel, ZR Media, OCH, NMC, OMS or OTS.

   ◦ **Admin Status**: The admin status: UP or DOWN.

   ◦ **Operational Status:** The operational status: UP or DOWN.

   ◦ **Endpoint A:** The starting endpoint.

   ◦ **Endpoint Z:** The terminating endpoint.

   ◦ For Ethernet links, the rate for **Port A Rate [Gbps]** and **Port A Rate [Gbps]**.

   ◦ For ZRM links, the min, average and max values for **Port A Pre-FEC BER**, **Port Z Pre-FEC BER**, **Port A Pre-FEC BER** and **Port Z Pre-FEC BER**.

   ◦ For OCH, NMC, OMS, and OTS links, the min, average and max values for **Port A Tx Power [dbm]**, **Port Z Tx Power [dbm]**, **Port A Rx Power [dbm]** and **Port Z Rx Power [dbm]**.

10.40.0.17 to 10.40.0.18 L3 Logical Link
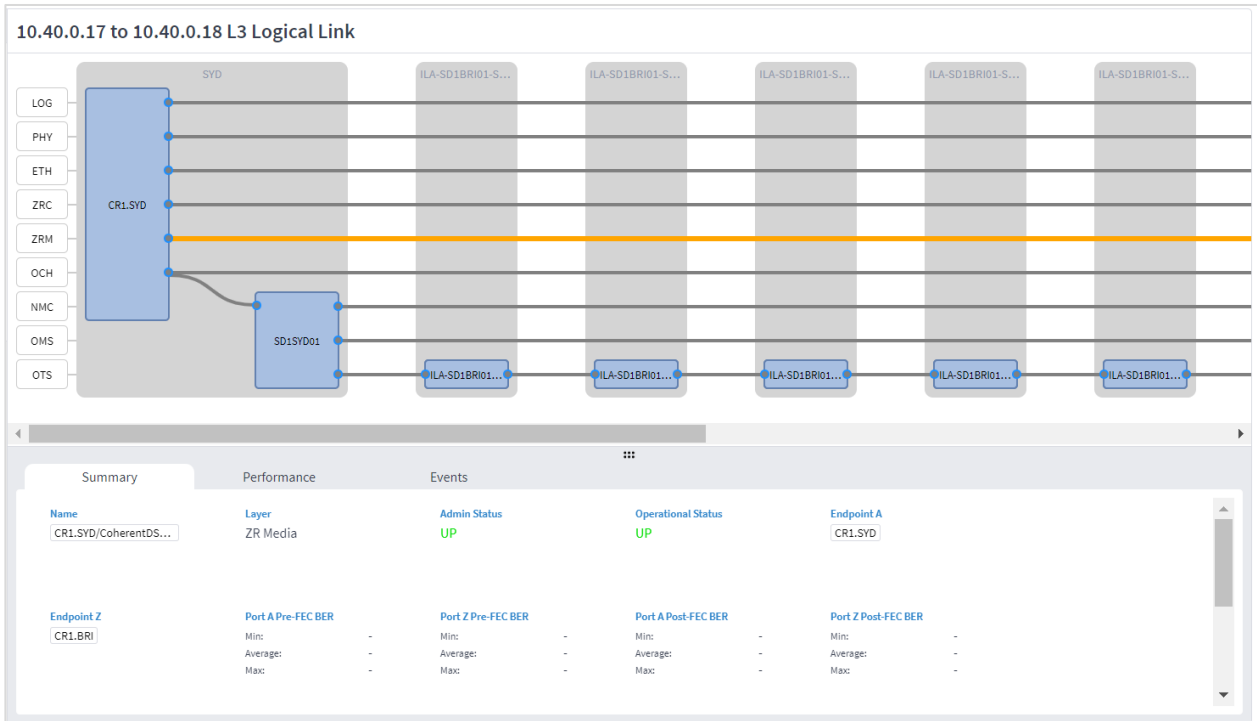
5. For Ethernet and IP links or ports the **Performance** tab includes **INBOUND TRAFFIC** and **OUTBOUND TRAFFIC** graphs for **BANDWIDTH** and **UTILIZATION**.

   For additional information on performance, see Performance.

6. Click ⚙ and specify the period to report on:

   ◦ **Select Time Span**: Select the required period, either **Today**, **Past 24 hours**, **Past 7 days**, **Past 14 days**, **Past 30 days**, **Past 60 days**, or **Custom**. If you select **Custom**, then click **From** and **To** and select a date and specify a time.

- In the **Select Daily Time Frame** area either select **Over entire day** or **Specific time span per day**. If you select **Specific time span per day**, then click **From** and **Until** to specify a time.

7. Click **Export** to download the performance statistics.

8. For layer 1 (ZR Media), the Performance tab includes **Post_FECBER**, **Pre_FECBER**, **Q_Factor** and **Q_Margin**.

   For additional information on performance, see Performance.
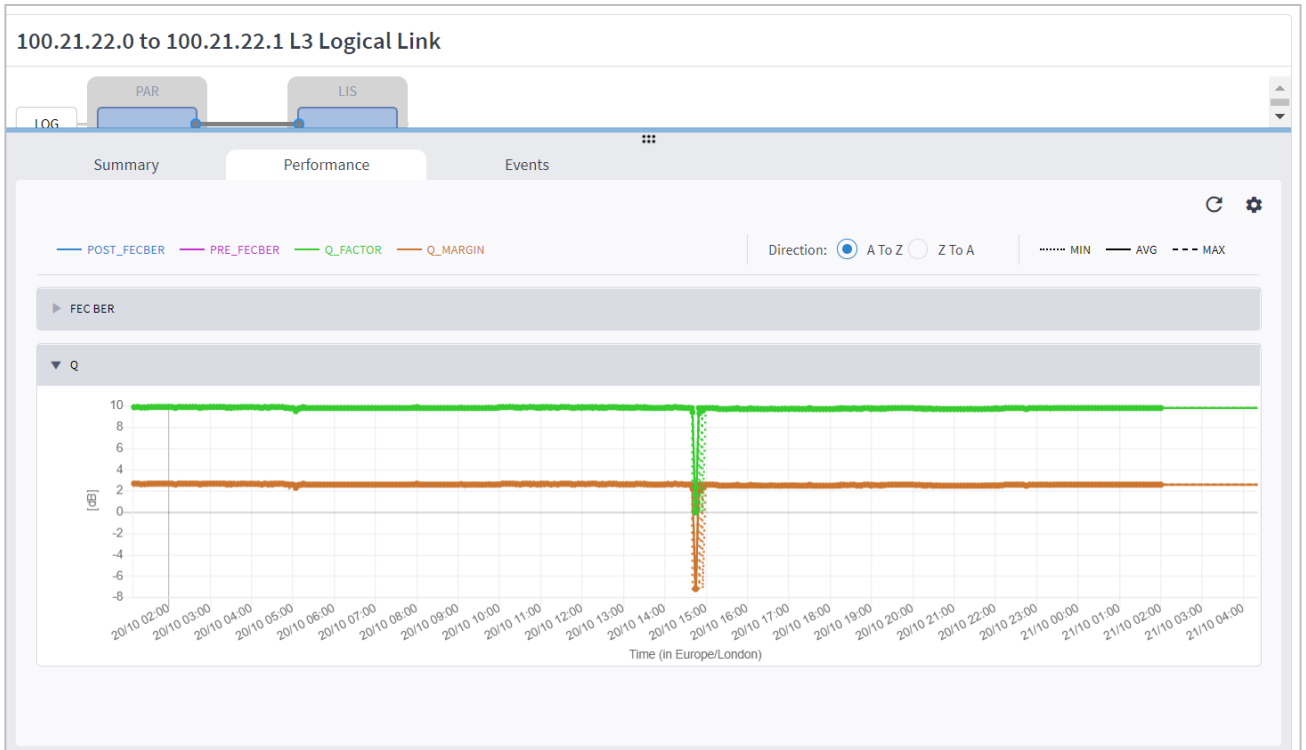
9. For layer 0 (OCH, NMC, OMS and OTS), the **Performance** tab includes Rx and Tx power data.

   For additional information on performance, see [Performance](#).

10. The **Events** tab includes a list of the operational status changes.

11. Click the port to view the related summary, performance, and events.

10.40.0.17 to 10.40.0.18 L3 Logical Link

| ZRC | CR1.SYD |
| ZRM |

Summary | Performance | Events

Name
CoherentDSP0/0/1/8

Type
ZR Media

Parent
CR1.SYD

Admin Status
UP

Operational Status
UP

Pre-FEC BER
Min: -
Average: -
Max: -

Post-FEC BER
Min: -
Average: -
Max: -

Q Factor [db]
Min: -
Average: -
Max: -

Q Margin [db]
Min: -
Average: -
Max: -

Configure Link Assurance

- The **Days Back** setting applies to the statistics data for the **Summary** and **Performance** tabs. Use this configuration to apply **the Days Back** to **Performance** tabs of all ports and links that can be selected, without having to repeat the settings for every port/link.

Link Assurance   Inspect Links   **Settings**

GENERAL SETTINGS

Days Back*
1

Path Analysis

This application analyses the potential IGP paths between two endpoints. Each path is analyzed and broken down into links, and the cost of each path is calculated. The path-selection decision is based on the minimum cost, where the cost is the total of the IGP metric values for the links in the path. All paths with a similar cost are returned.

Dynamic paths such as LDP and SR-ISIS, over IGP links, are supported (where no path preferences are provided).

Path Analysis Terminology

Table 2.   Path Analysis Terms

Term	Definition
Cost	The accumulated IGP metric for the path, that is, sum of the IGP metrics of the various links in the path.
Hops	The number of links in the path.
IGP Metric	The hop IGP metric.
Latency	The total latency of the links in the path.
TE Metric	The hop TE tunnel metric.

Analyze a Path

To analyze a path, select two endpoints. Endpoints can be a router or UNI port connected to a VPN service. The application returns all the alternate paths with the same minimum cost, where cost is defined as the aggregation of the IGP Metrics for the links in the path. Related performance data can be viewed for the logical IP links in the path.

To analyze a path:

1. In the applications bar, select **Path Analysis**.

2. Click 🔍 to add a router as endpoint A.
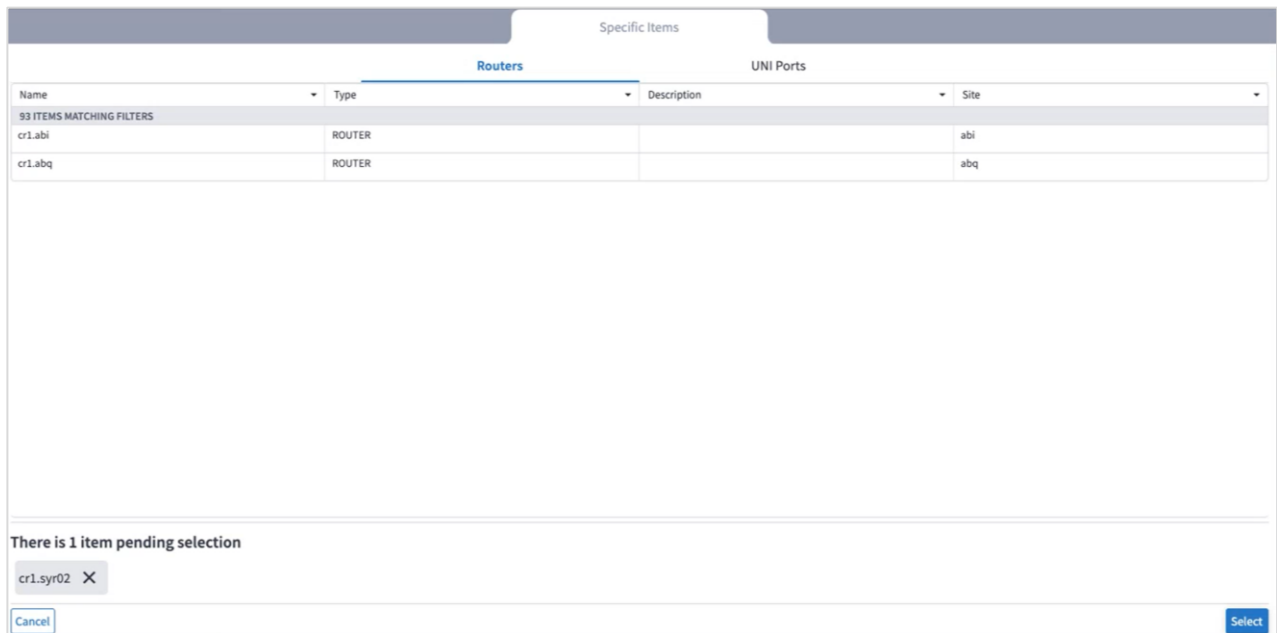
3. (Optional) Select the **UNI Ports** tab.

4. Select an endpoint and click **OK**.

5. Repeat to select endpoint B. A list of the paths with the same cost appears.

6. Click on a path to see the number of hops, latency, distance, number of IGP domains and admin cost for the path. The table details each of the links with their endpoint routers, IGP metric and TE metric.

7. Click on a link in the path to see the related performance information. The information appears in the **Summary** tab in the lower pane.

8. To view graphs of the performance, click the **Graphs** tab in the lower pane. For additional information on performance, see Performance.

9. Click the **Map** tab to view the path in the 3D Explorer map.

10. You can expand and scroll in the Metro view to see more of the path details.

11. You can also filter the path as required.

Root Cause Analysis

The Root Cause Analysis application finds the failed lower layer links that are the root cause of a link or a service failure. To establish root cause failures, Crosswork Hierarchical Controller considers both the operational status (up/down) of the links and the admin status (up/down) of the router ports.

When the operational status of a link is down, this is considered a failure. Crosswork Hierarchical Controller then checks all the lower layer links that have failed, until the element at the lowest level is identified. This is the root cause element. All elements above this root cause element are considered affected elements. A link with operational status down but with no links above it is still considered as a root cause.

If an element has an admin status of down, it is classified as a root cause element (and not as an affected element).

View Root Causes

You can view a list of the root causes and can view the:

- Root cause resource type: L3 Logical, OCH, OTS, LSP, or OMS.
- Root cause tags
- Number of affected links
- Affected capacity (Gbps)
- Time
- A list of the link layers and elements affected

You can also hover over the affected element to view the element in the map (and then view the element in Explorer) or click on the element name to drilldown directly to the element in Explorer.

Table 3.   Elements

Links	Description
LSP	The MPLS tunnel created between two routers over IGP links, with or without TE options.
IGP	The link between two routers that carries IGP protocol messages. The link represents an IGP adjacency.
L3 Logical (R_LOGICAL)	A link that connects VLANs on two IP ports.
L3 Physical (R_PHYSICAL)	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.
Ethernet (ETH)	An ETH L2 link, spans from one ETH UNI port of an optical device to another, and rides on top of ODU.
ODU	ODU links are sub signals in OTU links. Each OTU link can carry multiple ODU links, and ODU links can be divided into finer granularity ODU links recursively.
OTU	The underlay link in the OTN layer, used for ODU links. It can ride on top of an OCH.
OCH	A wavelength connection spanning the client port of one OEO device (transponder, muxponder, regen) and another. 40 or 80 OCH links can be created on top of OMS links. The client port can be TDM or ETH port.

Links	Description
OMS	The link connecting one ROADM to another. One OMS can be created over a chain of OTS links.
OTS	The physical link connecting between one line amplifier or ROADM and another. One OTS can be created over a fiber link.

For more information on Explorer and the various links, see the *Cisco Crosswork Hierarchical Controller Network Visualization Guide*.

To view root cause failures:

1. In the applications bar, select **RCA**. A list of the root causes appears with the following information:

   ◦ **Root Cause Resource Name**: The root cause link name. In this example, the OTS link.

   ◦ **Root Cause Resource Type**: The root cause link type.

   ◦ **Root Cause Tags**: The root cause tags.

   ◦ **Affected Links**: The total number of elements affected by this root cause.

   ◦ **Affected Capacity (Gbps)**: The total bandwidth lost in Gbps (the total of all links).

Root Cause Analysis   Records fetched at: 15:48:55 09-21-2022 UTC

Filter By Impacted

Root Cause Resource Name	Root Cause Resource Type	Root Cause Tags	Affected Links	Affected Capacity (Gbps)	Time
9 OUT OF 40 ITEMS MATCHING FILTERS					
10.40.2.202 to 10.40.2.201	L3 Logical	Tag All	66	193.0	
SD2BUC01/OCH-1-1-20 to SD2MOS01/OCH-1-1-15	OCH	Tag All	4	10.0	
SD2BUD01/OCH-1-1-36 to SD2MOS01/OCH-1-1-18	OCH	Tag All	4	10.0	
SD2KHAR01/OCH-1-1-9 to SD2KURSK01/OCH-1-1-12	OCH	Tag All	4	10.0	
ILA-SD2KHAR01-SD2KURSK01-1/OTS-1-1-3 to ILA-SD2KHAR01-SD2KURSK01-2/OTS-1-1-2	OTS	Tag All	2	0.0	
10.40.3.238 to 10.40.3.237	L3 Logical	Tag All	1	0.0	
ILA-SD2KONO01-SD2ORYOL01-1/OTS-1-1-3 to ILA-SD2KONO01-SD2ORYOL01-2/OTS-1-1-2	OTS	Tag All	1	0.0	
ILA-SD2BRYA01-SD2KONO01-1/OTS-1-1-3 to ILA-SD2BRYA01-SD2KONO01-2/OTS-1-1-2	OTS	Tag All	2	0.0	
10.40.2.225 to 10.40.2.226	L3 Logical	Tag All	50	147.0	

2. Select the required root cause. Detailed information for the root cause appears.

3. Hover over the root cause resource name and click ◀ to view the root cause in the map.

4. Click ⧉ **Open in Explorer** to open the root cause in Explorer.
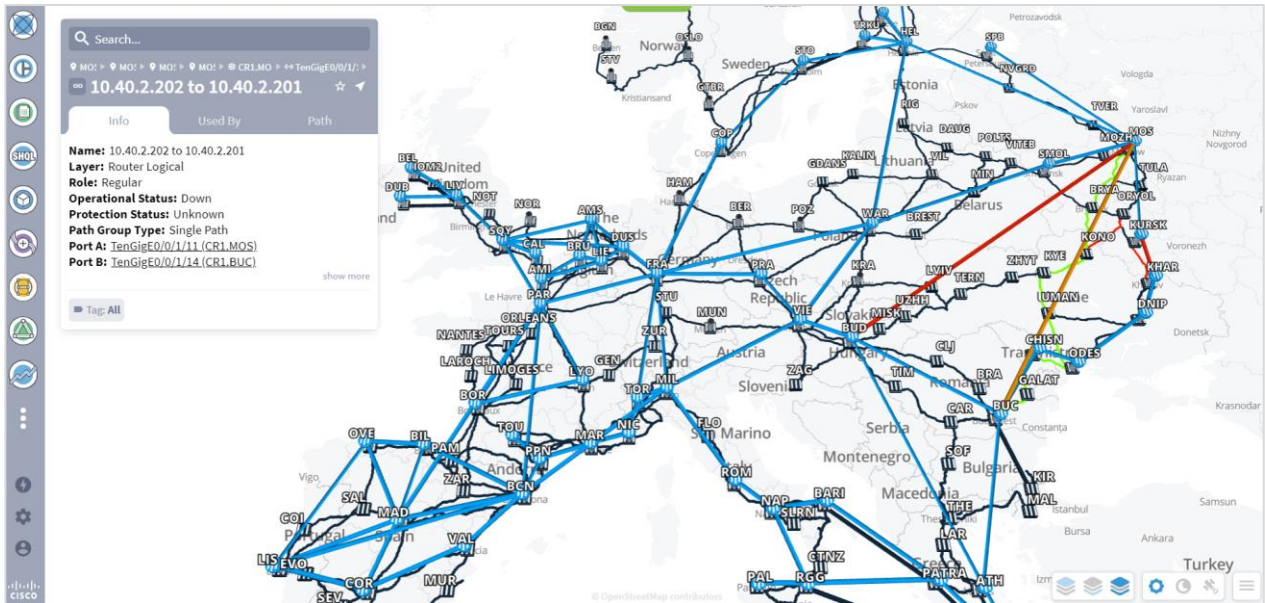
5. You can navigate up and down the link layers by clicking on the **Used By** tab.

6. In the **Used By** tab, click on the link name.
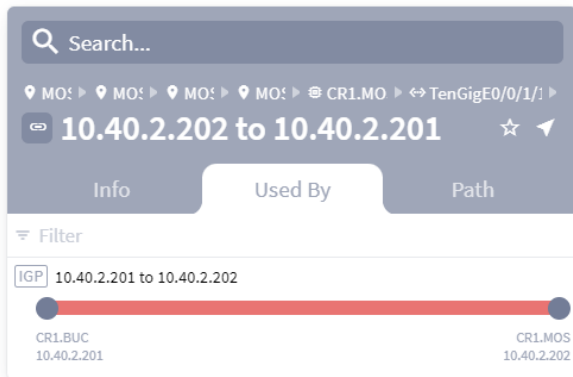
7. Repeat this to navigate to the next layer.

8. Continue until you get to the uppermost layer. The Explorer map is updated as you navigate.

9. Select the **Path** tab to view the layers.
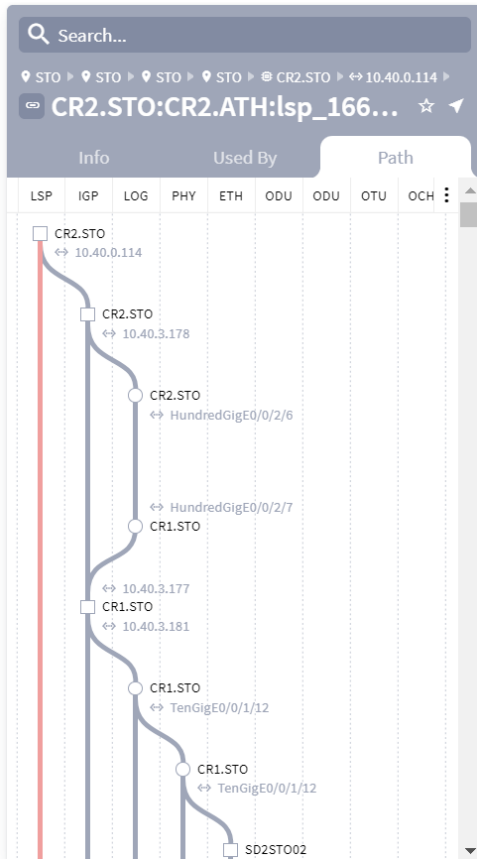
10. In this example, there are two root cause failures. The **Ethernet** root cause failure affects the **PHY** layer above it, but the **OMS** root cause failure does not affect any of the links above it and so there are 0 affected elements.
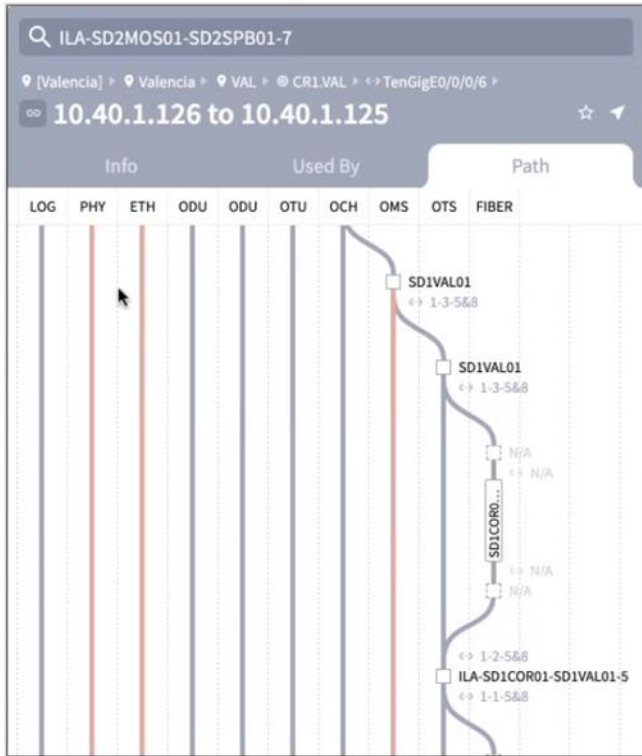
11. In this example, the root cause failure affects two links, the MC and OMS links.

12. In this example, there is an **Admin Status: Down**. This means that this element constitutes a root cause failure in and of itself (and not simply an affected element).

Download the Root Causes

You can download a comma separated file with the root cause information.

To download root causes:

1. In the applications bar, select **RCA**.

2. Click ⬇ . A **root_cause_analysis_<date>.csv** file is downloaded.

3. Open the downloaded file to view a list of the root causes appears with the following information:

    ◦ **Root Cause**: The root cause link name. In this example, the OTS link.

    ◦ **Root Cause Type**: The root cause link type.

    ◦ **Affected Link**: The link affected by this root cause.

- ◦ **Affected Type**: The type of the link affected by this root cause.

- ◦ **Capacity [Gbps]**: The bandwidth lost in Gb for the affected link.

Execution Parameter	Value			
Time Machine	14/05/2020 00:21			
Root Cause	Root Cause Type	Affected Link	Affected Type	Capacity [Gbps]
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.SQY:CR1.FRA:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.MAN:CR1.ROM:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.ROM:CR1.BEL:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.SQY:CR2.COR:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	10.40.0.26 to 10.40.0.25	IGP	0
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.BKL:CR2.SQY:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.LIV:CR2.FRA:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.OVE:CR2.SQY:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	SD1BKL01/1-10-1 to SD1SQY01/1-6-1	OTU	0
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.PAR:CR2.SQY:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.MIL:CR1.SQY:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.DUB:CR2.VIE:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.ROM:CR1.LIV:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.BKL/TenGigE0/0/0/6 to CR2.SQY/TenGigE0/0/0/6	R_PHYSICAL	10
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.LIS:CR1.MAN:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.MIL:CR2.DUB:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.DUB:CR1.BEL:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.BEL:CR2.BIL:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	SD1BKL01/1-4-1 to SD1CAM01/1-9-1	OTU	0
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.DUB:CR1.BKL:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.MAN:CR1.FRA:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.LIV:CR1.BKL:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR1.BEL:CR1.OVE:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.VIE:CR2.MAN:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.VIE:CR1.DUB:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	SD1BKL01/1-10-100-2 to SD1DUS01/1-4-100-2	ETH	10
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.DUB:CR2.FRA:lsp_0	LSP	0.01
SD1BKL01/1-2-5&8 to SD1SLO01/1-3-5&8	OTS	CR2.BKL:CR1.MIL:lsp_0	LSP	0.01

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