



Cisco Crosswork Hierarchical Controller 10.0

Network Visualization Guide

November 2024

Discovery and Visualization Applications and Feature Set

The following table lists the Crosswork Hierarchical Controller discovery and visualization applications. The Legend column indicates if the application/feature 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. Applications and Feature Set

Category	Application name	Legend	Description
Discovery and Visualization	3D Explorer	Common	Visualize IP and optical links/tunnels/services between geo sites on a satellite or schematic map, with correlation between layers.
	Time Machine	Common	Go back in time to a date in the past and analyze the network as it was at that point in time.
	Layer Relations	Common	Show relationships between links in different layers (for example, show all SR policies over all or specific physical links).
	Network Inventory	Common	Show full tabular view of devices, sites, links, connections, services, cards, ports, transceivers, power supplies, fans, and shelves.
	Dashboard	Common	View visual widgets displaying inventory, topology, and services info. Define rule-based widgets with SHQL queries.
	Network History	Common	Analyze historical records of all inventory resources, topology, and service changes (add, modify, and delete).

Terminology

The following terms are used interchangeably throughout the guide.

- Optical and L0/L1 (Layer 0/Layer 1)
- IP/MPLS and L3 (Layer 3)

Layers

IP/MPLS (L3)	L3/L2 service (L3VPN, ...)
	LSP – RSVP-TE, SR policy
	IGP/forwarding adjacency
	Logical router link (including LAG)
Packet transport (L2)	Physical router link
	Ethernet and/or MPLS-TP
	Multiple layers of OTN/ZR/Radio connections
OTN/ZR (L1)	Regenerated/multi-domain end-to-end connections
	OCh: a single wavelength and its corresponding OTN frame
WDM (L0)	OMS: the ROADM and links between them
	OTS: the amplifiers and links between them
Physical	Ducts, manholes etc.
	Physical route of ducts over map

Acronyms

Acronym	Definition
AGG	Aggregation
ARP	Address Resolution Protocol
CMD	Command key on a Mac
CTRL	Control key on Windows
EMS	Element Management System
ETH	Ethernet
Gbps	Gigabits per second
IGP	Interior Gateway Protocol
IP	Internet Protocol
L0	Layer 0
L1	Layer 1
L3	Layer 3
LAG	Link Aggregation Group
LOG	Logical
LSP	Label-Switched Path
MPLS	MultiProtocol Label Switching
NMS	Network Management System
OCH	Optical Channel
ODU	Optimized Distribution Unit

Acronym	Definition
OEO	Optical-Electrical-Optical
OMS	Optical Monitoring System
ONE	Optical Network Element
OPS	Optical Packet Switching
OTS	Optical Transmission Section
OTU	Optical Test Unit
PHY	Physical
QoS	Quality of Service
SDN	Software-Defined Networking
TE	Traffic Engineering
UI	User Interface

3D Explorer

Cisco Crosswork Hierarchical Controller 3D Explorer depicts a model of a multilayer, multi-vendor network that enables you to explore the relationship between the Optical layer and the IP/MPLS layer. The way this relationship is realized is through the discovery and visualization of the crosslinks that connect the layers.

The network map (model) displays L0-L3 topology and L0-L3 failures. To review this information and the multilayer relationships, you can show this network map as only the Optical layer, IP/MPLS layer, or both layers. Further exploration includes the ability to view intra-site connectivity and to drill down to specific object information, including crosslink port connectivity and multilayer paths.

This multilayer perspective enables you to better communicate with other network planners, operators, and architects within the company, as well as to answer critical questions about the network.

- What are the LSP (MPLS tunnel) paths?
- How many router hops are the LSPs taking and are they using optical resources efficiently?
- How are the L3 interfaces connected to the L0/L1 ports?
- How will a failure or temporary maintenance activity at the Optical layer impact service delivery at the IP/MPLS layer?
- How do I make sure that diversity is enforced for specific links or services?
- How do I detect proximity violations between fibers
- How do I check that planned path for new OMS is diverse from other OMSs
- Where are the optical vendors connected in the network?
- What is the intra-site connectivity within a site, such as within a metro area?
- What is the per-port connectivity in L3 link bundles?

Figure 1 shows a representation of how the multiple layers and the crosslink appear in the three-dimensional network map. The IP/MPLS layer is on top, the Optical layer is on bottom, and the crosslink connects the two.

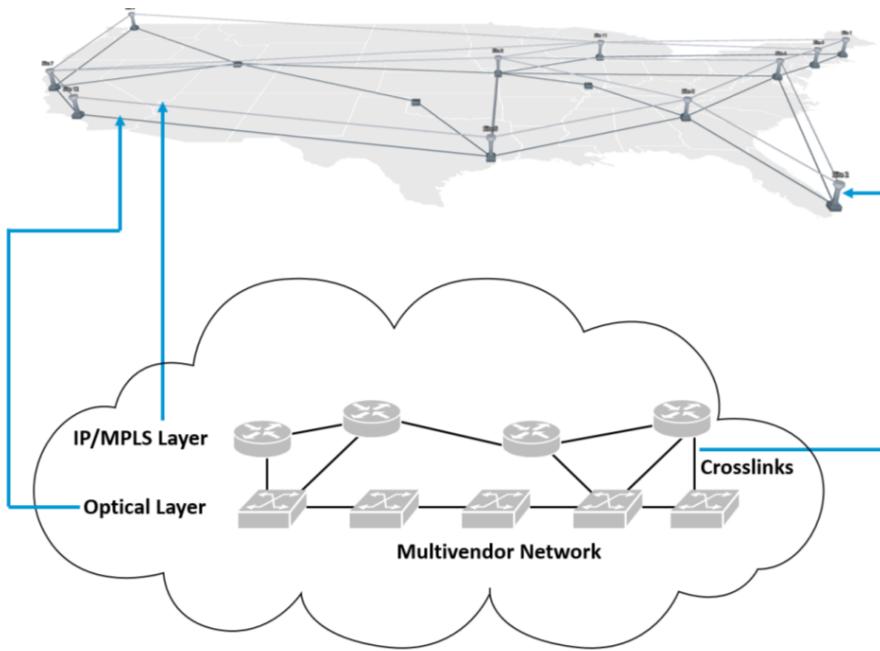


Figure 1.

Network Model Shown in Crosswork Hierarchical Controller 3D Explorer UI

Note: While this guide describes full functionality, feature availability depends on your configuration.

Note: The frequency of the network model updates is dependent on your configuration. For information on how often your model is updated, contact your system administrator or Cisco support representative.

UI Basics

This section describes the basic tools for using and understanding the 3D Explorer UI. These tools are pervasive throughout the UI. Detailed descriptions of features, such as objects and in-depth exploration, are described throughout the remainder of the guide. There are two ways of exploring networks in 3D Explorer: the network map and the sidebar.

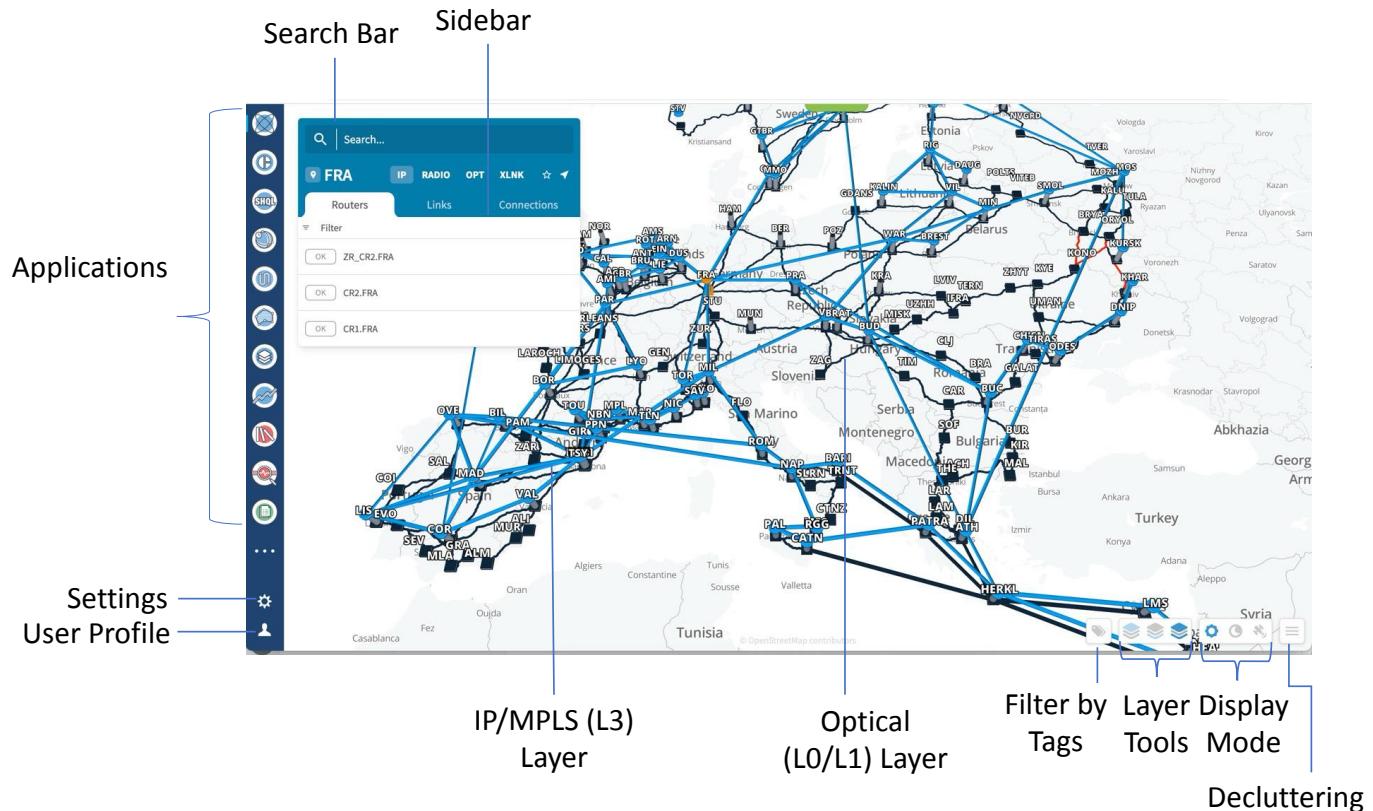


Figure 2.
Crosswork Hierarchical Controller 3D Explorer UI

- **Network Map** – Shows one or more layers of the network with a geographic outline as a background. Each site is placed according to the longitude and latitude of the ONEs (optical network elements) and IP/MPLS routers within it. All objects (sites, routers, ONEs, links, and crosslinks) are visualized as an aggregate view. For detailed information, see [Network Map](#).
- **Live** – Enables you to view the network on a specified date.
- **Filter by Tags** – Enables you to filter by tags such as vendor and region. For more information, see [Network Map](#).
- **View Layers** – Enables you to view the Optical layer, IP/MPLS layer, or both. For more information, see [Network Map](#).
- **Display Mode** – Enables you to toggle the display between dark and light schematic modes or the satellite map. For more information, see [Network Map](#).
- **Search Bar** – Located at the top left of the network map, the Search bar enables you to search the network for links, sites, network elements, etc.
- **Sidebar** – Enables you to drill down to more detailed information than what is available in the network map. For basic use, see [Sidebar](#). More detailed use is described throughout the guide.

- **Application Icons** – Located on the left of the screen, these icons enable you to access the applications installed in your system. The following applications are available but if an application is not installed in your system, the icon does not appear.
 - **3D Explorer** – Visualize IP and optical links/tunnels/services between geo sites on a satellite or schematic map, with correlation between layers. Using the time machine, go back in time to a date in the past and analyze the network as it was at that point in time.
 - **Dashboard** – View visual widgets displaying inventory, topology, and services info. Define rule-based widgets with SHQL queries. See [Dashboard](#).
 - **SHQL Query** – Simple, yet sophisticated multi-layer query language to get inventory, topology, tunnels, and services. All based on multi-layer correlation.
 - **Network History** – Analyze historical records of all inventory resources, topology, and service changes (add, modify, and delete).
 - **Path Analysis** – Calculate, on demand, an IGP path between two routers, visualize the path, and show performance of IP links across the path.
 - **Model Settings** – Add external data and tag resources based on rules and define Hyper Linker rules.
 - **Layer Relations** – Show relationships between links in different layers (for example, show all SR policies over all or specific physical links). See [Layer Relations](#).
 - **Performance** – For IP, view traffic utilization and OAM PM of port, links, tunnels and VPNs. Group links by topology context (all LAG members, between router A to B). Predict packet traffic utilization. For optical, show L0-L1 performance, including the correlation between photonic and L1 layer. View power level across a span of ROADM and Amplifiers.
 - **Failure Impact** – Plan a maintenance event, finding which connections will be impacted by taking resources down and if there is an alternative path. When found, comparing existing and alternative path latency, cost, and hops. Supported for OTN, ETH, RSVP-TE tunnels.
 - **RCA (Root Cause Analysis)** – 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.
 - **Network Inventory** – Show full tabular view devices, sites, links, connections, services, cards, ports, transceivers, power supplies, fans, and shelves. See [Network Inventory](#).
 - **Service Assurance** – Visualize L1-L2-L3 service configuration and underlay path, with UNIs performance and events history.
 - **Link Assurance** – Visualize RON link across ZR and OLS with performance in all layers.
 - **Service Manager** – Service CRUD, show and provision all service types as listed above. For IP, L2-L3-VPNs, RSVP-TE, and SR policies. For optical, ETH/OTN connections, OCH, and ZR links.
 - **Device Manager** – Manages Crosswork Hierarchical Controller southbound adapters, enabling you to add and manage devices, manage the assignment of devices to an adapter and monitor the adapter's health as well as the devices topology and discovery states.

- **Link Manager** – Enables you to manually add and validate inter-links (or cross-links) from IP to optical networks.
 - **Shared Risk Analysis** – Find if there are commonly shared resources (node, site, link, and card) between selected group of links in any layer. Group can be selected explicitly or as an SHQL rule.
 - **Settings** – Enables you to view system info, manage security settings and import or export Crosswork Hierarchical Controller settings.
 - **User Profile** – Displays the name of the person logged in to the local Crosswork Hierarchical Controller 3D Explorer. You can also change your password and logout of the Crosswork Hierarchical Controller 3D Explorer UI in this area.

By default, the map is configured for two layers. The number of layers can be customized, up to four layers by Cisco. For example, the OMS layer and the OTN layer may be displayed for the optical network.

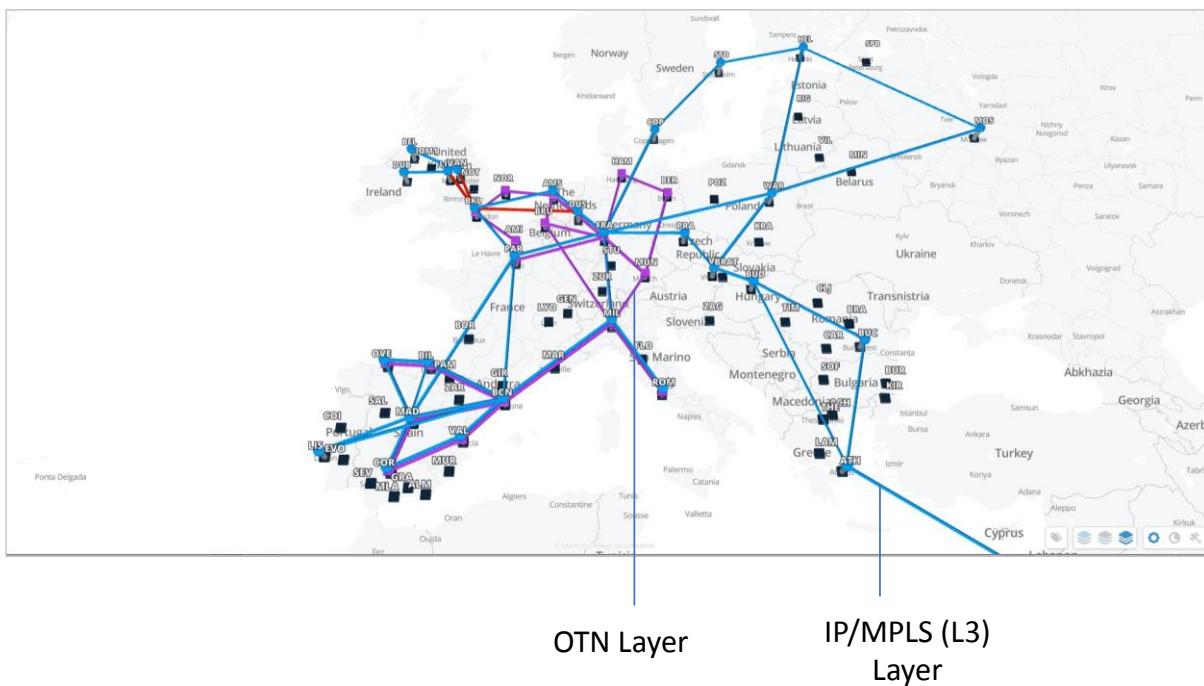


Figure 3.
3D Explorer UI – 3 Layers

Objects

An *object* is any logical or physical network component that is available for exploration or visualization in the 3D Explorer UI. These include the following, and each is defined throughout the guide.

- IP/MPLS—Routers, L3 links, logical and physical interfaces, and LSPs
 - Optical—ONEs, L0/L1 links, ports, and connections
 - Multilayer—Crosslink, sites

While there are many object icons, the basic premise is that routers appear as circle icons and ONEs appear as square icons. For a complete list of icons, see [Legend](#).

Example: You immediately know that all icons in Figure 4 represent crosslinks because they each contain a router (circle) and a ONE (square). When you select the crosslink, it appears in orange.



Figure 4.
Crosslink Icons

Legend

This legend helps you quickly identify icons. Detailed descriptions of them are throughout the guide.

- [Layer 3](#)
- [Layer 0/Layer 1](#)
- [Multilayer](#)

Tip: Remembering that a circle is always an L3 router and that a square is always an L0/L1 network element enables you to easily identify most other icons.

Layer 3

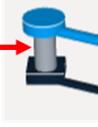
Icon	Description
	L3 router
	Network map showing a site containing at least one router in the IP/MPLS layer view. If all layers are visible in the network map this is a site that contains only routers whether directly or indirectly with nested sites containing only routers.
	L3 link
	L3 link bundle

Layer 0/Layer 1

Icon	Description
	ONE

Icon	Description
	<p>Network map showing a site containing at least one ONE in the Optical layer view.</p> <p>If all layers are visible, site in network map that contains only ONEs whether directly or indirectly with nested sites containing only ONEs.</p>
	L0/L1 link

Multilayer

Icon	Description
	Crosslink (link between a router and a ONE)
	<p>Site in network map that contains at least one router, at least one ONE, and at least one crosslink connecting a router and ONE, whether directly or due to nested sites within it.</p> <p>If a crosslink has not been discovered yet (or does not exist), the site appears without it.</p>

Sidebar

The sidebar enables you to view details of the network map. The information is organized in a hierarchical format, enabling you to drill down to more details for each object.

To open the sidebar, select an object from the network map.

- If you select a site, the sidebar opens to show all objects within the site and all multilayer options. If you select a grouped site, the sidebar lists all objects of all sites contained within the grouped site.
- To see details about any given object, select the applicable tab and then select the object.
- To expand or shrink the sidebar, drag the right-hand edge of the sidebar.
- For more information on grouped sites, see [Network Map](#). For more information on exploring data in the sidebar, see [Multilayer Crosslinks](#), [IP/MPLS Layer and Multilayer Paths](#), and [Optical Layer and Multilayer Paths](#).
- If you select an L3 link or L0/L1 link, the sidebar opens to show all L3 links or all L0/L1 links going between the two sites on each end of the link.

If you select the icon to the left of the object name in the sidebar, you can show the type of inventory item you are currently viewing.

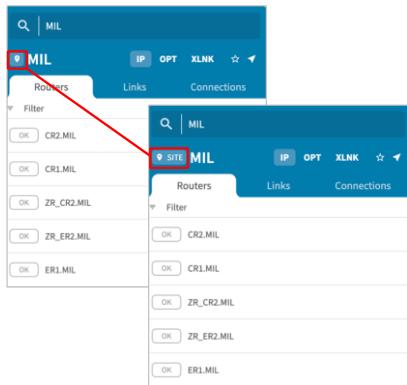


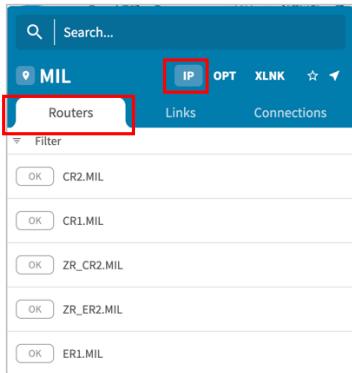
Figure 5.
Show Inventory Item

Select the object for which you need information. Each time you select a different object, all content in the sidebar updates to apply only to that object.

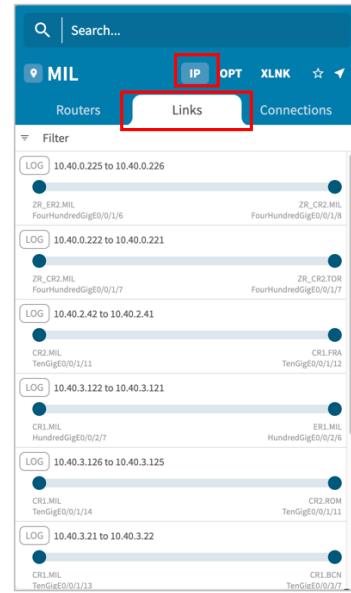
- If you select a site object, the Sidebar includes tabs for **IP** and **Optical** devices and cross links on that site. Click the **IP** tab to get more details of the routers at the site together with their links and connections. Click the **OPT** tab to get more details of the nodes at the site together with their links and connections. Click the **XLINK** tab to get more details on the cross links. By default, only logical links show for IP routers.
- If you select a crosslink, the Sidebar displays details of the crosslink, its connections, path, and history (up to 20 events).
- If you select an optical node, the Sidebar displays details of the node together with its links, connections, and history (up to 20 events).
- If viewing a path, such as an LSP path or the optical path that an L3 link or LSP path takes, moving the cursor between the routers or between the ONEs shows the link names.

Example: In this example, we will start at the **MIL** site and navigate through the various parts of the UI to drilldown to a router, an ONE and the links and connections that join them to each other and other components in the network. Figure 6 and Figure 7 show the **MIL** site information on the left. All links and LSPs accessed from here are applicable to any given router within the **MIL** site. Figure 8 shows selecting the **CR1.MIL** router to open information specific to that router. Then selecting the **Links** tile shows all links connected to the **CR1.MIL** router. Figure 9 shows a continuation of drilling down for more information by selecting an L3 link and then selecting the **Paths** tile to view the associated multilayer path. Figure 10 shows how to drilldown in a cross link.

MIL site IP routers



MIL site IP links



MIL site IP connections

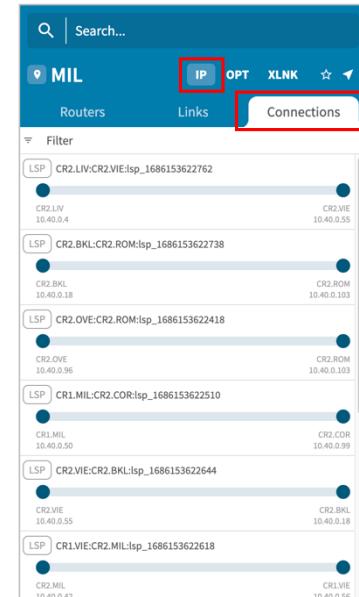
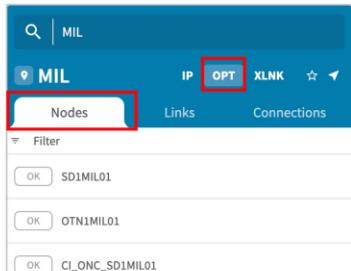


Figure 6.
Example of Site IP Links and Connections

MIL site OPT nodes



MIL site OPT links



MIL site OPT connections

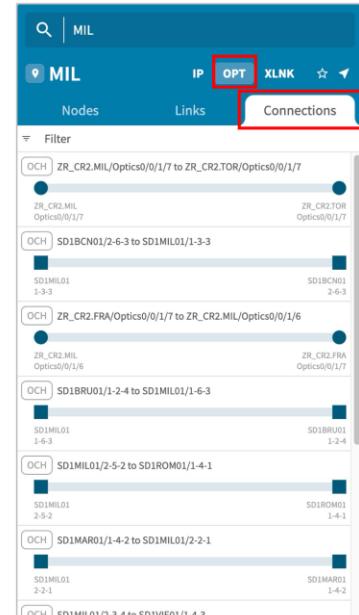


Figure 7.
Example of Site OPT Links and Connections

Router details

Router Links details

Router Connections details

Router Ports details

Router History details

Each screenshot shows a navigation bar with tabs: Info, Links, Connections, Ports, and History. The 'Links' and 'Connections' tabs are highlighted in red in the first three screenshots, and the 'Ports' tab is highlighted in red in the fourth screenshot.

Figure 8.

Example of Drilling Down to a Router

Note: By default, only logical links show for IP routers.

Link info

Link Used By - Links

Link Path

Link History

Link Used By - Services

Each screenshot shows a navigation bar with tabs: Info, Used By, Path, and History. The 'Used By' tab is highlighted in red in the first two screenshots, and the 'Path' tab is highlighted in red in the third screenshot.

Figure 9.

Example of Drilling Down in a Link

Figure 10.
Example of Drilling Down in a Cross Link

Searching by Network

The **Search** feature finds all network objects whose name includes the search string. Once the results are displayed, select the object for which you are looking, and it will then appear in the sidebar.

Start typing and as you type, the results narrow to fit the string. The input is not case-sensitive.

Figure 11 shows a search for all instances of the string MIL, which locates multiple objects using this search criteria.

Figure 11.
Example Search

Searching by Location

The **Search by Location** feature finds all locations whose name includes the search string. Once the results are displayed, select the location for which you are looking, and it zooms in to the location on the map.

Start typing and as you type, the results narrow to fit the string. The input is not case-sensitive.

Figure 11 shows a search for all instances of the string mil, which locates multiple locations using this search criteria.

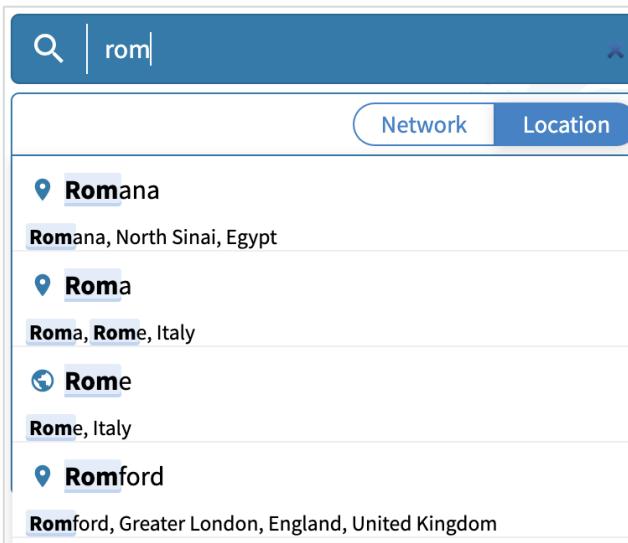


Figure 12.
Example Search by Location

Filtering

Filtering finds all instances of a name within the content that is displayed in the sidebar. For instance, if you are in the **Routers** tab, the filter only finds router names.

In the **Filter** text box, start typing and as you type, the results narrow to fit the string. The input is not case-sensitive. You can use an asterisk (*) as a wildcard between two strings.

Example: Figure 13 shows an unfiltered list of LSPs in a site (left) and a filter of an LSP on the site that has the number 122 as part of its name.

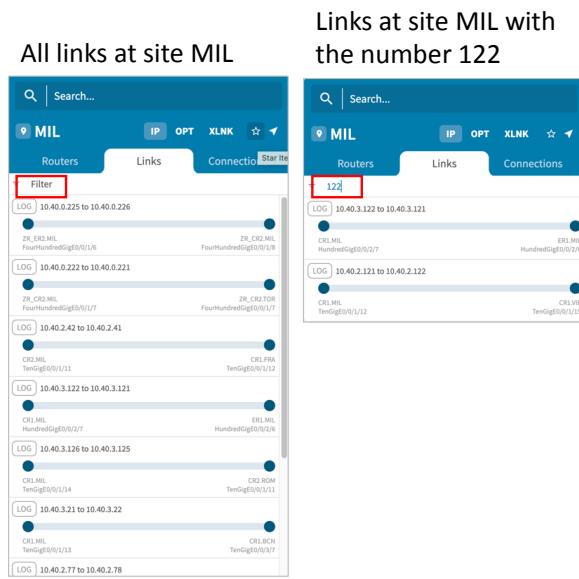


Figure 13.
Example Filter

You can also filter by event type in the **History** tab, for example, **Operational Status UP** or **Operational Status DOWN**.

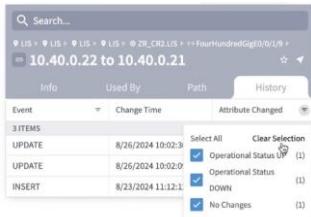


Figure 14.
Example Filter History Tab

Tagging

You can also filter by tags such as vendor/provider or region. Tags appear as filters and as attributes in the sidebar.

These tags are added using the REST API or the Model Settings application. For more information, see the *Cisco Crosswork Hierarchical Controller Administration Guide*. Tags can be attached to all types of resources.

The filtering system applies an **OR** to all selected values of a tag and an **AND** between tags.

For example, assuming these tags have been defined and assigned to routers:

Vendor

- [x] Cisco
- [] Juniper
- [x] Huawei

Function

- [] Core
- [x] Edge

This filter matches **(Vendor = (Cisco OR Huawei)) AND (Function = Edge)**.

That is, for a list of routers, the filter only shows Cisco Edge routers and Huawei Edge routers.

Example: Figure 15 shows a filter for Cisco components while Figure 16 shows shows the map that is generated with this filter applied.

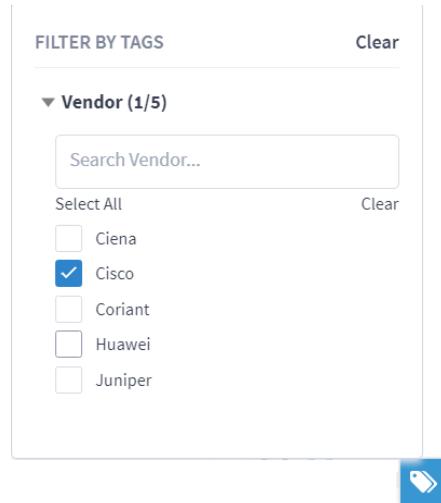


Figure 15.
Filter by Tags

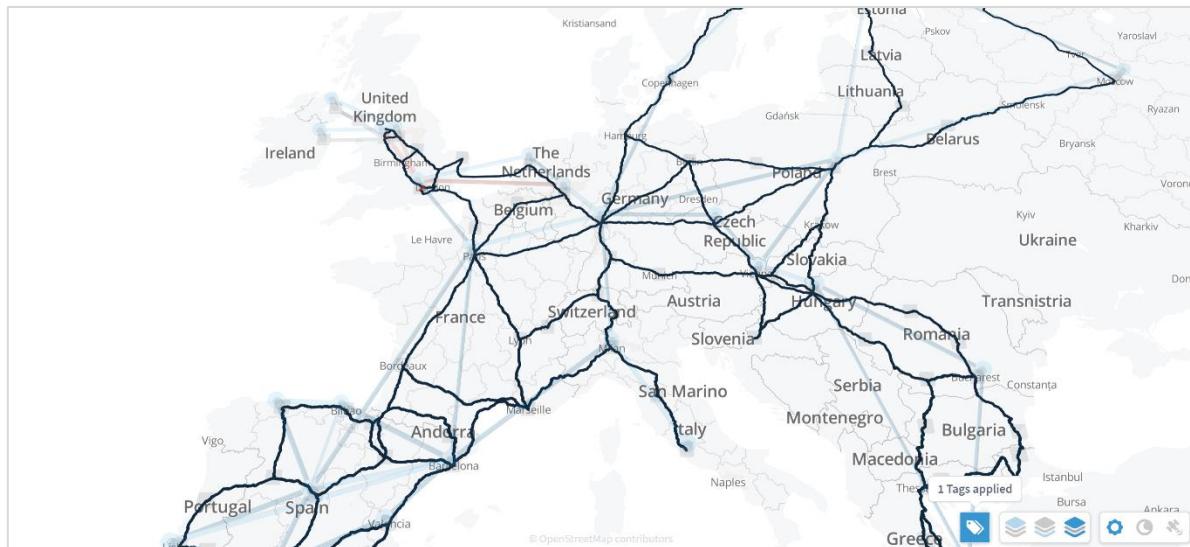
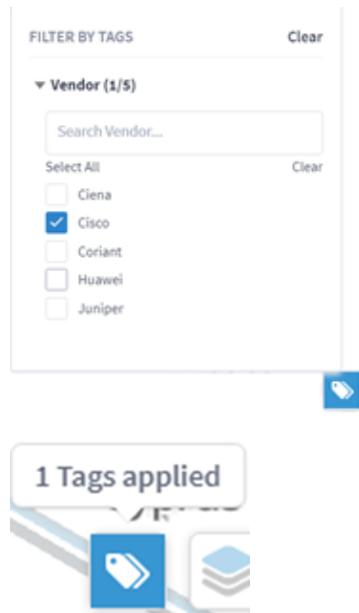
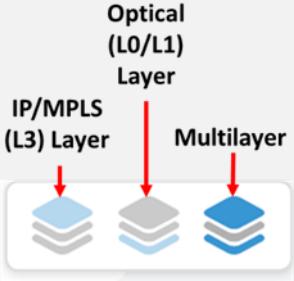
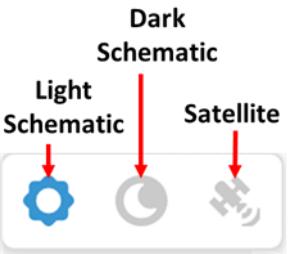
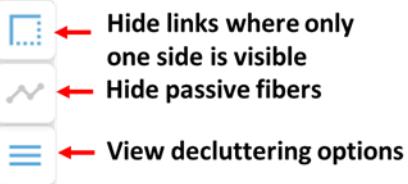


Figure 16.
3D Explorer Filtered by Tag

Viewing the Network Map

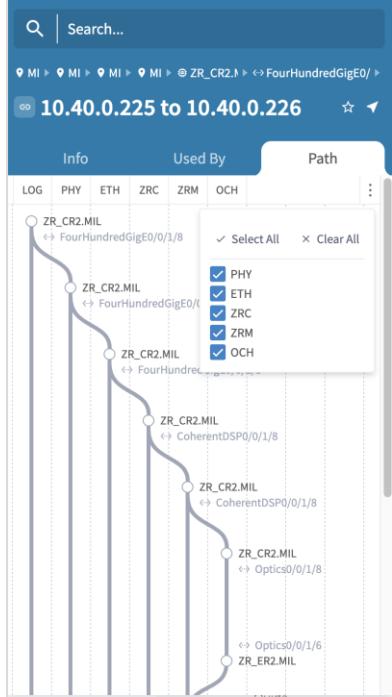
To	Do This
<p>Expand grouped sites (sites containing other sites) to view their contents or to collapse these grouped sites into one.</p> <p>Parent sites are indicated with stripes.</p> 	<p>Use the mouse scroll wheel to zoom in or out. Zooming in expands the grouped sites. Zooming out collapses them. Note that zooming in also enlarges the map.</p> <p>To declutter the map, when zooming in to a target area, if both ends of the link appear in the target area, the link remains visible. If only one end of a link is in the target area, the link may be hidden (if the decluttering option is selected). However, if a link is currently selected, it will always appear even if only one end is in the target area.</p> <p>To find a specific site, click and hold the map while dragging it to the location of that site.</p>
<p>View a flat network map as if looking down on it from above, and to move the network map horizontally or vertically. This is useful for when zooming in to see details of grouped sites</p>	<p>To move the network map, left-click and hold the cursor while dragging the network map horizontally or vertically. To zoom in or out, use the mouse scroll wheel.</p>
<p>Rotate the network map in a circular manner. For example, you could rotate the network map view so that the western view is at the forefront. This could be useful when exploring a specific region of the network map.</p>	<p>Right-click and hold the network map while dragging it left or right to rotate it in that direction. Move the cursor vertically to view the network map in 3D.</p>
<p>Rotate the network map horizontally or vertically to see it in 3D, as a flat view (looking from the side or top), or as perspectives anywhere between the two.</p>	<p>Right-click and hold the cursor while dragging the network map horizontally or vertically.</p>
<p>Filter by tags such as vendor/provider or region. Tags can be attached to any type of resource.</p>	<p>Select the filter by tag icon.</p> 

To	Do This
Show one or more network layers.	Select the applicable network layer icon. 
Show dark and light schematic modes or the satellite map.	Select the required icon. 
Reset the network map to the center of the page and show an aerial view of it	Double-press the space bar.
Decluttering options: Hide links where only one side is visible. Hide passive fibers (with no OMS links above it).	

Working with Objects and Views

To	Do This
Select an object. For information on objects, see Network Map .	Click on the object. Selected objects are highlighted in orange. If applicable, associated links are highlighted in green. For example, if an L3 link were selected, it would be highlighted in orange. If that L3 link traverses five L0/L1 links, all five of those L0/L1 links would be green. You can only select one object at a time. You can select an object in any one of the views. For example, selecting a link in a flat view also highlights that link in the network map in a 3D view.
Deselect objects.	Click in an empty area of the network map or press the ESC key.

To	Do This
Go back to the previous selection.	Use the browser's back feature. For instance, on one browser this might be the Backspace key, while on another it might be a combination of Alt and <- (back arrow) keys.
Go forward to a selection. This is useful if you go back to previous selections, but need return to the selection prior to going backwards.	Use the browser's forward feature. For instance, many browsers support a combination of the Alt and -> (forward arrow) keys.
Open the sidebar.	Select an object from the network map.
Close the sidebar.	Click in an empty area of the network map or press the ESC key.
Display details of a site containing only ONEs.	Click a site in the network map to display details of the site.
View an object in the network map or view an object's details in the sidebar.	<p>Click an object to view its details in the sidebar (see Sidebar). When you hover your mouse over an object in the network map, the object is highlighted in the map, but no other details are shown. To view details of the object, you must click it to open the sidebar (Figure 16).</p> <p>To view a router or a ONE in the network map, hover the mouse over the object (Figure 16).</p> <p>To view a list of routers or ONEs on a site, in the sidebar, click the site to display a list of all the NEs on the site (Figure 16).</p> <p>To view an LSP path, hover the mouse over an LSP link in the network map (Figure 18).</p> <p>To locate an optical connection path, click an LSP path. The connection paths are highlighted in green in the network map and its details are shown in the sidebar (Figure 18).</p>
Zoom into a specific area of the map. Note that this process also expands grouped sites to show their objects.	<p>Use the mouse scroll wheel while in the network map.</p> <p>Press the + (plus) and - (minus) keyboard keys.</p>
Center the map on an object.	Select an object and then click  Locate Item . The object is highlighted in the map and the map is centered and zoomed in on the object.
Add object to list of starred objects.	Select an object and then click  Star Item to add it to a list of starred objects that can be accessed from model selector in any Crosswork Hierarchical Controller application.
View the previous tab in the sidebar.	When navigating between tabs and objects in the sidebar, click the browser back button to view the previous tab. This is especially useful when you are drilling up or down the layers.
Resize the sidebar.	Resize the sidebar by moving the cursor to the right-hand edge of the window until a double-headed arrow appears. When this arrow appears, click-and-drag it to make the sidebar wider or narrower. This is especially useful in the Paths tab.

To	Do This
Scroll down the Paths tab faster.	In the Paths tab, to scroll down the path faster, click Labels to switch the labels off.
Hide layers in Paths tab.	<p>In the Paths tab, to hide layers, click  and then deselect any of the layers. The layers are hidden.</p> <p>This applies to all sections in the Paths tab where the composition of the layers is the same.</p> 
	When the header changes in the Paths tab (that is the composition of the layers changes), you can select to hide the relevant layers in this section (again this applies to all sections with the same composition).
	You can also deselect all the layers in a section.

Hovering over object in the network map does not open the sidebar



Selecting object in the network map opens the sidebar

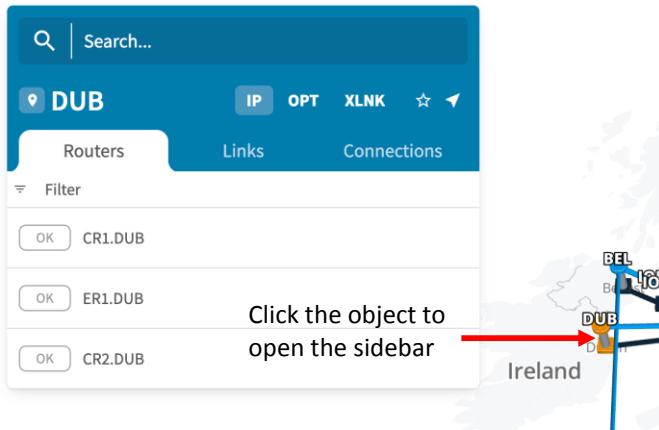
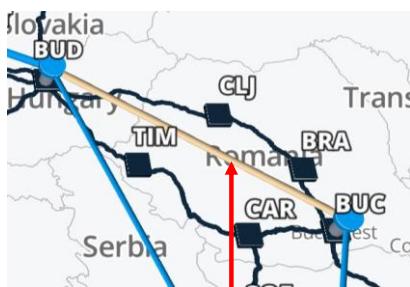


Figure 17.
Examples of Viewing an Object and its Details

Hovering over a link does not open sidebar or show connection links



Selecting the link opens sidebar and shows connection links

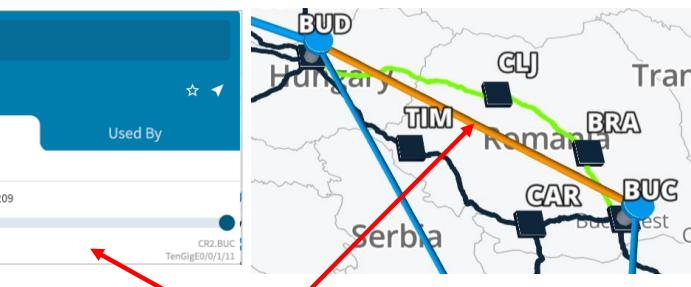


Figure 18.
Examples of Viewing a Link

Network Map

The network map models the multilayer, multi-vendor network, including topology, reserved TE-LSP bandwidth, LSP paths, and optical connection paths. This topology includes the crosslinks that connect the network layers, thus enabling you to see the relationship between the IP/MPLS and Optical layers. More specifically, you can see the optical paths that an L3 link or LSP traverses, and conversely see the L3 links that use any given L0/L1 link. You are visually alerted to failures in both layers, as well as given visual cues when reserved TE-LSP bandwidth thresholds are being met.

How often the network map is updated varies, depending on how equipment is configured. For information on how often your model is updated, contact your system administrator or Cisco support representative.

Note: The network map has several controls for changing how it is visualized. You can also show one or both layers in the network map. For information on how to use these network map and site features, see [3D Explorer](#).

Map Objects

The network map shows the following objects, which consist of sites, links, and crosslinks.

Note: All links and crosslinks are shown in aggregate on the network map.

- Sites contain ONEs (optical network elements), IP/MPLS routers, or both.
- L0/L1 links connect ONEs.
- L3 links connect routers.
- Crosslinks connect ONEs to routers.

In this example you can see two types of sites. The first contains a router, a crosslink and an ONE with connections from other sites. The second site consists of an ONE and the connections between it and the other sites that make up the network.

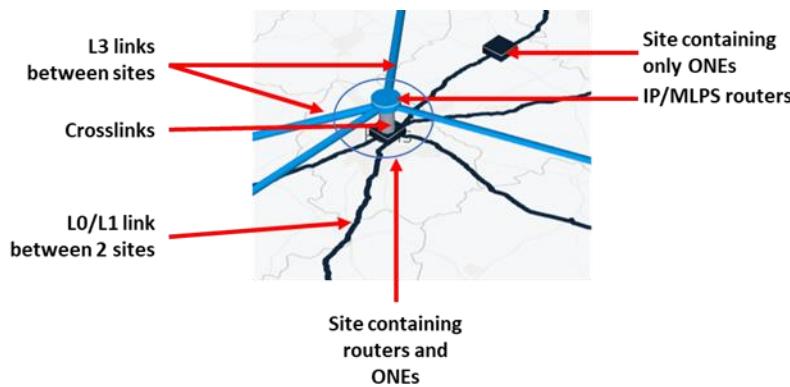


Figure 19.
Examples of Viewing Sites

Links

The term *link* applies to both Optical and IP/MPLS layers. All parallel links are visualized as one in the network map. Links are parallel if they are both in the same layer and if their two connecting sites are common. If any one of the links is not available due to failures or other non-operational states, they are shown as red. For more information on IP links and optical links, see [IP/MPLS Layer and Multilayer Paths](#) and [Optical Layer and Multilayer Paths](#), respectively.

- **Optical links**, also known as *L0/L1 links*, show in the lower layer of the network map. These links also show the connection paths when connections are selected. The L0/L1 link name format identifies the ONE on each end of it, which are colored in **black**.
`<ONE_name>:<port_name> - <ONE_name>:<port_name>`
- **IP links**, also known as *L3 links*, show in the upper layer of the network map (colored in **blue**). These links also show the LSP paths when LSPs are selected. The L3 link name format identifies the router on each end of it.
`<interface_IP_address> - <interface_IP_address>`

Crosslinks

Crosslinks show the connectivity between the Optical and IP/MPLS layers. All crosslinks within the site are visualized as one crosslink. For example, if the site contains ONE-A connected to router A and it contains

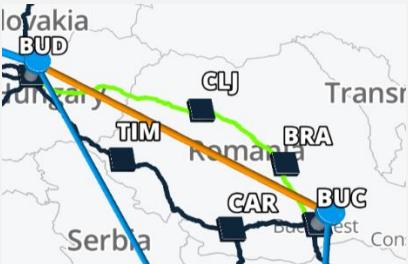
ONE-B connected by two different crosslinks to router B, the crosslink on the network map represents three crosslinks.

The crosslink name format identifies the router and the ONE.

<router_name>:<interface_name> - <ONE_name>:<port_name>

For information on viewing the details of crosslinks, see [Multilayer Crosslinks](#).

Multilayer Link Relationships

To	Do This
Show all L3 links that traverse an L0/L1 link	Select the L0/L1 link. It becomes orange, and all L3 links that traverse the selected L0/L1 link become green. Below is an example of a selected L0/L1 link that is traversed by two L3 links.
	
Show all L0/L1 links over which an L3 link traverses	Select the L3 link. It becomes orange, and all L0/L1 links that it traverses become green. Below is an example of a selected L3 link that traverses three L0/L1 links. The L3 link traverses two crosslinks, the three L0/L1 links, and four ONEs (one in each headend or tailend site and two in between the sites).
	

Sites

Sites typically represent ONEs and routers that are clustered together to represent a small city, region, data center, or a central office. They are positioned on the network map according to their general geographical location. Each site contains one or more ONEs, routers, or both. A site can also include radio devices.

The sites in the network map when it is shown in the default size (not zoomed) can be *parent* or *grouped* sites. that contain *child* sites. You can have many levels of parent/child sites, and child sites can have other child sites. This visualization is configured by the Crosswork Hierarchical Controller administrator.

If a Site Contains...	Site Visualization
Only routers whether directly or indirectly with nested sites containing only routers.	
Only ONEs whether directly or indirectly with nested sites containing only ONEs.	
At least one router, at least one ONE, and at least one crosslink connecting a router and ONE, whether directly or due to nested sites within it.	
If a crosslink has not been discovered yet, the site temporarily appears without it.	

Expanding and Collapsing Grouped Sites

To expand grouped sites to view their objects or to collapse these grouped sites into one, use the mouse scroll wheel to zoom in or out. Zooming in expands the grouped sites. Zooming out collapses them. Note that zooming in also enlarges the map. To find a specific site, click and hold the map while dragging it to the location of that site. The example below shows a collapsed grouped site and its expanded view.

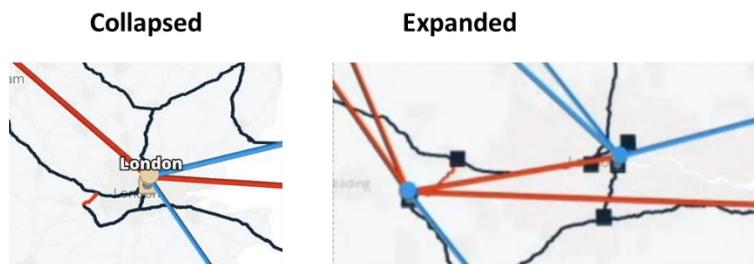


Figure 20.
Expanded Site

Discovered Link/Connection Types

Link/Connection	Description
Links	
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.
Radio Channel	The media layer as a carrier of radio channels.
Radio Aggregate	Multiple radio channels can be on top of radio media, each channel represents a different ETH link with its own rate.
OTS	OTS is the physical link connecting one line amplifier or ROADM to another. An OTS can be

Link/Connection	Description
	created over a fiber link.
OMS	OMS is the link connecting between one ROADM and another. An OMS can be created over a chain of OTS links.
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.
E LINE	ETH L2 link, spans from one ETH UNI port of an optical device to another, and rides on top of ODU.
E LINE 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.
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 Aggregate	Agg is Link Aggregation Group (LAG) where multiple ETH links are grouped to create higher bandwidth and resilient link.
L3-VPN link	The connection between two sites of a specific L3-VPN (can be a chain of LSP connections or IGP path).
Logical link, IGP, LSP	Logical link connects VLANs on two IP ports.
IGP	IGP is the link between two routers that carries IGP protocol messages. The link represents an IGP adjacency.
SR Segment	A segment routing path between two nodes, with mapping to the IGP links based on SIDs list.
MC	A Media Channel.
Connections	
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.
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.
OTU	OTU is the underlay link in OTN layer, used for ODU links. It can ride on top of an OCH.
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.
ETHERNET	
MPLS TP	MPLS-TP tunnels over ETH links.
PSEUDOWIRE	Binds a tunnel (for example MPLS) to the specific service PE ports. It communicates a service "label" with the other side, this label is below the routing labels and this label routes packets at the end of the tunnel to the correct PE port.
SR Policy	A segment routing path between two nodes, with mapping to the IGP links based on SIDs list
LSP	LSP is the MPLS tunnel created between two routers over IGP links, with or without TE

Link/Connection	Description
	options.
MC	A Media Channel is a connection that takes several wavelengths and routes them together as a single circuit.
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.
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.
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.

Multilayer Crosslinks

Each crosslink represents an L3 interface connection to an L0/L1 port. Studying crosslinks and multilayer paths (where and how routers connect to ONEs [optical network elements]) gives you an understanding of how network traffic is flowing. Knowledge of this port mapping between the two layers is essential for identifying how taking down an optical link will affect the network at both layers. This information is also useful, for instance, when optimizing the network and configuring it for restoration.

Exploring Multilayer Crosslinks

The network map shows these crosslinks in aggregate. For example, Figure 20 shows a router in a data center connected to a ONE using 3 crosslinks. These three crosslinks appear in the network map as one. Selecting the site enables you to determine how many interface-to-port mappings there are per site, and enables you to drill down to the details of each individual crosslink in the sidebar (Figure 21). To view details of a crosslink, you must click on the column of the crosslink that connects the L0/L1 layers to the L3 layer.

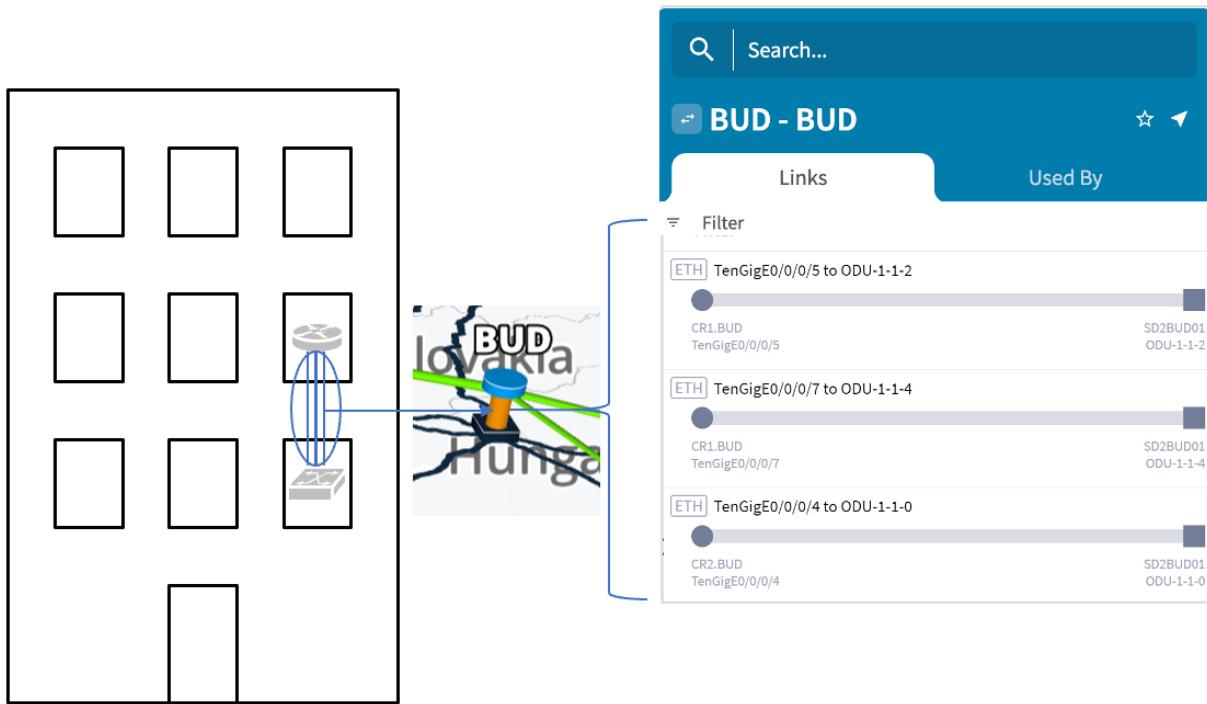


Figure 21.

Discovered and Visualized Crosslinks

The crosslink name format identifies the router and the ONE.

<router_name>:<interface_name> to <ONE_name>:<port_name>

Example: Figure 21 shows that the L3 interface **E0/0/0/5** on the **CR1.BUD** router is connected to the L0/L1 port **1-1-2** on the **SD2BUD01** ONE.

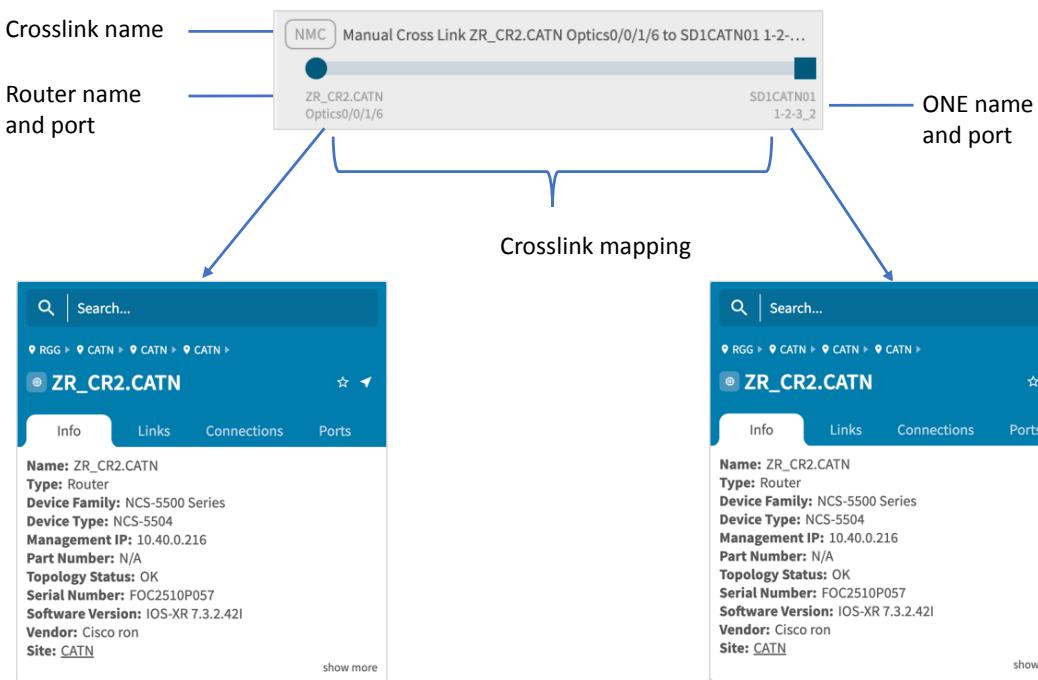


Figure 22.

Example Crosslink

IP/MPLS Layer and Multilayer Paths

The 3D Explorer UI enables you to explore the IP/MPLS layer and its relationship with the Optical layer. As outlined in [Network Map](#), the network map sites containing routers represent all routers within the site as one. L3 links between sites are all represented as one link.

This topic describes how to further explore the IP/MPLS layer and its relationship with the Optical layer beyond what is in the network map and site views. Understanding this multilayer relationship helps you better plan the L3 topology and route L3 traffic. For instance, by exploring IP/MPLS and multilayer features you might find that L3 links or LSPs share risk of failure at the Optical layer because they share optical links. You might find that the LSP path hops are not optimized for the best routes.

Viewing L3 Details

To view details about the IP/MPLS layer, select a site containing a router from the network map. A sidebar opens to the **IP** tab. From here you can explore details on routers, L3 links, ports, LSPs, and multilayer paths by clicking on any of the sub-tab that appear. Available sub-tabs are listed below. Some sub-tabs may not be visible, depending on what is selected.

- **Routers**—All routers within the site or a selected router. You can view the details of a router at the site by clicking it in the sidebar, see [Exploring Routers](#).
- **Ports**—All logical and physical ports on the selected router.
- **Links**—If a site is selected, these are all L3 links to routers within the site. If a router is selected, these are all the L3 links connected to it. If an L3 link is selected, these are all L3 links between the sites on either end of the selected link.
- **Used By**—Shows all links and connections that are in the layer above the displayed link/connection, and all services using the selected L3 link.
- **Connections**—If a site is selected, these are all LSPs going through all routers in the site, regardless of whether the router is a source, a destination, or a hop (transit router). If a router is selected, these are all LSPs going through that router. If an L3 link is selected, these are all LSPs traversing that link.
- **Paths**—Describes the path of the selected element. The LSP path shows each hop (source, destination, and transit) used by the LSP. If a site is selected, these are LSP paths going through all routers in the site. To view the LSP path, click the LSP name. If a router is selected, these are all LSP paths traversing all L3 links connected to that router. If an L3 link is selected, these are all LSP paths traversing that link. The optical path for the L3 links that are traversed is also shown. This path includes *link bundles*, also known as aggregated links, port bundles, or LAGs. A link bundle is a logical grouping of physical interfaces so that they can be easily configured and maintained as one.
- **History**—Lists the last 20 events for the selected element.

Selecting any L3 link in the network map highlights it in orange and highlights the L0/L1 links and connections that the L3 object traverses in green. For example, Figure 23 shows a selected L3 link between **CR1.VIE** and **VR2.WAR** uses three L0/L1 links.

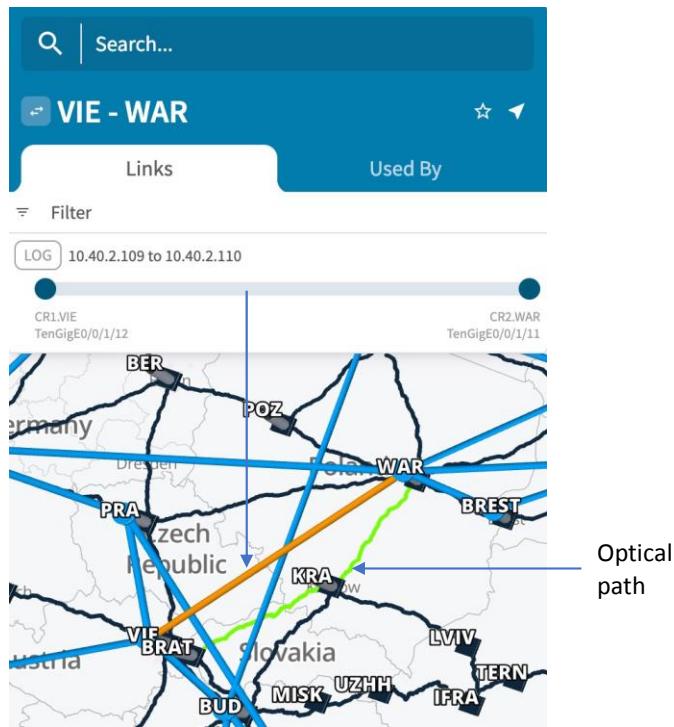


Figure 23.

Selecting an L3 Link Highlights Its L0/L1 Path

Exploring Routers

Selecting a site containing routers opens a sidebar that shows all routers in the site.

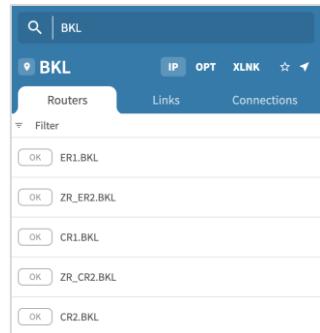


Figure 24.

Sidebar Showing Routers at Site

Routers at site

The screenshot displays the Cisco Crosswork Hierarchical Controller interface, specifically the 'Routers at site' section. It shows a hierarchical tree of routers under the site 'MIL'. The routers listed are ZR_ER2.MIL, CR2.MIL, CR1.MIL, ZR_CR2.MIL, and ER1.MIL. The 'CR1.MIL' node is expanded, showing its detailed configuration and connections. The configuration includes the router's name, type (Router), device family (NCS-5500 Series), device type (NCS-5501-SE), management IP (10.40.0.50), part number (N/A), topology status (OK), serial number (FOC2102R0KG), software version (7.1.2), vendor (Cisco), and site (MIL). The 'Links' tab shows various network links between the routers, such as '10.40.3.126 to 10.40.3.125' and '10.40.3.27 to 10.40.3.28'. The 'Connections' tab lists connections like 'CR1.ROW to CR1.ROW'. The 'Ports' tab shows port details for each router, including port numbers and bandwidths (e.g., '100 Gbps', '10.0 Gbps'). The 'History' tab shows a history of events for the router, with the most recent entry being 'INSERT' on 10/15/2024 at 10:41:...'. The interface is designed for network management and visualization, providing a clear overview of the site's router configuration and connectivity.

Figure 25.

Example of a Site in the Sidebar Showing the Routers, Links, Connections and Ports

The screenshot shows the Cisco Crosswork Hierarchical Controller interface with a focus on an unreachable router path. The path '12.3.4.5 to 12.3.4.4' is highlighted in red, indicating a problem. The 'Info' tab for this path shows the following details:

- Partial Data: Unreachable or stale NEs detected in path
- Name: 12.3.4.5 to 12.3.4.4
- Layer: Router Logical
- Role: Regular
- Operational Status: Up
- Protection Status: Unknown
- Path Group Type: Single Path
- Port A: [HundredsGigE0/0/0/22/2 \(ron-8201-32FH-3\)](#)
- Port B: [HundredsGigE0/0/1/0/2 \(ron-asr9903-1\)](#)

The 'Used By' tab shows a similar list of details. The 'Path' tab shows a note: 'OCH link has a missing path hop'. The 'History' tab for the path shows a red box around the message 'Failure in device topology discovery'. The 'Connections' tab shows a red box around the message 'Failure in device topology discovery'. The 'Ports' tab shows a red box around the message 'Failure in device topology discovery'. The 'Info' tab for the router 'P-BOTTOMLEFT' shows the following details:

- GUID: IN/cisco-cnc-adpt/ROUTER-P-BOTTOMLEFT
- Name: P-BOTTOMLEFT
- Type: Router
- Device Family: Cisco ASR 9000 Series Aggregation Ser...
- Device Type: Cisco IOS XRv 9000 Router
- Management IP: 10.56.113.108
- Part Number: N/A
- Topology Status: Failure
- Serial Number: 557881A1DA1
- Software Version: 7.7.1
- Vendor: Cisco systems, inc
- Description: Cisco IOS XR Software (IOS-XRv 9000), Ve...
- Provider: cisco-cnc-adpt

Figure 26.

Example of an Unreachable Router

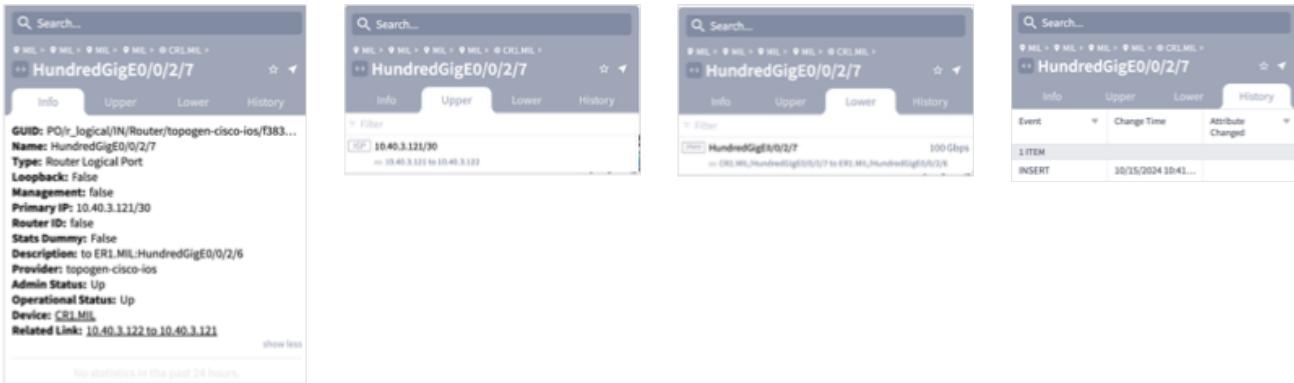


Figure 27.
Example of Port Info, Upper Ports, Lower Ports, and History



Figure 28.
Example of Router Physical Port Utilization

To view details about a router, select it. The sidebar shows the following details for the selected router:

- **Info:** Shows information about the router, including its GUID, name, type, device family, device type, management IP, part number, topology status, serial number, software version, vendor, provider, and site. Click **show more** or **show less** to see more or fewer details. If a device is unreachable a message appears. For an example, see Figure 26.
- **Links:** Lists the router's logical interfaces. Click the arrow to see the physical interfaces.
 - If the space on the right is empty, the L3 link or crosslink is unknown.
 - If the crosslink to the ONE is known, the expansion shows the router's physical interfaces and the ONE's ports, as well as a crosslink icon.
- **Connections:** Lists the router's LSP connections.

- **Ports:** Lists the router's ports and the links connected to each port. The **Admin Status (Up or Down)** and the **Operational Status (Up or Down)** can be viewed when drilling down on a port to the **Info** tab.
 - **History:** Lists the last 20 events for the selected router.

Note: You cannot view all ports for a site. You can only view them on a per-router basis.

To view details about a router physical or logical port, select it. The sidebar shows the following details for the selected port:

- **Info:** Shows information about the physical or logical port. For a physical port, its GUID, name, type, physical address, speed, provider, admin status, operational status, relative direction and device. For a logical port, its GUID, name, type, loopback, stats dummy, provider, admin status, operational status, relative direction, device and relative port. Click **show more** or **show less** to see more or fewer details. If the router is tagged, the tags appear at the bottom of the tab.
 - **Upper:** Lists the upper ports. The upper port details appear when drilling down on a port.
 - **Lower:** Lists the lower ports. The lower port details appear when drilling down on a port.
 - **History:** Lists the last 20 events for the selected port.

Exploring L3 Links

The blue lines connecting sites on the network map indicate the L3 links between sites. However, as there may be numerous L3 links between sites, they are not all shown in the network map. Consequently, the blue line between sites also represents the sitelink between two sites. Click on a link in the map to show its details (Figure 29).

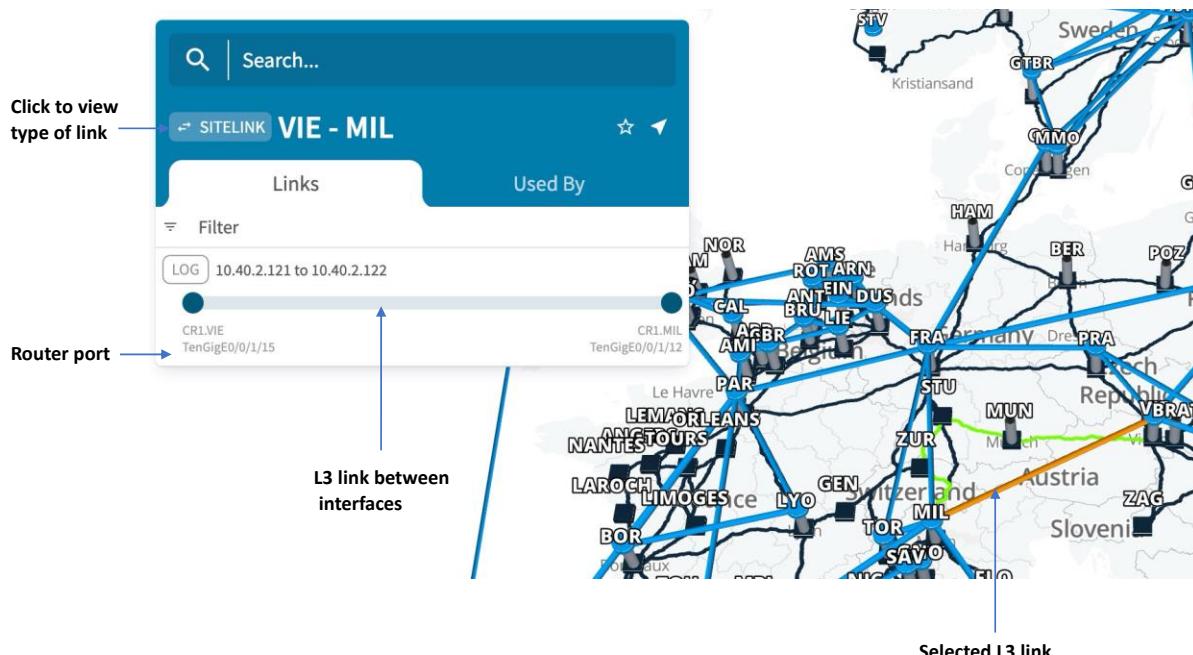


Figure 29.

Figure 25: Example showing Sidebar with Details of Logical Sitelink Selected in the Network Map

Note: Connections shown in red indicate that the connections are down

The Links tab in the sidebar shows the following information (Figure 29):

- Type of link—In this example, a logical sitelink that indicates the names of the connected sites.
- L3 link name—The name of the link named according to the IP addresses at each end of the link in the form:

<interface_IP_address> to <interface_IP_address>

To view details of the logical link, click the link name in the **Links** tab (Figure 29). The sidebar now shows details of the L3 link including the names of the logical and physical ports at each end of the link, as well as the link itself. The **Info** tab also shows more details of the link as shown in Figure 30.

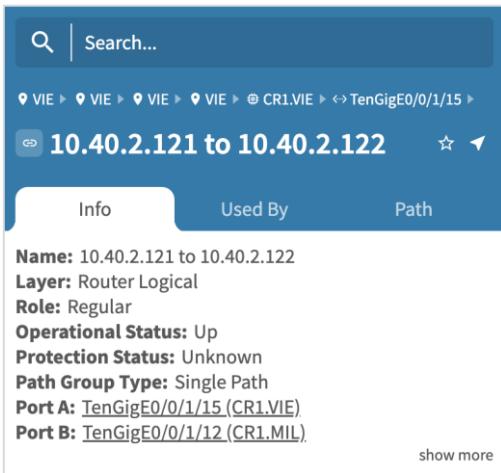
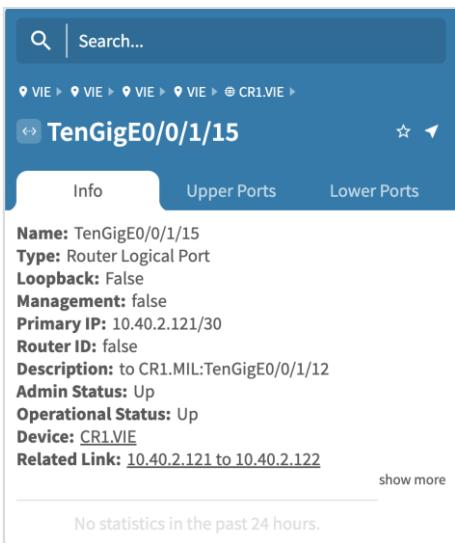


Figure 30.
Sidebar Showing Logical Link

If an L3 link is not available due to failures or other non-operational states, it is shown as red in the network map. L3 links are marked as **Down** in the sidebar if a router on either end of the link does not identify the logical interface in the ARP table. To view details on any of the logical or physical ports, click on the port link in the sidebar.



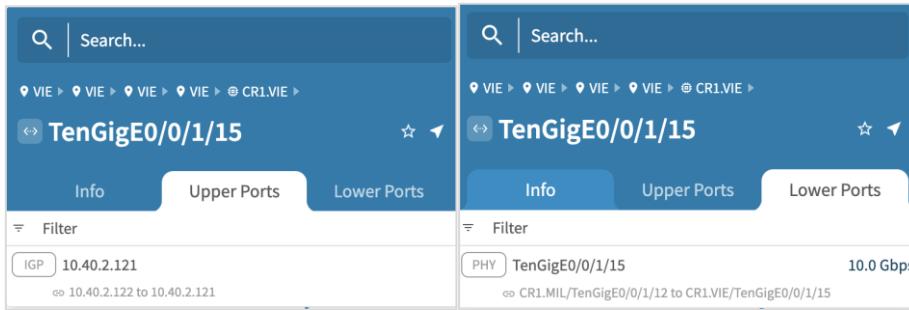


Figure 31.
Example of Logical Port Info, Upper Ports and Lower Ports

You can also view logical links in a site by clicking the site and then selecting the **Links** tab in the sidebar.

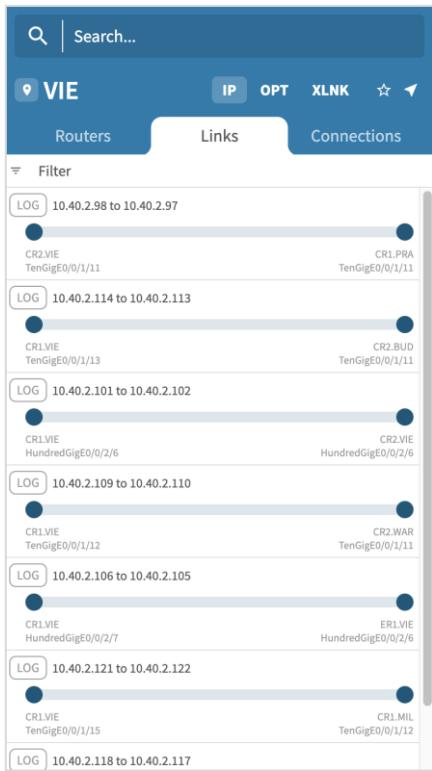


Figure 32.
Example of the Links in a Site

In the sidebar for a logical link, click the **Path** tab to see the visual details of all the layers in the logical link including the L3 and L1 layers.

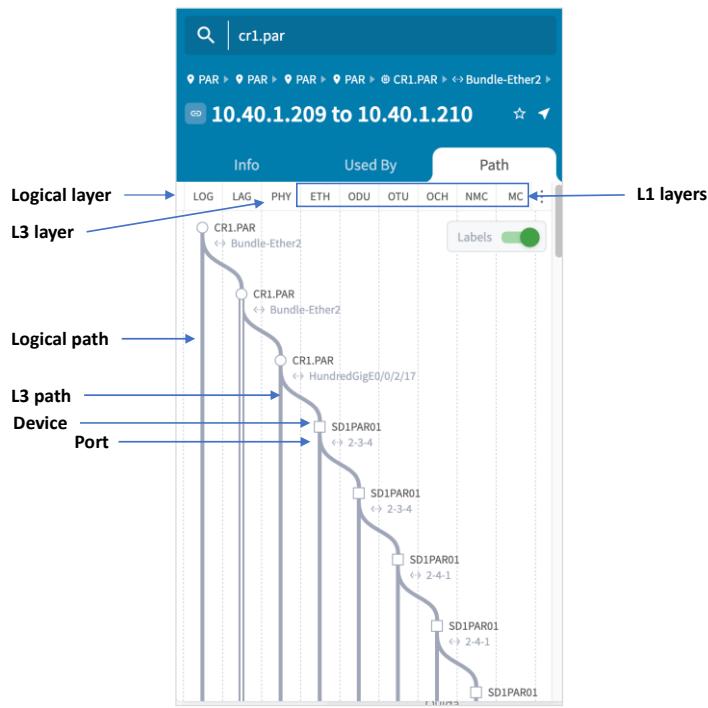


Figure 33.
Example of the Layers in a Path of a Logical Link.

Note: The above example shows the layers in a logical link. These layers may differ according to the links used in your network and according to the level at which you viewed the paths. For example, in Figure 33, the path was viewed from the logical layer. If the path was viewed from the physical layer level, the path of the logical layer does not appear. This means that the paths shown are always the paths downwards from the level from which you view the path.

Figure 34 shows an example of the layers in a path from the LSP level downwards. For more information on LSPs, see [Exploring LSPs](#).

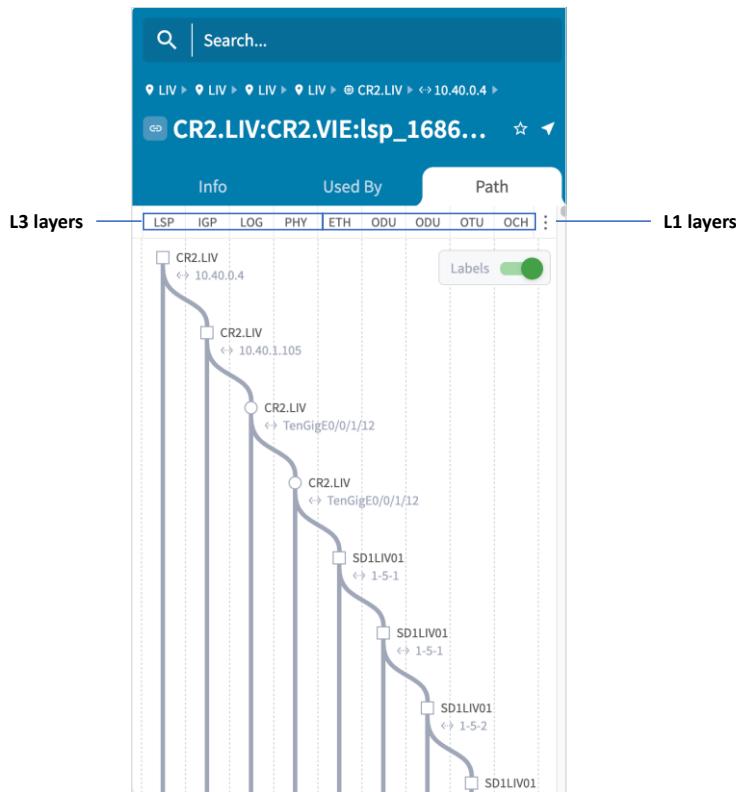


Figure 34.
Example of LSP Path Layers

Link Bundle Paths

You can configure an aggregate interface on a router. This adds another layer to the path. Figure 35 is an example of an aggregated link between two routers.

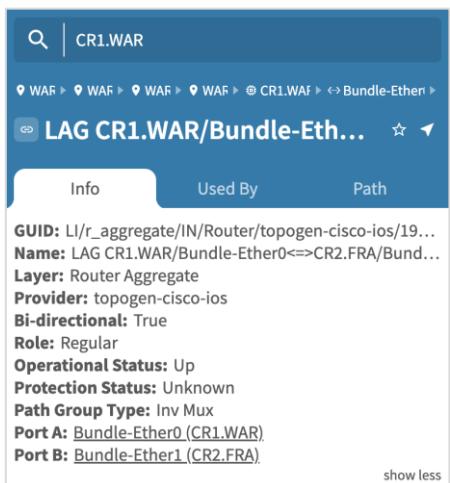


Figure 35.
Aggregate Links between Two Routers

Link bundles show as parallel L3 links (Figure 36).

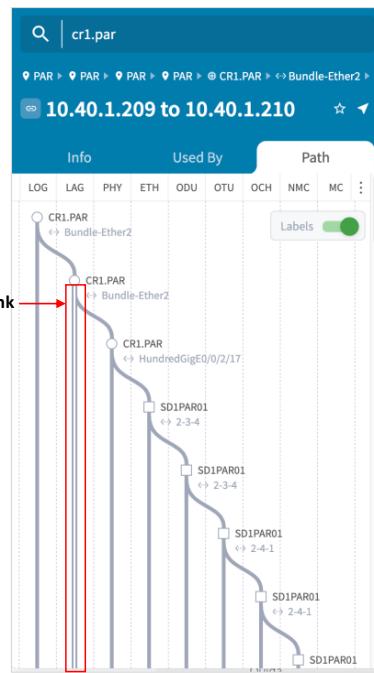


Figure 36.
Bundled Link in Path Tab

Clicking the area to the right of the aggregated link, changes the selected link sequentially up (to the right) or down (to the left). Each time you click to show a new L3 link, the optical path changes to reflect the newly selected L3 link.

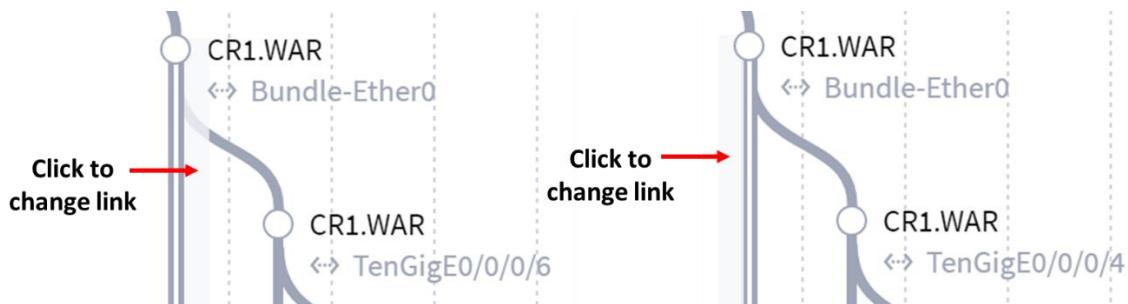


Figure 37.
Selecting Links in Bundled Link in Path Tab

Exploring LSPs

The sidebar lists the LSPs traversing or using the currently selected object in the network map. For example:

- If a site is selected, the **Connections** tab in the sidebar lists all the LSPs starting and ending at the site.
- If a link between sites is selected, drill down until a logical link is selected. The **Used By** tab in the sidebar lists all the LSPs traversing that link and services using the link.

Exploring L0/L1 Paths Traversed by LSPs

To locate an LSP, click on a site in the map to show its details in the sidebar. Then click the **Connections** tab to view all the LSP links that traverse the site (Figure 38).

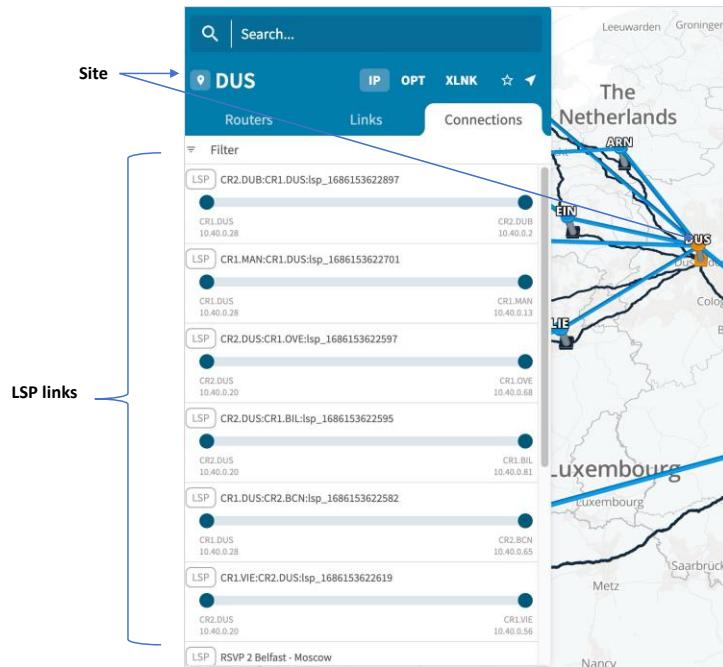


Figure 38.
Connections Tab showing LSP Links

Clicking the LSP name in the sidebar shows you both the LSP paths and the optical paths it traverses in the network map. At the same time the sidebar changes to show the **Info**, **Used By** and **Path** tabs for the selected LSP. The LSP paths are shown in orange, while optical links it traverses are shown in green (Figure 39).

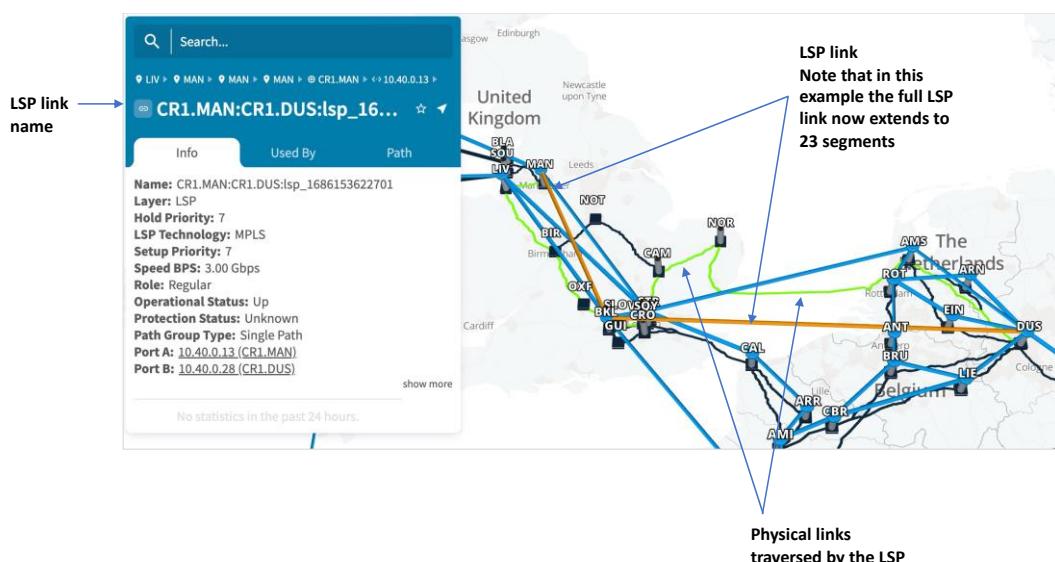


Figure 39.
LSP and Physical Links

For protected LSPs with active and standby (also known as secondary) paths, the standby paths are indicated in dashed lines.

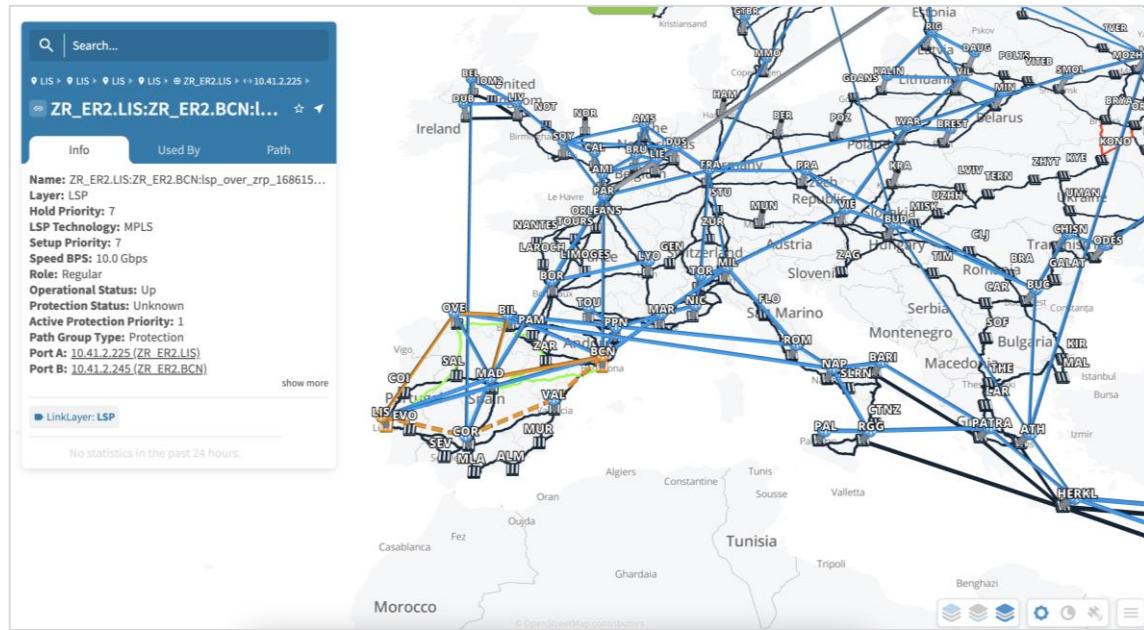


Figure 40.
Protected LSP

When expanded, an LSP shows the following information:

- LSP path
 - Source site or source router–LSP head end.
 - Destination site or destination router–LSP tail end.
- LSP name
- LSP path showing the hops that the path takes
- In the network map, the logical and optical paths are highlighted in orange and green respectively

Click the **Path** tab to view the LSP path details.

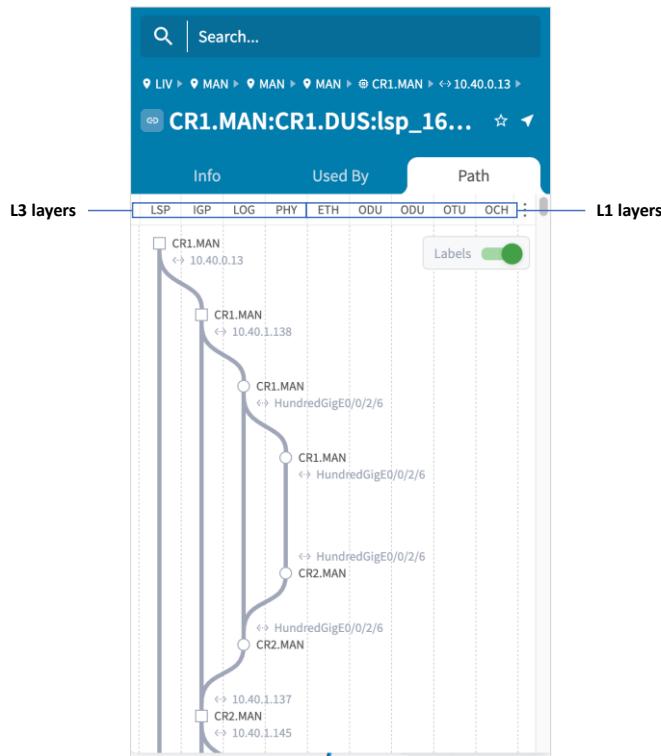
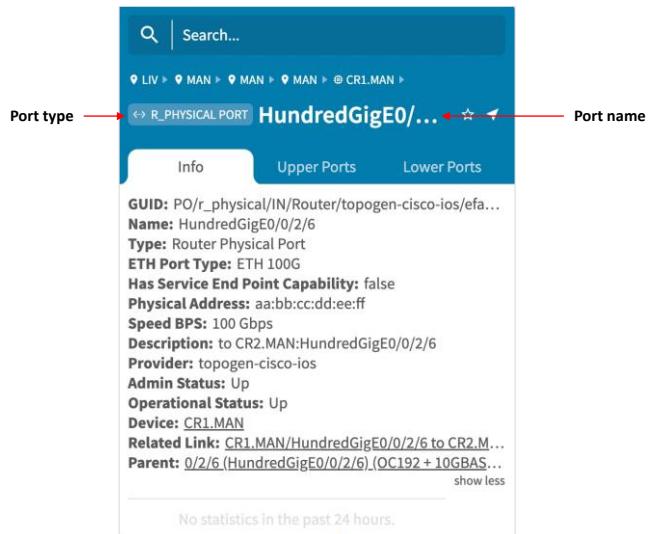
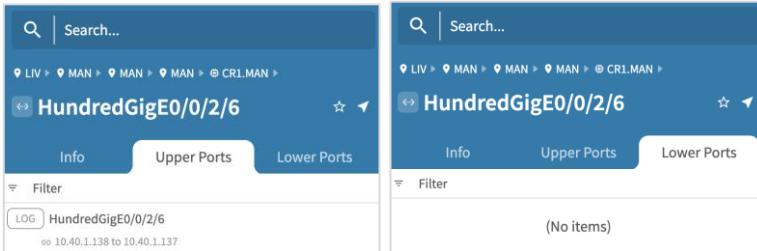


Figure 41.
LSP Path Details

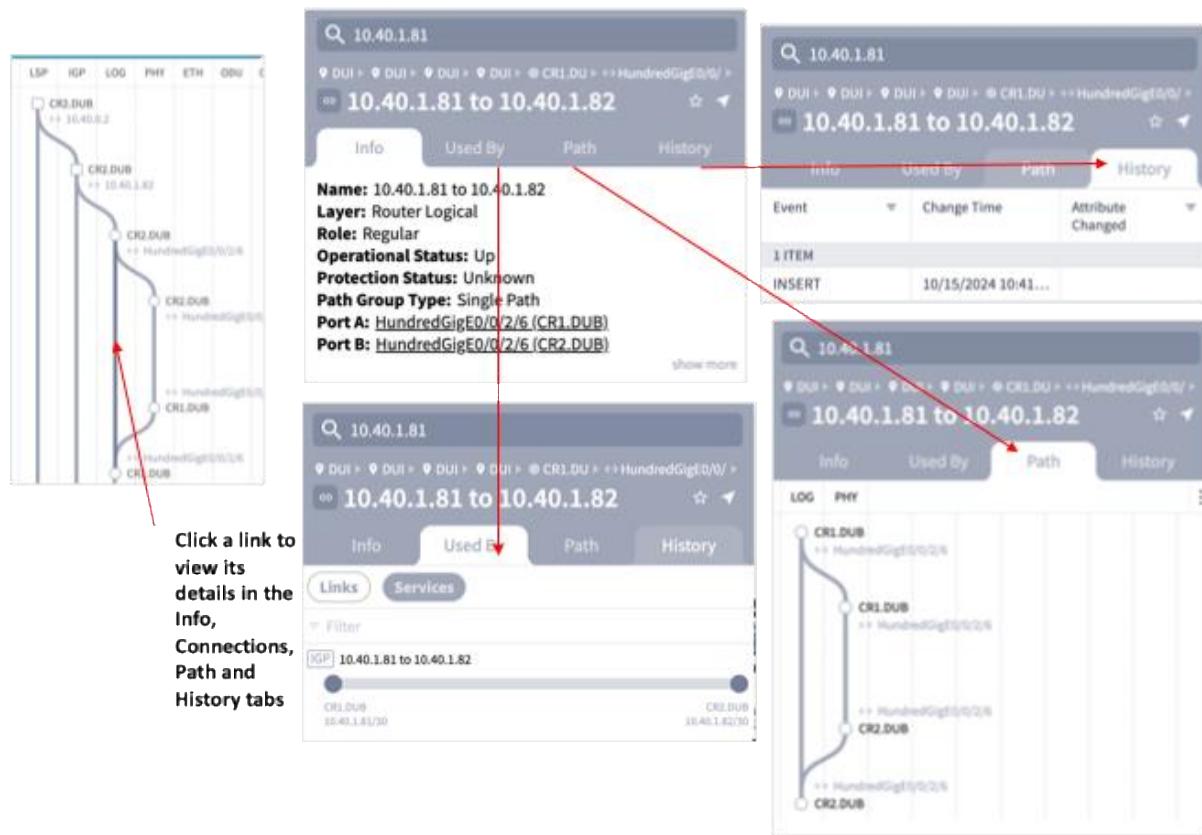
Click on a router name in the **Path** tab to view its details. Likewise you can click on a port name in the Path tab to view its details (Figure 42).



**Figure 42.**

Port Info Tab & Upper Ports & Lower Ports

Click on any of the vertical path lines in the Path tab (Figure 41) to view its details in the respective **Info**, **Used By** and **Path** tabs for that path.

**Figure 43.**
Path Details

Exploring SR Policies

The network model supports Segment Routing (SR) Policies. An SR Policy is modelled as a tunnel comprising multiple SR Segments over IGP links.

Each SR Segment is a link in the model represented by a SID, that is configured in the end node of the SR Segment. For example, the first SR Segment in the example below is between A and the node configured as SID C. The second SR Segment is between C and the node configured as SID B.

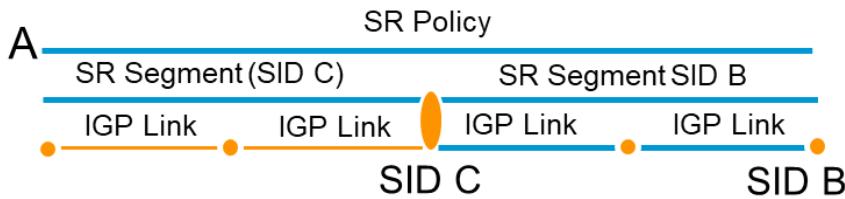


Figure 44.
SR Policy

A SID can be associated with multiple SR Segments with different starting points (and the same endpoint based on the SID), and can also be used in multiple SR Policies.

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.

In addition, SR Segment routing configuration is modelled for the device, card and IGP interface.

SR Policies

Policy Name	A - B	SID List	Segments
Metro1	6 - 11	9,11	6-9, 9-11
Metro2	10 - 11	9,11	10-9, 9-11
Metro3	8 - 12	6	8-6, 6-12

Segments

A - B	Used by Policies
6 - 9	Metro1
9 - 11	Metro1, Metro2
10 - 9	Metro2
8 - 6	Metro3
6 - 12	Metro3

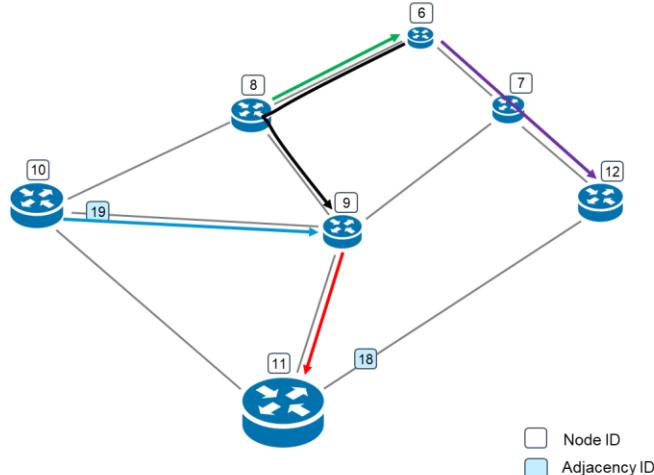


Figure 45.
SR Policies and Segments

To view a list of SR Policies, select the **Network Inventory** application and then click on the **Connections** tab.

Network Inventory

Filter inventory by: Regions/Sites/Devices

Devices Sites Links Connections Services Cards Ports Transceivers Power Supplies Fans Shelves

SR POLICY LSP MC

Apply Inventory Filter On Connections Export Table

16 ITEMS

Name	Source Device	Destination Device	Operatio... State	Protecte...	IGP Hops Count	Tags	Color	Preferenc...
SR_P_201_reverse	ZR_ER2.SQY	ZR_ER2.BCN	UP	SINGLE...	1		14298	0
SR_P_300_reverse	ZR_ER2.PAR	ZR_ER2.BIL	UP	SINGLE...	2		14301	0
SR_P_500	CR1.COR	CR1.MOS	UP	SINGLE...	12		14500	0
SR_P_100	ZR_ER2.LIS	ZR_ER2.SQY	UP	PROTE...	3		14100	0
SR_P_300	ZR_ER2.BIL	ZR_ER2.PAR	UP	SINGLE...	2		14300	0
SR_P_500_reverse	CR1.MOS	CR1.COR	UP	SINGLE...	12		14501	0
SR_P_400	ZR_ER2.MAD	ZR_ER2.SQY	UP	SINGLE...	6		14400	0
SR_P_200_reverse	ZR_ER2.SQY	ZR_ER2.BCN	UP	SINGLE...	3		10299	0
SR_P_200	ZR_ER2.BCN	ZR_ER2.SQY	UP	SINGLE...	3		10200	0
SR_P_400_reverse	ZR_ER2.SQY	ZR_ER2.MAD	UP	SINGLE...	6		14401	0
SR_P_101_reverse	ZR_ER2.SQY	ZR_ER2.LIS	UP	PROTE...	1		14198	0
SR_P_600	CR1.SPB	CR1.DUB	UP	SINGLE...	7		14600	0
SR_P_101	ZR_ER2.LIS	ZR_ER2.SQY	UP	PROTE...	6		14101	0
SR_P_201	ZR_ER2.BCN	ZR_ER2.SQY	UP	SINGLE...	1		14201	0
SR_P_600_reverse	CR1.DUB	CR1.SPB	UP	SINGLE...	7		14601	0

Figure 46.

SR Policies in Network Inventory

The network map shows you a visual representation of the SR Policy and the SR Segments over IGP links. Selecting any SR Policy in the network map highlights the links in the color is specified when the policy is provisioned using the Service Manager application.

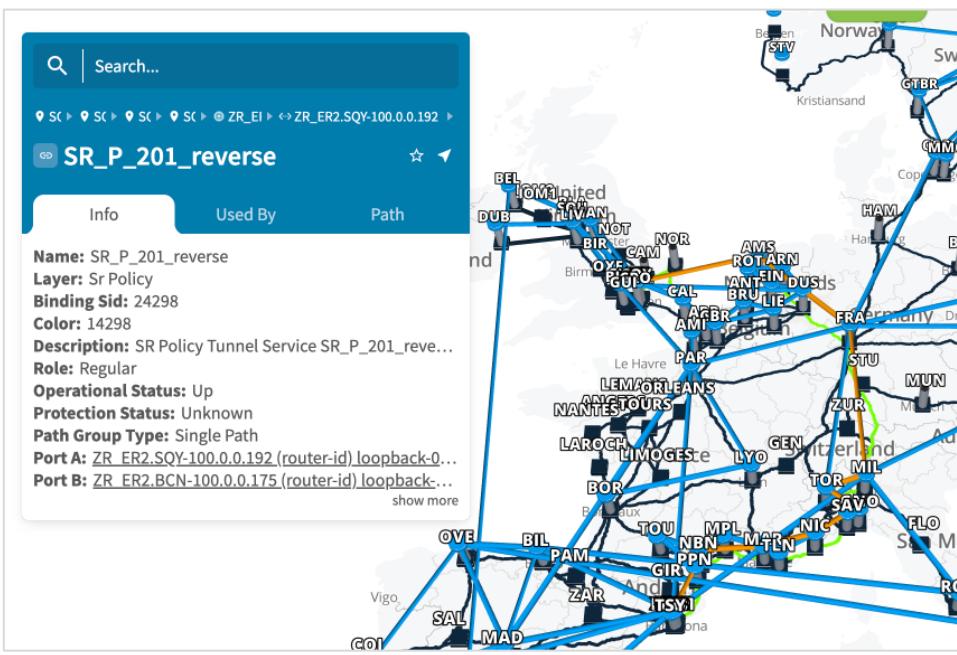


Figure 47.

SR Policies and SR Segments

Click on the **Path** tab to view the path of the current SR Policy including the SR Segments over IGP links.

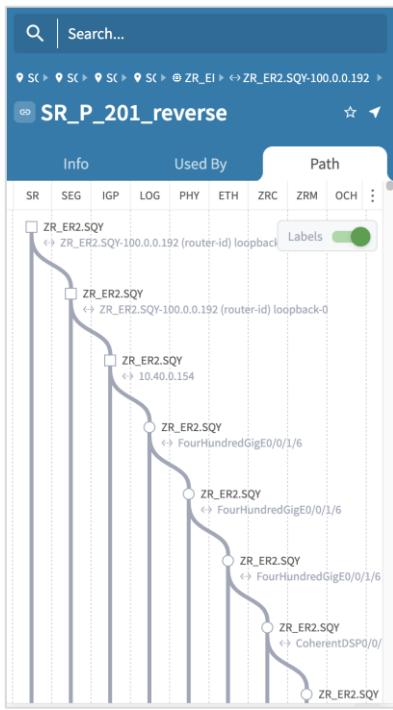


Figure 48.
SR Policy Path

Scroll down to view the SID for each SR Segment.

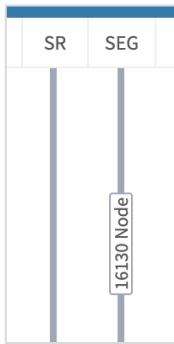


Figure 49.
SR Policy Path

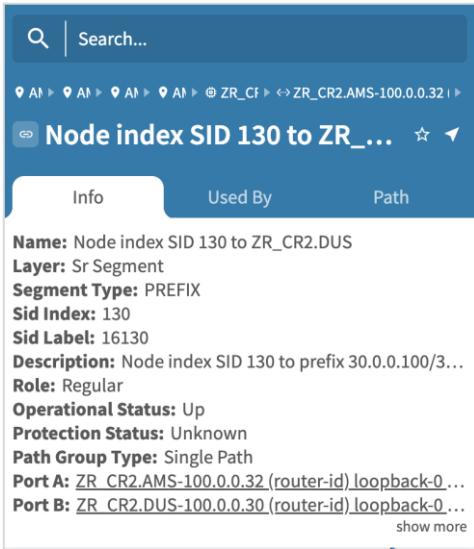


Figure 50.
SR Segment

An SR Segment may be shared by multiple SR policies. To view the SR Policies above the selected element, select the **Used By** tab.

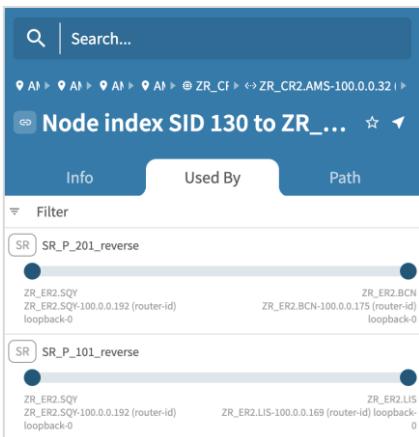


Figure 51.
SR Segment Used By

Optical Layer and Multilayer Paths

The 3D Explorer UI enables you to explore the Optical layer and its relationship with the IP/MPLS layer. As outlined in [Network Map](#), sites in the network map containing ONEs (optical network elements) represent all ONEs within the site as a single ONE icon. L0/L1 links between sites are all represented as one link. To drill down into the site to explore its ONEs and their intrasite relationships, double click on a site in the network map.

This topic describes how to further explore the Optical layer beyond what is in the network map and site views.

Note: To view multilayer paths in the sidebar, see [IP/MPLS Layer and Multilayer Paths](#).

Viewing L0/L1 Details

To view details about the Optical layer, select a site containing a ONE from the network map. A sidebar opens to the **IP/MPLS** tab. From here, select the **OPT** tab so you can explore details on ONEs, L0/L1 links, ports, and connections by clicking on any of the tabs that appear. The following tabs are available, although they may or may not be visible, depending on what is selected.

Note: If you select a site in the network map that only contains ONEs, the OPT link is automatically opened.

- **Nodes**—All ONEs within the site or a selected ONE.
- **Info**—Details about the node. If the node is tagged, the tags appear at the bottom of the tab.
- **Links**—If a site is selected, these are all L0/L1 links to and from ONEs within the site. If a ONE is selected, these are all the L0/L1 links connected to it. If an L0/L1 link is selected, these are all L0/L1 links between the sites on either end of the selected link.
- **Connections**—If a site is selected, these are all connections going through all ONEs in the site, regardless of the positions of the ONEs in the path. If a ONE node is selected, these are all connections going through that ONE node.
- **Ports**—All physical ports on the selected ONE.
- **Used By**—Shows all links and connections that are in the layer above the displayed link/connection and the services using the links and connections.
- **Paths**—Describes the path of the selected element.
- **History**—Lists the last 20 events for the selected element.

Selecting any L0/L1 object in the sidebar highlights it in the network map as orange.

Exploring ONEs and their Ports

Selecting a site containing ONEs opens a sidebar that shows all ONEs in the site. To view details about a ONE, select it.

To view optical ports, select a ONE from the sidebar and then select the **Ports** tab. For an example, see Figure 53.

- The L0/L1 port type is labeled as **ETH**, **ODU**, **OTU**, **OCH**, **OMS**, **OTS**, **FIBER**, or **FSEG**.
- The ODU ports are further labelled by type.

Note: You cannot view all ports for a site. You can only view them on a per-ONE basis.



Figure 52.
Example Ports Tile Showing Ports Used by L0/L1 Links and Crosslinks

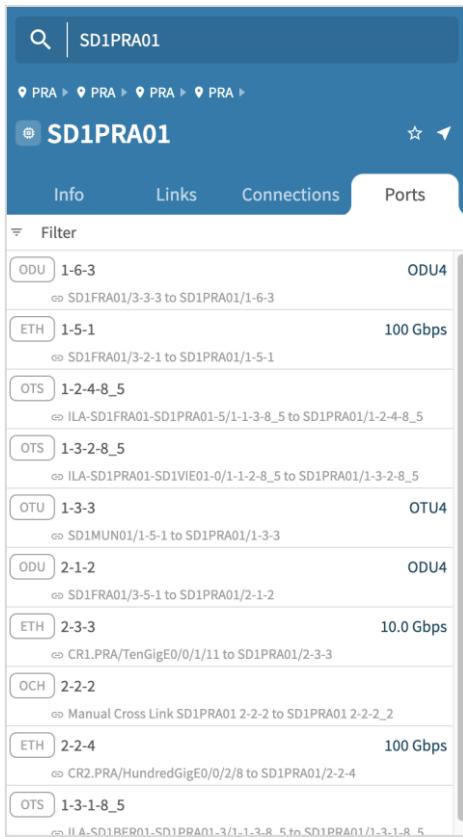


Figure 53.
Example ODU Port Types

Note: If a port is down it appears in red in the **Ports** tab.

Click a port to view its details in the **Info** tab. The port view includes the **Upper Ports** tab and **Lower Ports** tab, as well as the **History** tab.

For optical ports, a performance graph for the last 24 hours showing **TX Power** and **RX Power** for OTS, OMS, OCH, and NMC ports, as well as **Pre FEC BER**, **Post FEC BER**, **Q Factor**, and **Q Margin** for ZR Media and OTU. Hover over the performance graph to view the values in a tooltip.

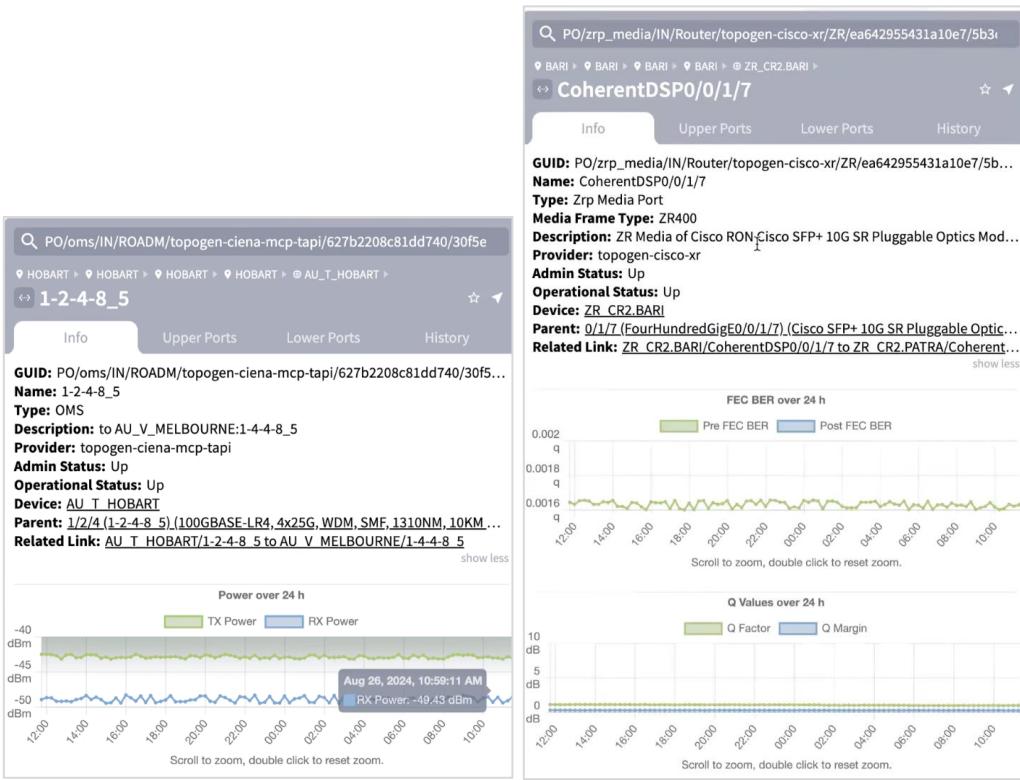


Figure 54.

Port Info Tab with Port Utilization

Exploring L0/L1 Links

The L0/L1 link name format identifies the ONE on each end of it.

<ONE_name>:<port_name> to <ONE_name>:<port_name>

Links show the ONE name, and port name. If an L0/L1 link is not available due to failures or other non-operational states, it is shown as red in the network map. L0/L1 links are marked as **DOWN** in the sidebar if the controller or management system identifies it as down.

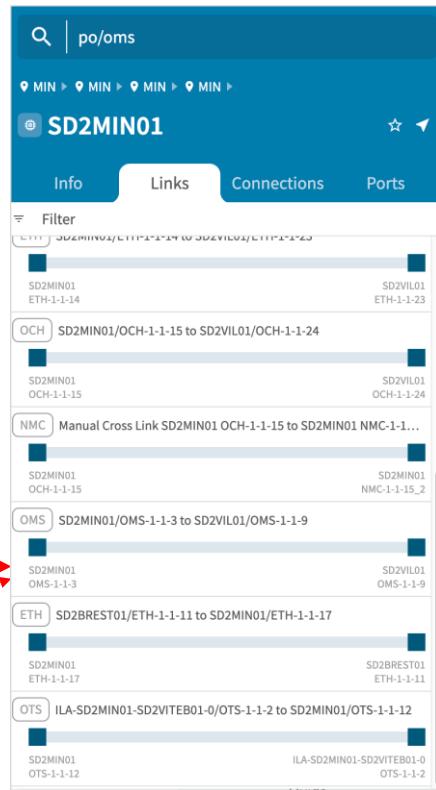


Figure 55.
Example L0/L1 Link

Exploring L3 Links that Traverse L0/L1 Links

The network map shows you a visual representation of the relationship between the Optical and IP/MPLS layers. However, the network map representation is of all links going between the two sites. The sidebar enables you to view these relationships on a per-L0/L1 link basis.

Selecting any L0/L1 link in the network map highlights the L3 links that use the L0/L1 link in green.

Example: Figure 56 shows a selected L0/L1 link between **BRAT** and **KRA** has two L3 links traversing it.

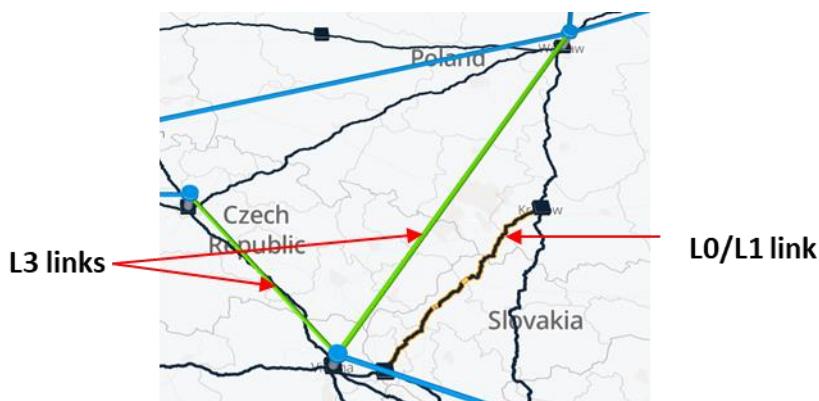


Figure 56.
Selecting an L0/L1 Link Highlights the L3 Links Traversing It

To view the elements in the layers above the selected element, select the **Used By** tab and select the required element. Click on the **Path** tab to view the path of the current element.

Repeat to step through the elements in the layers above the selected element. The map is updated as you navigate through the elements.

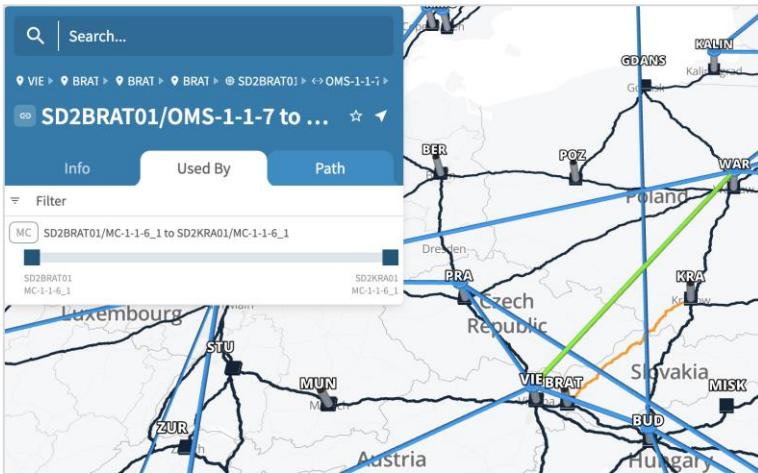


Figure 57.
Navigating Layers

You can continue viewing the elements in the layer above until there are no elements in the **Used by** tab.

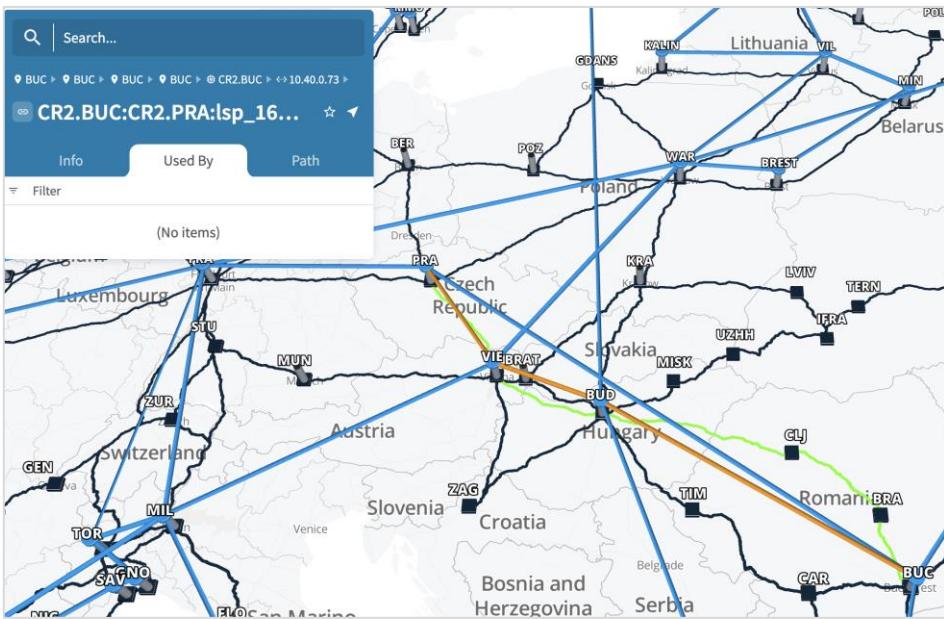


Figure 58.
LSP

Radio Devices

The 3D Explorer UI enables you to locate radio devices of type:

- Indoor_Unit (IDU)
- Outdoor_Unit (ODU)
- Radio_Antenna
- All_Outdoor_Unit (an all-in-one radio device).

When you select a radio device in 3D Explorer, the site is highlighted.

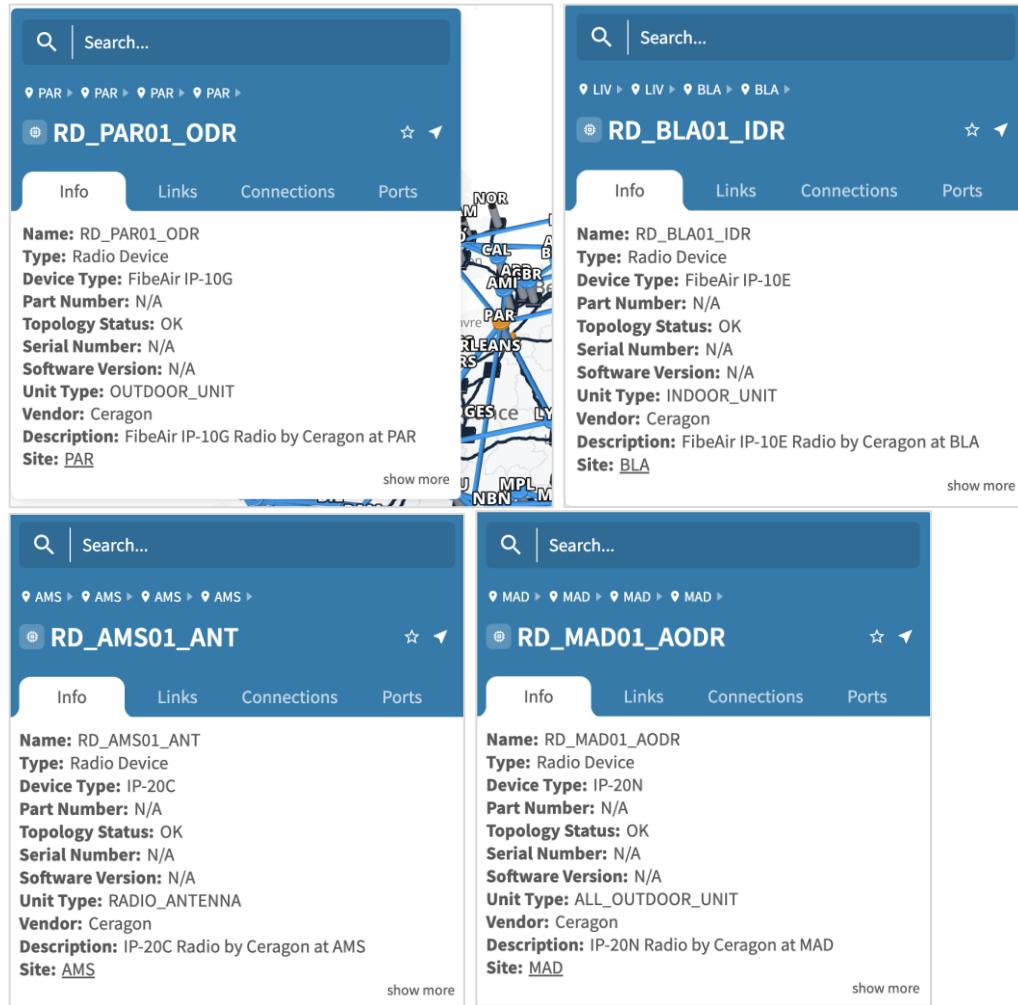


Figure 59.
Radio Device

A radio channel (Routeradio Channel) represents the physical radio layer of a microwave network. Radio-channel ports model “radio” endpoints of the radio-side network (as opposed to client-side ports that serve as end-points of client services such as Ethernet, SONET/SDH, and PDH).

Radio-channel ports are physically connected to radio outdoor units (ODUs) and from there to antennas. These ports contain rf-physical-parameters such as modulation, frequencies, bandwidth, and power, in addition to regular port fields.

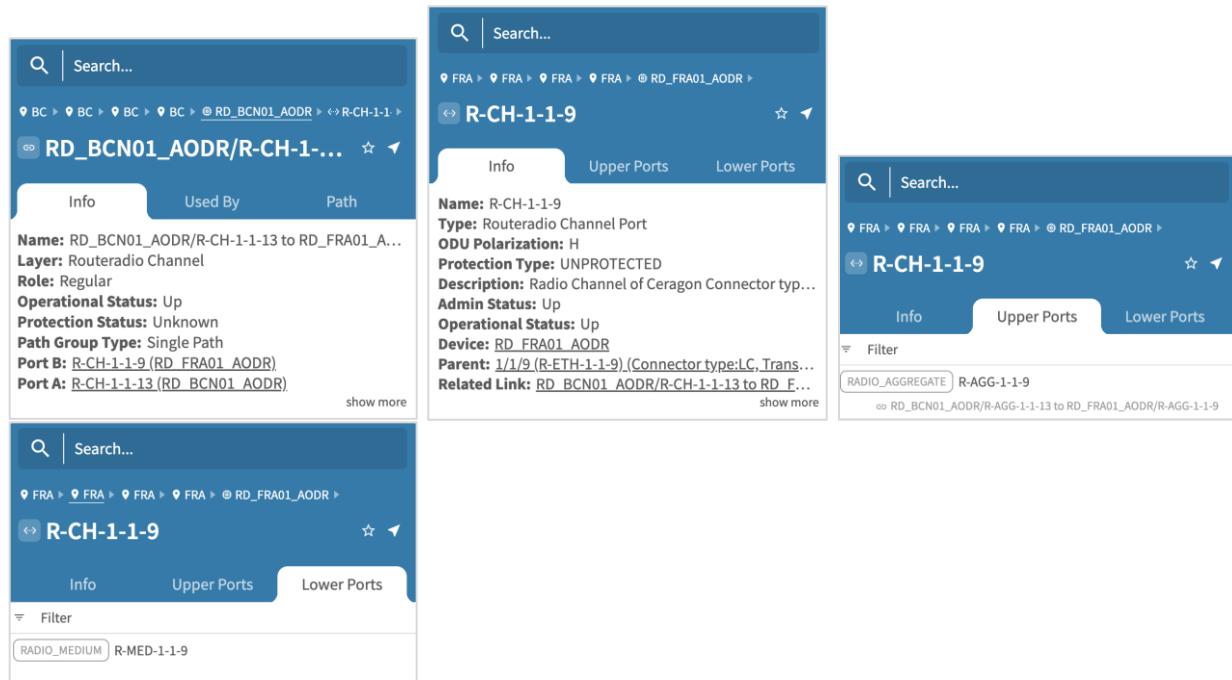


Figure 60.
Radio Channel

Between two radio-channel ports having radio-connectivity there is a radio-channel link (link with layer ‘radio-channel’).

Note: The radio-channels links are not represented on the 3D Explorer map.

Since a single radio-channel has limited capacity, many vendors have some sort of proprietary mechanism for aggregating multiple radio-channels between same sites into a single managed entity having the sum capacity of the radio links below it (different vendors have different names for this aggregation, but it is essentially very similar).

This aggregation (Routeradio Aggregate) is modelled in Crosswork Hierarchical Controller as a RadioAggregate link. By having this aggregation on the radio-side, vendors allow a more robust use of the total capacity as this capacity can be used “elastically” to transport higher capacity client services that cannot fit in a single radio-channel, or transport multiple smaller capacity services while optimally using the radio-bandwidth.

This aggregation can also be used as a form of protection when the available aggregated capacity is bigger than the needed capacity, allowing the network to pass traffic using active radio-links if some become inactive, or if the total capacity is reduced because of weather conditions.



Figure 61.
Radio Aggregate

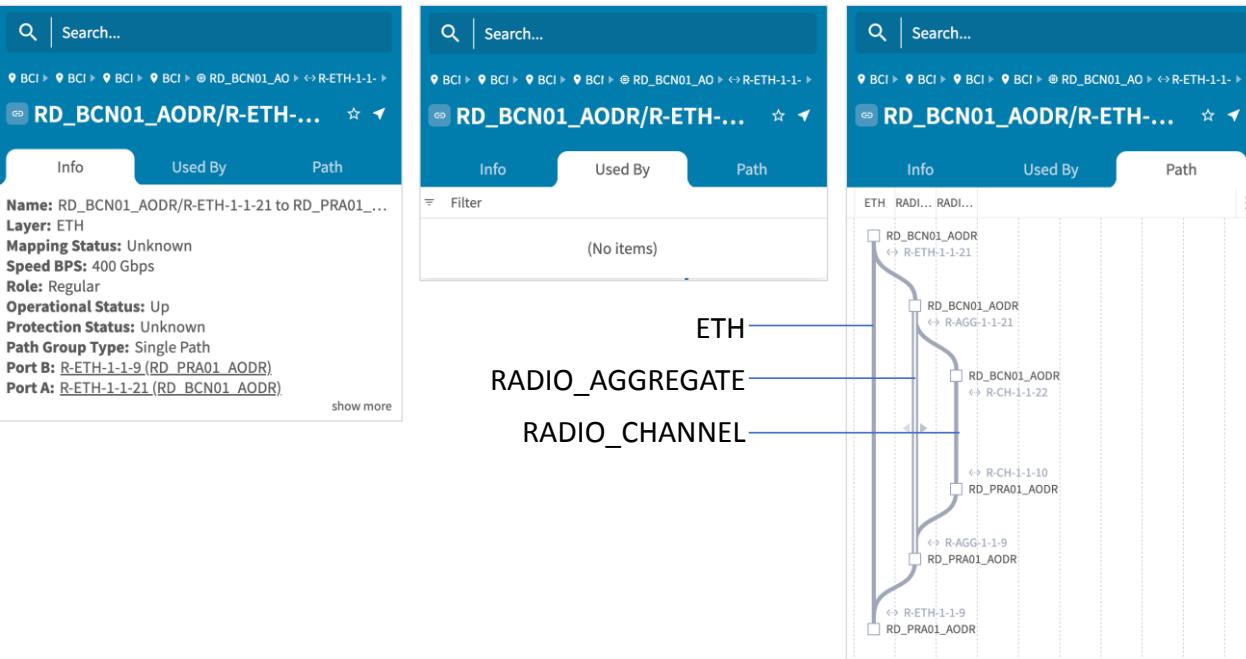


Figure 62.
ETH Layer powered by Radio

Time Machine

The time machine provides a snapshot of the state of the network as it was at a date in the past. In this mode, all applications reflect data and analysis that apply to this point in time.

Note: By default, you can go back in time 365 days.

The applications that support time machine are:

- 3D Explorer
- SHQL Dashboard
- Network Inventory
- Failure Impact
- Shared Risk Analysis
- RCA
- Services Manager (without configuring new services)

Click **Live**, select a date and click **Confirm**.

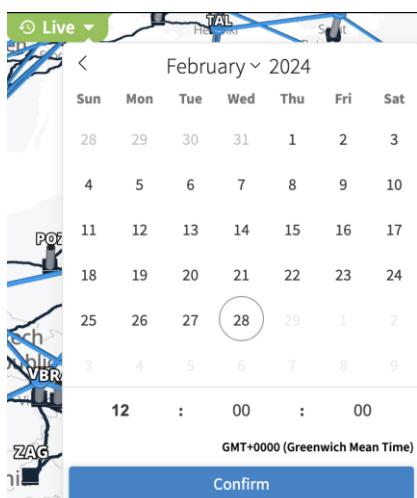


Figure 63.
Time Machine

You are now viewing the network as at the selected date. Click **Back to Live** to return to the current view of the network.

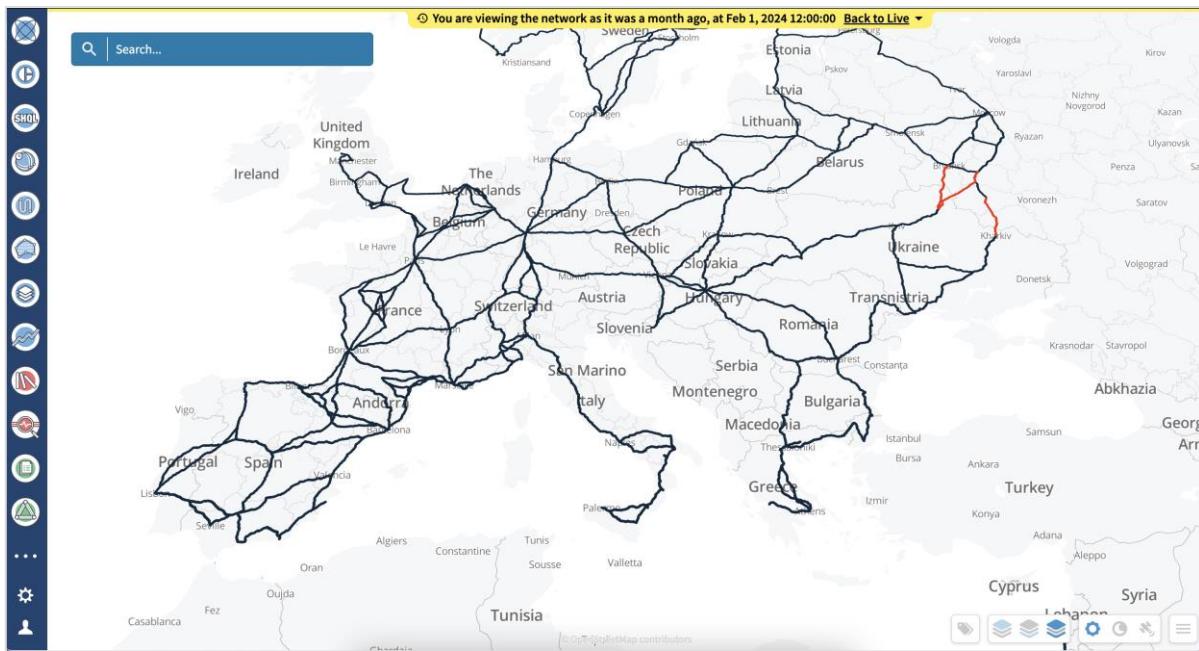


Figure 64.
3D Explorer with Time Machine Applied

Layer Relations

The Layer Relations application enables you to see the relationship between the different layers in the network. Navigation up and down the layers of the network enables you to better understand how the network is structured.

Within the application a layer can be designated as a Primary Object or a Related Object. These terms are used for comparison purposes only and should not be interpreted as meaning that a Primary Object is higher in the layer hierarchy than the Related Object, and vice versa.

The purpose of the applications is therefore to show the relationship between two selected layers. This means that you can select any layer as a Primary Object and any layer as a Related Object, no matter where they appear in the hierarchy, and you can inverse between them. For example, if you select your Primary Object as L3 Physical and the Related Object is OMS, you are shown a list of all the L3 Physical links and the OMSs they are using.

Layer Types

The Layer Relations application enables you to compare the following layer types in a network.

- Pseudo Wire
- LSP
- SR Policy
- SR Segment
- IGP
- L3 Logical
- L3 Physical
- L3 Aggregate
- Ethernet Chain
- Ethernet
- ODU
- OTU
- OCH
- NMC
- OMS
- OTS
- STS
- STS Virtual Group
- OCG
- OTN
- Fiber

- Fiber Segment
- Radion Channel
- Radio Aggregate
- Radio Medium
- ZR Channel
- ZR Media

Using the Layer Relations Application

You access the Layer Relations application by clicking the **Layer Relations** icon on the left of 3D Explorer network map.



Figure 65.
Layer Relations Application

The Layer Relations user interface opens as follows:

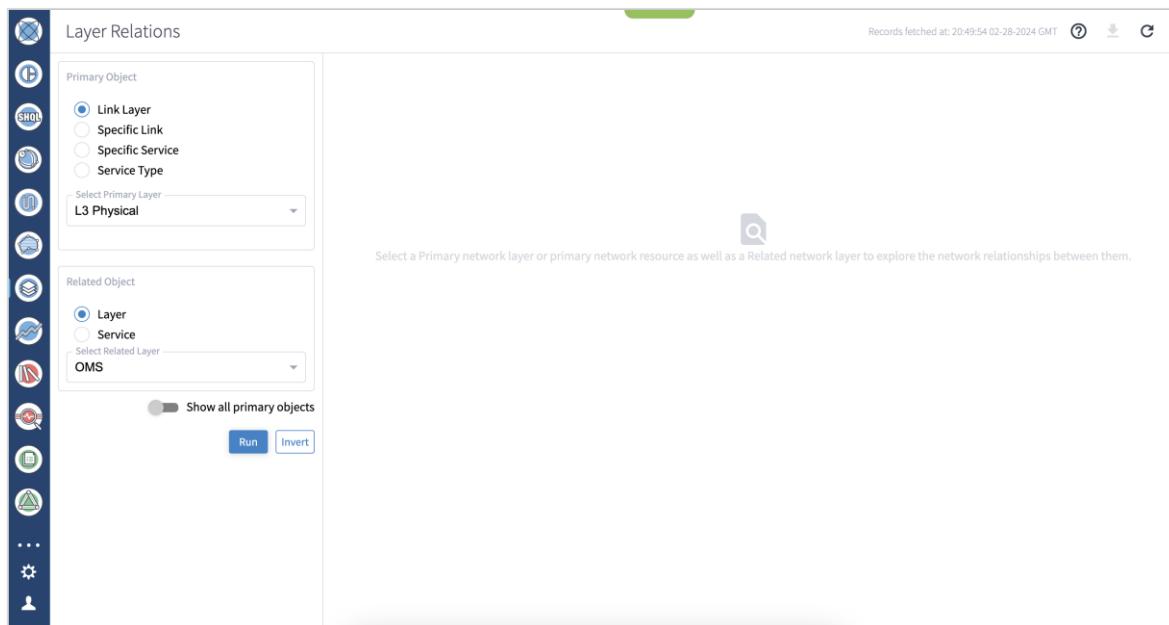


Figure 66.
Layer Relations User Interface

You can choose to view the layer relations between layers or between a specific link and layers within that link.

Note: If a Related Object does not exist for the selected Primary Object, no results are shown, even if there are other layers in the Primary Object. For example, if you select L3 Physical as your Primary Object, and want to see the related OMS links. If there are no OMS links, no results are shown even though there may be OTS links related to the Primary Object.

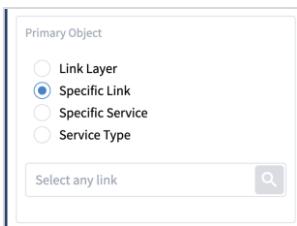
Viewing Layer Relations Between a Specific Link and a Layer

You can view relations between layers where the Primary Object is a Layer or the Primary Object is a Specific Link. This topic describes how to view layer relations where the Primary Object is a specific link. For information on how to view layer relations where the Primary Object is a layer, see [Viewing Layer Relations Between Layers](#).

This example shows the layer relations when you choose a specific link as the Primary Object and OMS as the Related Object. Bear in mind that you can choose any link as the Primary Object and any layer as the Related Object irrespective of where they are in the hierarchy.

To view layer relations between a link and a layer:

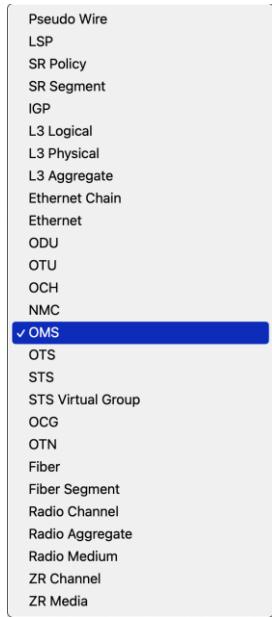
1. Select the **Specific Link** option.



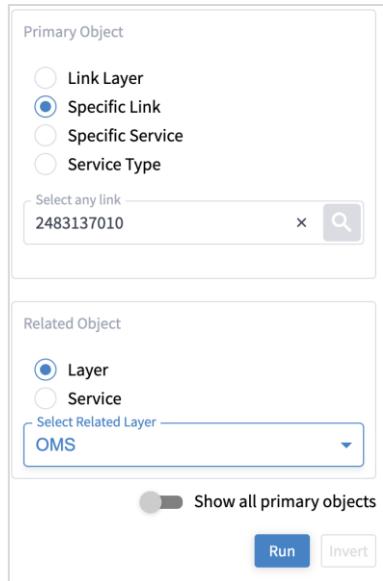
2. Click to select a link.

Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
47139 ITEMS							
1701281029	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2483137010	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
377819015	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7719514046	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4863132060	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4206530003	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7727478000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
3843519000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
9462416089	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5619162000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6767141010	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1865569028	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6407891040	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
8532305005	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR

3. Select a link in the **Advanced** tab or in the **3D Explorer** to select a specific link as your **Primary Object**.
4. In the **Related Object** area, from the **Select Related Layer Type** dropdown list, select the related layer type.



The following image shows the selected **Primary** and **Related** objects.



5. Click **Run**.

A list of **Primary Objects** that match your selection is generated and appears on the right side of the screen.

The screenshot shows the 'Layer Relations' interface. On the left, the 'Primary Object' section has 'Specific Link' selected and a 'Find' box containing '2483137010'. The 'Related Object' section has 'Layer' selected and a 'Select Related Layer' dropdown set to 'OMS'. On the right, a table titled 'Primary Object' shows one item: '2483137010' with '1' related object. The table has columns for 'Primary Object', 'Number Of Related Objects', and 'Tags'. The top right of the interface shows 'Records fetched at: 20:49:54 02-28-2024 GMT' and icons for refresh, download, and search.

View details and information about the links as described in [Viewing Layer Relations Between Layers](#).

Using the Model Selector

The Model Selector is a tool used to select objects. It lists details of the links and ports in the network and enables you to filter the list according to your requirements.

This topic describes how to use the Model Selector for selecting a specific link for which you want to find Related Objects in the network.

To select a specific link using the Model Selector:

1. In the **Primary Object** area, select the Specific Link option.

The **Find** box appears.

The screenshot shows the 'Primary Object' selection interface. It has 'Specific Link' selected and a 'Find' box containing 'Select any link'. Below the box is a magnifying glass icon.

2. Click the **Find** icon.

The Model Selector window opens.

Advanced

3D Explorer

LINKS

Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
47139 ITEMS							
1701281029	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2483137010	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
377819015	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7719514046	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4863132060	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4206530003	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7727478000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
3843519000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
9462416089	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5619162000	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6767141010	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1865569028	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
6407891040	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
8532305005	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR

Cancel OK

3. Click **3D Explorer**.

4. Find and select a link.

5. Click **OK**.

6. Click **Run**. The link with its related objects appears.

Layer Relations

Records fetched at: 17:10:20 03-07-2021 UTC

Primary Object

1 ITEM

SD1FRA01/1-20-100-2 to SD1PAR01/1-12-100-2

Number Of Related Objects

1

Primary Object

Layer

Specific Link

Select any link

SD1FRA01/1-20-100-2 to SD1...

Related Object

Select Related Layer

OMS

Run Insert

7. If there are related objects, click on the object to view a list of the related objects.

The screenshot shows the 'Layer Relations' interface. On the left, a sidebar has radio buttons for 'Link Layer', 'Specific Link', 'Specific Service', and 'Service Type', with 'Link Layer' selected. Below it is a search bar with the text 'CR1.BUC:CR2.ATH:lsp_1686153622959' and a magnifying glass icon. The main area has a table with one item: 'CR1.BUC:CR2.ATH:lsp_1686153622959' with a 'Number Of Related Objects' of 22. To the right is a list titled 'Related OTS Objects' containing 22 items, each starting with a triangle icon and a long identifier like 'SD2ATH01/OTS-1-1-8 to SD2DIL01/OTS-1-1-6'.

8. Alternatively, click the **Find** icon.

9. Click the **Advanced** tab.

The screenshot shows the 'Advanced' tab of the interface. At the top, there are tabs for 'Advanced' and '3D Explorer'. Below is a table titled 'LINKS' with columns: Name, Layer, Device A, Port A, Device B, Port B, Operational Status, and Role. The table lists numerous entries, mostly 'FIBER_SEGMENT' type links between devices like CR1.MIL, CR2.MIL, CR1.FRA, CR2.MIL, etc., with operational status 'UP' and role 'REGULAR'. Buttons 'Cancel' and 'OK' are at the bottom right of the table area.

10. Click a column heading to sort the column in ascending or descending order.
11. To filter a column, click the **Filter** icon to the right of the column heading and enter the filter criteria in the **Filter** box.
12. Click a link to select it or click and select a starred item.

The screenshot shows the Cisco Crosswork Hierarchical Controller interface. At the top, there is a search bar with a location icon and the text 'FRA'. Below it is another search bar with a location icon and the text 'PAR'. The main area is a table titled 'LINKS' with the following columns: Name, + Layer, Device A, Port A, Device B, Port B, Operational Status, and Role. The table contains 23104 items, all of which are 'FIBER_SEGMENT'. The 'Operational Status' column shows 'UP' for all entries, and the 'Role' column shows 'REGULAR' for all entries. The 'Operational Status' column is currently sorted in ascending order. The 'OK' button is visible in the bottom right corner of the table area.

Name	+ Layer	Device A	Port A	Device B	Port B	Operational Status	Role
2611222037						UP	REGULAR
7891902051						UP	REGULAR
229767015						UP	REGULAR
7891902061						UP	REGULAR
7891902127						UP	REGULAR
7891902089						UP	REGULAR
1504564013						UP	REGULAR
2918594019						UP	REGULAR
7891902115						UP	REGULAR
7891902084						UP	REGULAR
7891902048						UP	REGULAR
229767009						UP	REGULAR
7767796003						UP	REGULAR
7891902135						UP	REGULAR
6423467002						UP	REGULAR
8546849012						UP	REGULAR
7891902076						UP	REGULAR
6423467016						UP	REGULAR
2918594005						UP	REGULAR
2094104002						UP	REGULAR
6864901008						UP	REGULAR
1504564008						UP	REGULAR
6957979026						UP	REGULAR

13. Click **OK** to accept your selection and return to the **Layer Relations** page.

Viewing Layer Relations Between Layers

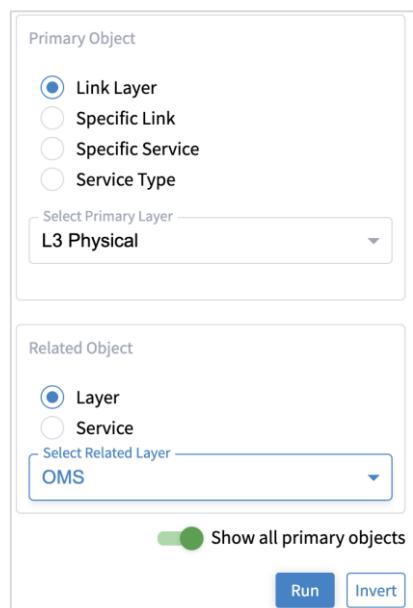
You can view relations between layers where the Primary Object is a Layer or the Primary Object is a Specific Link. This section describes how to view layer relations where the Primary Object is a layer. For information on how to view layer relations where the Primary Object is a specific link, see [Viewing Layer Relations Between a Specific Link and a Layer](#).

This example shows the layer relations when you choose **L3 Physical** as the Primary Object and **OMS** as the Related Object. Bear in mind that you can choose any layer as the Primary Object and any layer as the Related Object irrespective of where they are in the hierarchy.

To view layer relations between layers:

1. Select **Layer**.
2. In the **Primary Object** area, from the **Specific Layer** dropdown list, select the primary layer type.
3. In the **Related Object** area, from the **Layer** dropdown list, select the related layer type.

The following image shows the selected **Primary** and **Related** objects.



4. Click **Run**.

A list of **Primary Objects** that match your selection is generated and appears on the right side of the screen.

Layer Relations

Records fetched at: 11:55:02 03-02-2024 GMT [?](#) [Download](#) [Copy](#)

Primary Object	Number Of Related Objects	Tags
414 ITEMS		
LI/R_PHY/PO/r_physical/IN/Router/topogen-cisco-xr/ZR/2f45051eb5e8cae9/9a3d1c669e6fa6b1/PO/r_physical/...	0	
CR1.BOR/HundredGigE0/0/2/11 to CR2.BOR/HundredGigE0/0/2/7	0	
CR1.TRKU/HundredGigE0/0/2/6 to CR2.TRKU/HundredGigE0/0/2/6	0	
LI/R_PHY/PO/r_physical/IN/Router/topogen-cisco-ios/640eb904b3651f8e/4ccc322e9c50b6c0/PO/r_physical/IN...	0	
CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/TenGigE0/0/1/11	3	
CR1.LYO/HundredGigE0/0/2/10 to ER1.LYO/HundredGigE0/0/2/6	0	
CR2.HEI/HundredGigE0/0/2/10 to CR2.OULU/HundredGigE0/0/2/6	1	
CR1.DUB/HundredGigE0/0/2/6 to CR2.DUB/HundredGigE0/0/2/6	0	
LI/R_PHY/PO/r_physical/IN/Router/topogen-cisco-ios/6a7fb4a89d7358e7/511758061926c46d/PO/r_physical/IN...	0	
ZR_CR2.HERKL/TenGigE0/0/2/7 to ZR_CR2.TLV/TenGigE0/0/3/6	1	
ZR_CR2.NAH/FourHundredGigE0/0/1/8 to ZR_CR2.HFA/FourHundredGigE0/0/1/6	1	
CR1.DUB/TenGigE0/0/1/12 to CR2.LIV/TenGigE0/0/1/11	2	
CR1.ATH/HundredGigE0/0/2/6 to CR2.ATH/HundredGigE0/0/2/6	0	
CR1.MAD/HundredGigE0/0/2/7 to ER1.MAD/HundredGigE0/0/2/7	0	
CR1.MMO/HundredGigE0/0/3/7 to CR2.MMO/HundredGigE0/0/2/11	0	
ZR_CR2.LMS/FourHundredGigE0/0/1/7 to ZR_ER2.LMS/FourHundredGigE0/0/1/6	0	
CR1.BOR/FortyGigE0/0/3/6 to CR1.LYO/FortyGigE0/0/3/6	5	
CR2.LIS/TenGigE0/0/1/11 to ER1.LIS/GigabitEthernet1/2/1	0	
CR1.MMO/TwoHundredGigE0/0/2/8 to CR1.UPP/TwoHundredGigE0/0/2/8	1	
ZR_CR2.FRA/FourHundredGigE0/0/1/7 to ZR_CR2.MIL/FourHundredGigE0/0/1/6	1	
11/D_H4V/PO/r_nhysical/IN/Router/TwoHundredGigE0/0/2/7 to ZR_CR2.MIL/FourHundredGigE0/0/1/6	0	

Primary Object Link Layer Specific Link Specific Service Service Type

Select Primary Layer **L3 Physical**

Related Object Layer Service

Select Related Layer **OMS**

Show all primary objects

Run **Invert**

The **Primary Objects** area lists links to all the primary objects that meet your selection (in this case **L3 Physical** links) and indicates the **Number of Related Objects** in a column on the right of the screen.

The link L3 link name format identifies the ONE on each end of it, in the format:

<ONE_name>:<port_name> - <ONE_name>:<port_name>

Note: The Invert button is activated at this time. This enables you to show the inverse relations between the selected layers. In this example if you click **Invert**, OMS becomes the Primart Layer Type and L3 Physical becomes the Related Layer Type. Click **Invert** again to go back to your initial selection.

If the **Primary Object** is lower in the hierarchy than the **Related Object**, an additional column on the right shows the **Total Capacity Occupied by the Related Objects**, as shown in the following example.

Layer Relations

Records fetched at: 15:00:04 03-02-2024 GMT [?](#) [Download](#) [Copy](#)

Primary Object	Primary Object	Number Of Related Objects	Tags	Total Capacity Occupied By Related Object (Gb)
208 ITEMS				
<input checked="" type="radio"/> Link Layer	SD1GAN01/OMS-1-1-3 to SD2TLV01/OMS-1-1-3	1		10.0
<input type="radio"/> Specific Link	SD1BCN01/1-2-1-8_5 to SD1ZAR01/1-2-1-8_5	1		10.0
<input type="radio"/> Specific Service	SD1BOR01/1-1-3-8_5 to SD1PAR01/1-2-3-8_5	15		810.0
<input type="radio"/> Service Type	SD2NVGRD01/OMS-1-1-5 to SD2TVER01/OMS-1-1-3	4		310.0
Select Primary Layer OMS	SD2GTBRI/OMS-1-1-9 to SD20SL001/OMS-1-3	4		400.0
	CI_ONC_SD1DUS01/1-1-1/CHAN 2 (195.95) to CI_ONC_SD1FRA01/1-1-3/CHAN 2 (195.95)	1		400.0
<input checked="" type="radio"/> Layer	SD2SMOL01/OMS-1-1-3 to SD2VITEB01/OMS-1-1-7	1		10.0
<input type="radio"/> Service	SD2MOS01/OMS-1-1-9 to SD2MOZH01/OMS-1-1-3	1		10.0
Select Related Layer L3 Physical	SD2DAUG01/OMS-1-1-3 to SD2RIG01/OMS-1-1-5	1		100.0
<input type="radio"/> Show all primary objects	SD1HFA01/1-1-3-8_5 to SD1NAH02/1-1-3-8_5	1		400.0
	SD1HFA01/1-2-1-8_5 to SD1TLV01/1-1-3-8_5	1		400.0
	SD1BLA02/1-2-1-8_5 to SD1MAN01/1-2-1-8_5	2		20.0
	SD1LMS02/1-2-1-8_5 to SD1NAH01/1-1-3-8_5	1		400.0
	SD1BCN01/1-2-3-8_5 to SD1VAL01/1-1-3-8_5	2		20.0
	SD2KHAR01/OMS-1-1-5 to SD2KURSK01/OMS-1-1-3	1		10.0
	CI_ONC_SD1ANT01/1-1-1/CHAN 2 (195.95) to CI_ONC_SD1BRU01/1-1-2/CHAN 1 (196.03)	1		400.0
	CI_ONC_SD1ARR01/1-1-2/CHAN 1 (196.03) to CI_ONC_SD1CAL01/1-1-1/CHAN 2 (195.95)	1		400.0
	SD1STR01/1-1-3-8_5 to SD1WE501/1-2-1-8_5	5		440.0
	SD2TRKU02/OMS-1-1-7 to SD2UPP01/OMS-1-1-9	4		400.0
	CI_ONC_SD1MIL01/1-1-1/CHAN 2 (195.95) to CI_ONC_SD1TOR01/1-1-2/CHAN 3 (195.88)	1		400.0

- Click on a **Primary Object** to display the related objects (in this example, the related OMS links) and then hover over a link in the **Related OMS Objects** pane. Click on the arrow adjacent to a link and the network map appears with the link in orange.

Layer Relations

Primary Object

- Link Layer
- Specific Link
- Specific Service
- Service Type

Select Primary Layer: L3 Physical

Related Object

- Layer
- Service

Select Related Layer: OMS

Show all primary objects

Run Invert

Primary Object

217 ITEMS

CR1.BUD/TenGigE0/0/1/13	1
CR2.HEL/HundredGigE0/0/2/10 to CR2.ULU/HundredGigE0/0/2/6	1
ZR_CR2.HERKL/TenGigE0/0/2/7 to ZR_CR2.TLV/TenGigE0/0/3/6	1
ZR_CR2.NAH/FourHundredGigE0/0/1/8 to ZR_CR2.HFA/FourHundred...	1
CR1.DUB/TenGigE0/0/1/12 to CR2.LIV/TenGigE0/0/1/1	2
CR1.BOR/FortyGigE0/0/3/6	5
CR1.MMO/TwoHundredGigE0/0/2/8 to CR1.UPP/TwoHundredGigE0/0/...	1
ZR_CR2.FRA/FourHundredGigE0/0/1/7 to ZR_CR2.MIL/FourHundred...	1
CR2.ULU/HundredGigE0/0/2/11 to CR2.TRKU/HundredGigE0/0/2/12	1
CR1.COR/TenGigE0/0/1/12 to CR1.MAD/TenGigE0/0/1/14	1
CR2.BREST/100ge-0/3/1 to CR2.MIN/100ge-0/3/1	1
ZR_CR2.BIL/FourHundredGigE0/0/1/7 to ZR_CR2.OVE/FourHundred...	1
CR1.OSLO/HundredGigE0/0/2/8 to CR1.STO/HundredGigE0/0/2/14	2
ZR_CR2.BCN/FourHundredGigE0/0/1/8 to ZR_CR2.BIL/FourHundred...	1
CR2.COP/HundredGigE0/0/2/9 to CR2.MMO/HundredGigE0/0/2/7	1
ZR_CR2.NBN/FourHundredGigE0/0/1/6 to ZR_CR2.PPN/FourHundre...	1
CR2.COP/HundredGigE0/0/2/11 to CR2.MMO/HundredGigE0/0/2/9	1
ZR_CR2.ARN/FourHundredGigE0/0/1/6 to ZR_CR2.ROT/FourHundre...	2
ZR_CR2.DUS/FourHundredGigE0/0/1/9 to ZR_CR2.FRA/FourHundre...	1
CR1.BUC/TenGigE0/0/1/12 to CR2.ATH/TenGigE0/0/1/11	7

Related OMS Objects

CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/TenGigE0/0/1/11

- SD2BRA01/OMS-1-1-5 to SD2CLJ01/OMS-1-1-7
- SD2BUD01/OMS-1-1-11 to SD2CLJ01/OMS-1-1-3

6. The related link name format identifies the ONE on each end of it, and the ports to which they are connected in the format:

<ONE_name>:<port_name> to <ONE_name>:<port_name>

7. Click on the down arrow of a **Related Object** link to view the path of the **Primary Object** link and the paths of all the layers that are related to the **Primary Object** link, including the selected **Related Layer** (in this case the **OMS** layer).

Layer Relations

Primary Object

- Link Layer
- Specific Link
- Specific Service
- Service Type

Select Primary Layer: L3 Physical

Related Object

- Layer
- Service

Select Related Layer: OMS

Show all primary objects

Run Invert

Primary Object

217 ITEMS

CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/TenGigE0/0/1/11	3
CR2.HEL/HundredGigE0/0/2/10 to CR2.ULU/HundredGigE0/0/2/6	1
ZR_CR2.HERKL/TenGigE0/0/2/7 to ZR_CR2.TLV/TenGigE0/0/3/6	1
ZR_CR2.NAH/FourHundredGigE0/0/1/8 to ZR_CR2.HFA/FourHundred...	1
CR1.DUB/TenGigE0/0/1/12 to CR2.LIV/TenGigE0/0/1/1	2
CR1.BOR/FortyGigE0/0/3/6	5
CR1.MMO/TwoHundredGigE0/0/2/8 to CR1.UPP/TwoHundredGigE0/0/...	1
ZR_CR2.FRA/FourHundredGigE0/0/1/7 to ZR_CR2.MIL/FourHundred...	1
CR2.ULU/HundredGigE0/0/2/11 to CR2.TRKU/HundredGigE0/0/2/12	1
CR1.COR/TenGigE0/0/1/12 to CR1.MAD/TenGigE0/0/1/14	1
CR2.BREST/100ge-0/3/1 to CR2.MIN/100ge-0/3/1	1
ZR_CR2.BIL/FourHundredGigE0/0/1/7 to ZR_CR2.OVE/FourHundred...	1
CR1.OSLO/HundredGigE0/0/2/8 to CR1.STO/HundredGigE0/0/2/14	2
ZR_CR2.BCN/FourHundredGigE0/0/1/8 to ZR_CR2.BIL/FourHundred...	1
CR2.COP/HundredGigE0/0/2/9 to CR2.MMO/HundredGigE0/0/2/7	1
ZR_CR2.NBN/FourHundredGigE0/0/1/6 to ZR_CR2.PPN/FourHundre...	1
CR2.COP/HundredGigE0/0/2/11 to CR2.MMO/HundredGigE0/0/2/9	1
ZR_CR2.ARN/FourHundredGigE0/0/1/6 to ZR_CR2.ROT/FourHundre...	2
ZR_CR2.DUS/FourHundredGigE0/0/1/9 to ZR_CR2.FRA/FourHundre...	1
CR1.BUC/TenGigE0/0/1/12 to CR2.ATH/TenGigE0/0/1/11	7

Related OMS Objects

CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/TenGigE0/0/1/11

- SD2BRA01/OMS-1-1-3 to SD2BUC01/OMS-1-1-7
- [L3 Physical] CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/T...
- [Ethernet] SD2BUC01/ETH-1-1-23 to SD2BUD01/ETH-...
- [ODU] SD2BUC01/ODU-1-1-23 to SD2BUD01/ODU-1-1-29
- [ODU] SD2BUC01/ODU-1-1-24 to SD2BUD01/ODU-1-1-30
- [OTU] SD2BUC01/OTU-1-1-24 to SD2BUD01/OTU-1-1-30
- [OCH] SD2BUC01/OCH-1-1-24 to SD2BUD01/OCH-1-1-30
- [NMC] SD2BUC01/NMC-1-1-24_2 to SD2BUD01/NMC-1...
- [MC] SD2BUC01/MC-1-1-25_1 to SD2BUD01/MC-1-1-3...
- [MC] SD2BRA01/MC-1-1-2_1 to SD2BUC01/MC-1-1-6_1
- [OMS] SD2BRA01/OMS-1-1-3 to SD2BUC01/OMS-1-1-7
- SD2BRA01/OMS-1-1-5 to SD2CLJ01/OMS-1-1-5
- SD2BUD01/OMS-1-1-11 to SD2CLJ01/OMS-1-1-3

8. Hover your cursor over a layer in the path. Click on the arrow adjacent to a layer in the path and the network map appears with the path in green on the network map.

Layer Relations

Records fetched at: 15:00:04 03-02-2024 GMT

Primary Object

- Link Layer
- Specific Link
- Specific Service
- Service Type

Select Primary Layer: L3 Physical

Related Object

- Layer
- Service

Select Related Layer: OMS

Show all primary objects

Run Invert

Primary Object

Number Of Related Objects Tags

Related OMS Objects

CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/TenGigE0/0/1/11

SD2BRA01/OMS-1-1-3 to SD2BUC01/OMS-1-1-7

[L3 Physical] CR1.BUD/TenGigE0/0/1/13 to CR2.BUC/T...

[Ethernet] SD2BUC01/ETH-1-1-23 to SD2BUD01/ETH-...

[ODU] SD2BUC01/ODU-1-1-23 to SD2BUD01/ODU-1-1-29

[ODU] SD2BUC01/ODU-1-1-24 to SD2BUD01/ODU-1-1-30

[OTU] SD2BUC01/OTU-1-1-24 to SD2BUD01/OTU-1-1-30

[OCH] SD2BUC01/OCH-1-1-24 to SD2BUD01/OCH-1-1-30

[NMC] SD2BUC01/NMC-1-1-24_2 to SD2BUD01/NMC-1...

[MC] SD2BUC01/MC-1-1-25_1 to SD2BUD01/MC-1-1-3...

[MC] SD2BRA01/MC-1-1-2_1 to SD2BUC01/MC-1-1-6_1

[OMS] SD2BRA01/OMS-1-1-3 to SD2BUC01/OMS-1-1-7

SD2BRA01/OMS-1-1-5 to SD2CLJ01/OMS-1-1-5

SD2BUD01/OMS-1-1-11 to SD2CLJ01/OMS-1-1-3

9. Click to view the object in 3D Explorer.

Search...

SD2COP01/OMS-1-1-3 to SD2MMO01/OMS-1-1-9

Info Used By Path

Name: SD2COP01/OMS-1-1-3 to SD2MMO01/OMS-1-1-9

Layer: OMS

Role: Regular

Operational Status: Up

Protection Status: Unknown

Path Group Type: Single Path

Port B: OMS-1-1-9 (SD2MMO01)

Port A: OMS-1-1-3 (SD2COP01)

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Network Inventory

The Network Inventory app shows a full tabular view of devices, sites, links, connections, services, cards, ports, transceivers, power supplies, fans, and shelves.

The purpose of this application is to allow users to explore, in a filterable and sortable table format, the various resources that Crosswork Hierarchical Controller maintains and which constitute their network.

The data is broadly categorized as follows:

- Devices (Routers, Optical Network Elements, Radio Devices)
- Sites
- Links (Fiber, Radio Channel, Radio Aggregate, OTS, OMS, ZR Media, ZR Channel, E Line, E Line Chain, L3 Physical, L3 Aggregate, L3 Logical, IGP, SR Segment, MC)
- Connections (NMC, OCH, OTU, ODU, Ethernet, MPLS TP, Pseudo Wire, SR Policy, LSP, MC)
- Services (L3-VPN, L2-VPN, E-Line, OTN Line, RSVP Tunnel)
- Cards (pluggable cards of optical devices and routers)
- Ports (Radio Medium, OTS, OTU, ZR Media, ZR Channel, Ethernet, L3 Physical (on routers), MC, STM)
- Transceivers
- Power Supplies
- Fans
- Shelves

Resources in each category are organized in tables, are sortable and filterable. Several data analysis tasks are simplified. For example, finding IP links whose metrics are above some specified threshold can easily be accomplished by navigating to the **Links** tab, choosing **IGP** links, and applying a greater than (>) filter to the **Metric** column.

The output will show a list of all links that match the criteria, along with the key attributes of those links (IGP interface, Metric, Router, etc.).

Hovering over cells that correspond to a network entity allows the user to quickly visualize that entity in the context of the network. Clicking on an entity takes the user to the 3D Explorer-based view of that entity.

The tabular data can be exported into a CSV file for offline analysis.

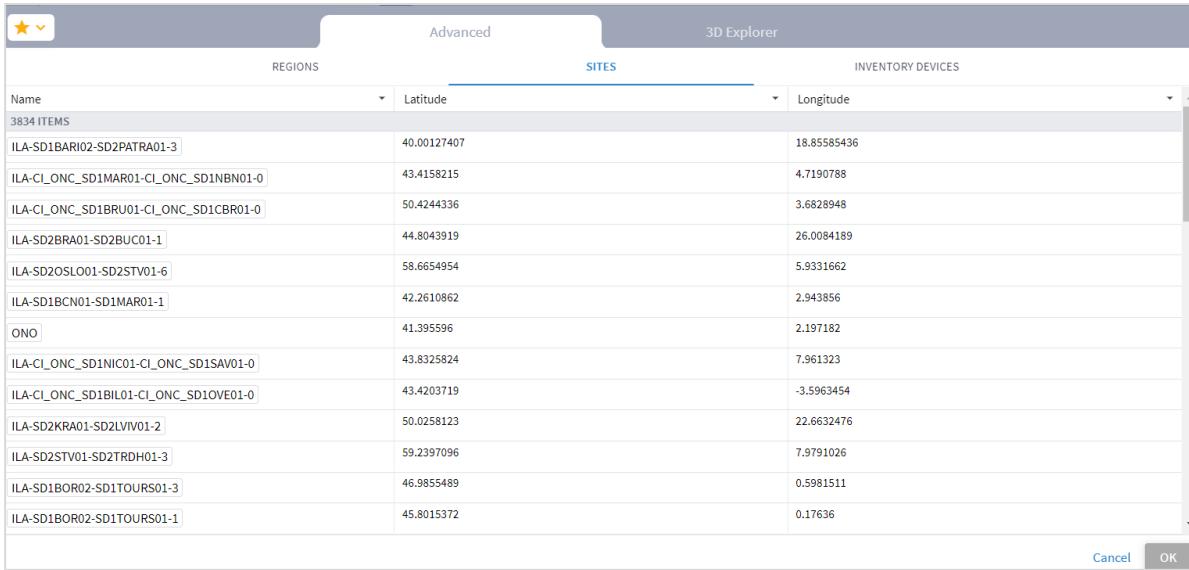
Filtering Inventory

To filter inventory:

1. Click .

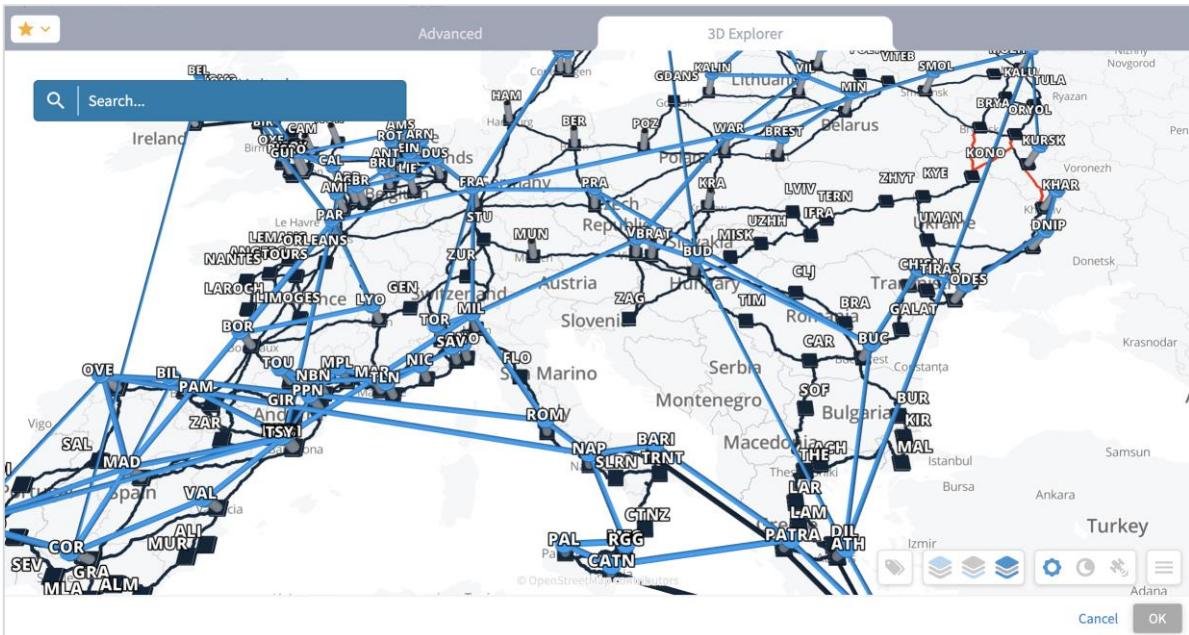
Filter inventory by: 

2. In the **Advanced** tab, select **REGIONS**, **SITES** or **INVENTORY DEVICES**, and select the required item.

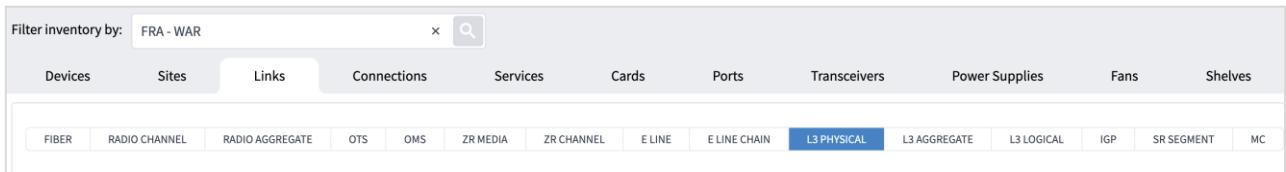


REGIONS		SITES		INVENTORY DEVICES	
Name	Latitude	Latitude	Longitude	Longitude	
3834 ITEMS					
ILA-SD1BARI02-SD2PATRA01-3	40.00127407		18.85585436		
ILA-CI_ONC_SD1MAR01-CI_ONC_SD1NBN01-0	43.4158215		4.7190788		
ILA-CI_ONC_SD1BRU01-CI_ONC_SD1CBR01-0	50.4244336		3.6828948		
ILA-SD2BRA01-SD2BU01-1	44.8043919		26.0084189		
ILA-SD2OSL001-SD2STV01-6	58.6654954		5.9331662		
ILA-SD1BCN01-SD1MAR01-1	42.2610862		2.943856		
ONO	41.395596		2.197182		
ILA-CI_ONC_SD1NIC01-CI_ONC_SD1SAV01-0	43.8325824		7.961323		
ILA-CI_ONC_SD1BIL01-CI_ONC_SD1OVE01-0	43.4203719		-3.5963454		
ILA-SD2KRA01-SD2LVV01-2	50.0258123		22.6632476		
ILA-SD2STV01-SD2TRD01-3	59.2397096		7.9791026		
ILA-SD1BOR02-SD1TOURS01-3	46.9855489		0.5981511		
ILA-SD1BOR02-SD1TOURS01-1	45.8015372		0.17636		

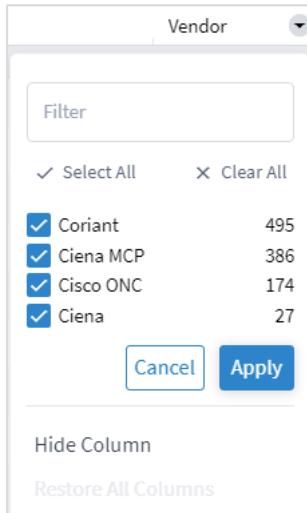
Or select the **3D Explorer** tab and select the required item.



3. Click **OK**.
 4. Use the **Apply Inventory Filter on Devices** toggle to view the table with or without the filter applied.
- Apply Inventory Filter On Devices**
5. Select the required types, for example, in the **Links** tab, for example select **L3 PHYSICAL**.



6. To further filter any of the result tables, filter using the columns.



Exporting Inventory

To export inventory:

1. Select the required tab and filter the table.
2. Click **Export Table**. The data is exported to a csv file.

Viewing Transceivers

Crosswork Hierarchical Controller models pluggable transceivers as inventory ports with transceiver details as attributes. For cases with multiple ports on the same transceiver, the transceiver details are mapped to the parent inventory port and the sub ports are defined as 'not pluggable'. The Network Inventory app shows the router physical ports (built on top of the sub ports, which are also inventory ports) as mapped to the transceiver in the **Transceivers** tab. Click to expand the ports.

Network Inventory										
Filter inventory by: Regions/Sites/Devices <input type="text"/> <input type="button" value="Search"/>										
Devices	Sites	Links	Connections	Services	Cards	Ports	Transceivers	Power Supplies	Fans	Shelves
TRANSCEIVERS										
Name	Lower Ports	Device	State	Vendor	Model Number	Part Number	Serial Number			
497 ITEMS										
1/1/2 (1-1-2-8_5) (Power Card 60... ▶ 1 Port	ILA-SD1MOU02-SD1TOW02-6	INSTALLED	Ciena MCP	N/A	NTK505DA	N/A				
1/1/2 (1-1-2-8_5) (OC-3 0-34dB C... ▶ 1 Port	ILA-SD1BRO02-SD1POR02-0	INSTALLED	Ciena MCP	N/A	NTK592NG	N/A				
1/1/2 (1-1-2-8_5) (Power Card 60... ▶ 1 Port	ILA-SD1ADE02-SD1MEL02-4	INSTALLED	Ciena MCP	N/A	NTK505DA	N/A				
1/1/3 (1-1-3-8_5) (10G-3 12-42d... ▶ 1 Port	ILA-SD1BRO02-SD1WAG02-6	INSTALLED	Ciena MCP	N/A	NTK592NV	N/A				
1/1/3 (1-1-3-8_5) (100GBASE-LR... ▶ 1 Port	ILA-SD1BRI02-SD1TOW02-4	INSTALLED	Ciena MCP	N/A	160-9401-900	FNSRMY0123456789				
1/1/2 (1-1-2-8_5) (10G-3 12-42d... ▶ 1 Port	ILA-SD1SYD02-SD1WAG02-4	INSTALLED	Ciena MCP	N/A	NTK592NV	N/A				
0/1/8 (FourHundredGigE0/0/1/8... ▶ 5 Ports	CR1.SYD	INSTALLED	Cisco RON	QSFP-100G-AOC3M	N/A		DTS24279794-B			
	Optics0/0/1/8									
	CoherentDSP0/0/1/8									
	CoherentDSP0/0/1/8									
	FourHundredGigE0/0/1/8									
	FourHundredGigE0/0/1/8									
0/2/7 (HundredGigE0/0/2/7) (40... ▶ 1 Port	CR2.SYD	INSTALLED	Cisco RON	QDD-400G-ZRP-S	N/A		ACA25033485			
1/1/3 (1-1-3-8_5) (OC-3 0-34dB C... ▶ 1 Port	SD1CAI02	INSTALLED	Ciena MCP	N/A	NTK592NG	N/A				
1/1/3 (1-1-3-8_5) (100GBASE-SR... ▶ 1 Port	ILA-SD1MOU02-SD1TOW02-1	INSTALLED	Ciena MCP	N/A	160-9400-900	N/A				

Viewing a Hyper Linker Link

The Hyper Linker enables you to make vendor/controller-specific systems accessible directly from the object in the Crosswork Hierarchical Controller applications such as the Network Inventory application. The user selects the objects in the Crosswork Hierarchical Controller UI (Device, Link, SR Policy) and opens a menu with direct links to view the object in the underlay controller.

You can click to drill-down to the associated link in the Crosswork Hierarchical Controller applications such as the Network Inventory application.

For more details, see the *Cisco Crosswork Hierarchical Controller Admin Guide*.

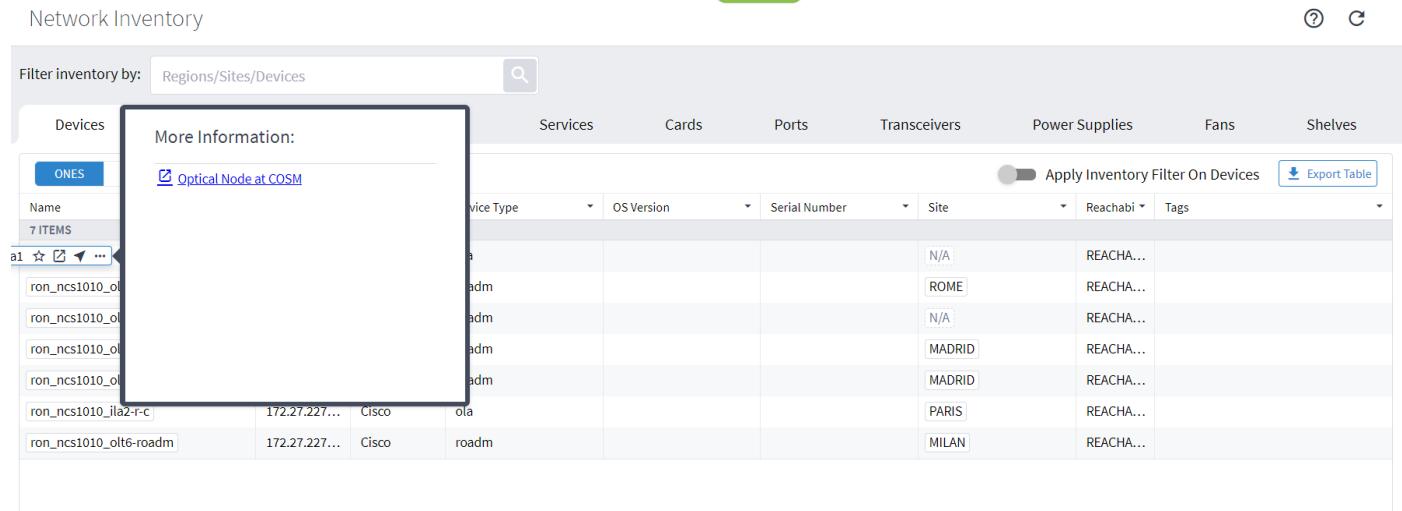
For example, you can drill-down through a Cisco optical node, to the Cisco Optical Site Manager.

Network Inventory									
Filter inventory by: Regions/Sites/Devices <input type="text"/> <input type="button" value="Search"/>									
Devices	Sites	Services	Cards	Ports	Transceivers	Power Supplies	Fans	Shelves	
ONOS									
7 ITEMS									
a1	star	checkbox	...		More Information: Optical Node at COSM	Apply Inventory Filter On Devices			
ron_ncs1010_ol...	adm								
ron_ncs1010_ol...	adm								
ron_ncs1010_ol...	adm								
ron_ncs1010_ol...	adm								
ron_ncs1010_ll...	172.27.227...	Cisco	ola						
ron_ncs1010_olt6...	172.27.227...	Cisco	roadm						

To view the link:

1. In the applications bar in Crosswork Hierarchical Controller, select **Network Inventory**.

2. Select the required tab.
3. Click ... next to the required object.



The screenshot shows the Network Inventory interface. On the left, a sidebar lists 'Devices' with a 'ONES' tab selected, showing 7 items. One item, 'a1', is highlighted with a red box. A modal window titled 'More Information:' is open over the table, containing the link 'Optical Node at COSM'. The main table has columns for 'Device Type', 'OS Version', 'Serial Number', 'Site', 'Reachability', and 'Tags'. The table data includes several entries for 'ron_ncs1010_ol' and one for 'ron_ncs1010_il2-r-c'.

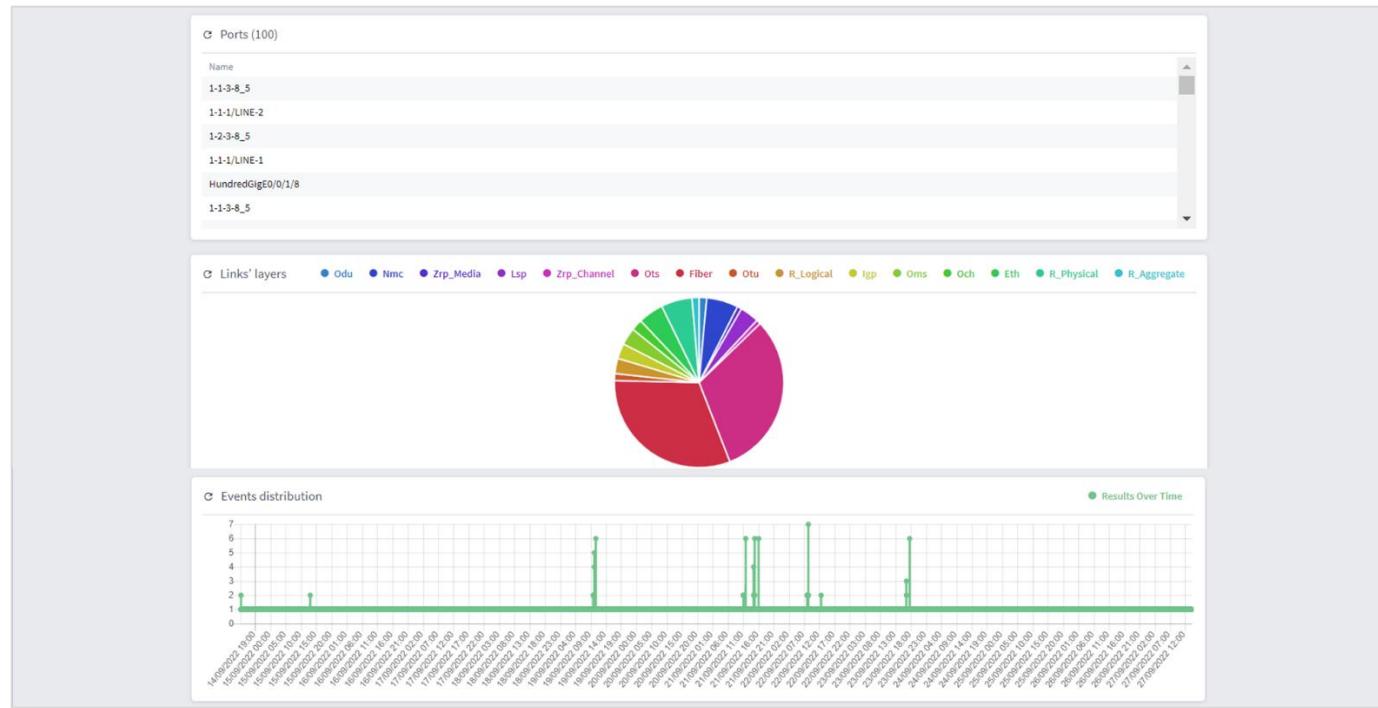
4. Click on the link.

Dashboard

The Dashboard is made up of table, pie, chart, or custom widgets. The information presented in a widget is updated periodically, typically every few minutes. The dashboard is a 2D grid in which the widgets can be placed as desired.

There are also several builtin custom widgets:

- **Operational Down Services:** Shows the number of services which are not operational
- **RCA Impacted List:** List of impacted links by current failures (maximum 10 entries).
- **Discovered Services:** Shows the number of services discovered in the network.
- **PerformanceWidgetApp**
- **SRLG Policy Violations:** Shows SRLG policy violations.
- **Srlg Daily last run:** Displays SRLG count between links types of the last run of Daily test.
- **Srlg Weekly last run:** Displays SRLG count between links types of the last run of Weekly test.



Creating Widgets

You can create customized widgets, rapidly with no development efforts and no software delivery. The widget query runs when opening the Dashboard application and the widgets are displayed. The widget also has a refresh button to run the query manually.

The widget attributes are:

- **Title:** The name of the SHQL widget as it appears in the SHQL Dashboard.
- **Type:**
 - Pie/bar – when the query contains counters only
 - Graph – when the query contains timestamp and counters
 - Table – when the query returns a list
- **Query:** Guidance is provided according to the widget type selected.
 - A Table or Pie widget query must include a View statement of no more than 5 fields. The results are limited to 100 items. For example:
`port | view("Name": .name)`
 - A Graph widget query must include the add_counters rule, which adds the number of occurrences of each of the unique values of the specified field/s. There must be only 1 time-based field under the rule, which will be the desired data (like timestamps). For example:
`event | add_counters(.timeStamp)`

NOTE: timestamps in query should be in ISO format (YYYY-MM-DD hh:mm:ss)

- **'About'** text
- Additional options that define if, and how, the widget will appear in the Dashboard.

To create a widget:

1. In the applications bar in Crosswork Hierarchical Controller, select **Dashboard**.
2. Select **Widget Settings**.
3. Click **+ New SHQL Widget**.

New SHQL Widget

Choose a widget type

Title*

Type*

SHQL Query

Size Multiplier*

1

Visible in the dashboard

Figure 67.
Creating New Widget

4. Enter the **Title**.
5. Select the **Type**. This can be **Table**, **Graph**, **Pie**, or **Custom**.

New SHQL Widget

The SHQL query must include the add_counters rule, which will add the number of occurrences of each of the unique values of the specified field/s. There must be only 1 field under the rule, which will be the desired data. For example:
link | add_counters(.operStatus)
NOTE: timestamps in query should be in ISO format (YYYY-MM-DD hh:mm:ss)

Visible in the dashboard

Dashboard Index*

8

Refresh the results in the widget every 0 minutes

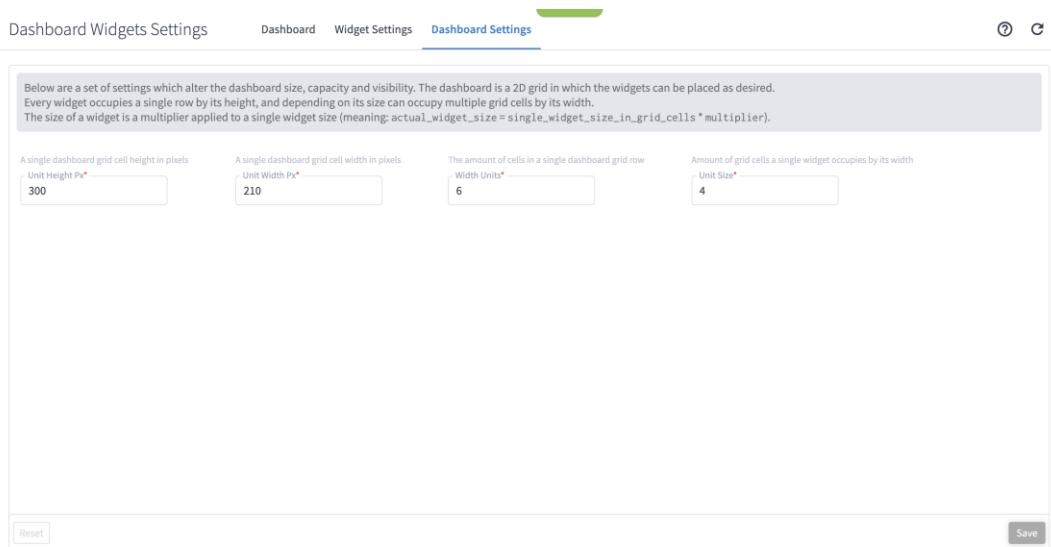
About

Figure 68.
Creating New Widget

6. Specify the **SHQL Query**.
7. Specify the **Size Multiplier**. This sets the relative size of the widget as a multiplier of a single widget size, determining the actual size in grid cells.
8. Select whether the widget should be **Visible in the dashboard**.
9. Select whether you want to refresh the widget, and if so, how often (in minutes).
10. Enter some information about your widget.
11. Click **Save**.

Configuring Dashboard Settings

You can alter the dashboard size, capacity and visibility. Every widget occupies a single row by its height, and depending on its size can occupy multiple grid cells by its width. The size of a widget is a multiplier applied to a single widget size (meaning: $\text{actual_widget_size} = \text{single_widget_size_in_grid_cells} * \text{multiplier}$).



The screenshot shows the 'Dashboard Settings' page with the following configuration:

- Unit Height Px:** 300
- Unit Width Px:** 210
- Width Units:** 6
- Unit Size:** 4

At the bottom, there are 'Reset' and 'Save' buttons.

Figure 69.
Dashboard Settings

- **Unit Height Px:** A single dashboard grid cell height in pixels.
- **Unit Width Px:** A single dashboard grid cell height in pixel.
- **Width Units:** The amount of cells in a single dashboard grid row.
- **Unit Size:** Amount of grid cells a single widget occupies by its width.

Network History

Cisco Crosswork Hierarchical Controller keeps records of all changes in the network inventory and topology. Changes are stored as:

- Snapshots of the network model at different times (used in the 3D Explorer Time machine).
- A list of events (used in the Network History application).

An event is a record of any resource addition, deletion, or attribute change. The event record includes all changes that may potentially help with failure analysis, capacity planning, early detection of outages, and more.

The Network History application enables you to view the events table with all the details of the change including the time, resource ID, object type, event type, and the value before and after the change. You can run queries based on a time range, specific resources (selected by tags, SHQL query or specific resources), event types and by attribute values. Queries can be saved for later use.

A unique implementation was selected to include all resources that were in the model at some point in the selected time range in the returned results. Thus, it guarantees that services or links that were subsequently deleted are still found.

For example, if you filter the table to get events for all services with specific tags for the past two weeks, the results will include the relevant services, including those that no longer exist at the end of the period.

The results are displayed in a table, with options to sort and filter the columns, group by time, object type or event type to get a count of the events.

The Network History application records all changes in inventory, topology, performance, configuration, and status and save them as events. Update, insert and delete events are saved.

The Network History application helps you analyze these events and answer questions, helping you to find correlations between changes such as:

- Discovering that the ports went down after a SW upgrade.
- Noting that the cards reset led to configuration changes.
- Seeing that the outage of certain devices caused rerouting and traffic congestion.

The following changes are recorded.

Inventory:

- New inventory – card, chassis, transceiver
- Card replacement
- SW upgrade

Status:

- Link failures
- Device reachability
- Link and port operation state
- Link and tunnel path rerouted

- VPN site down

Configuration:

- Link and tunnel configuration (BW, admin state, affinities)

Create Network History Report

You can complete the query form and then save the query as a network history report. Saved reports are available to all users.

You can select which resources to get the history report for:

- All resources
- By SHQL Query
- By tags
- By specific resources

You can also specify whether you want to query all events or events of a specific type (Insert, Delete and Update). You must also specify a time period. By default, the events for the past 2 days appear.

- In addition, you can limit the scope of results by changed attribute for the following object types:
 - Inventory Item
 - Link
 - Path
 - Port
 - Region
 - Service
 - Service Intent
 - Service Intent Resource
 - Site
 - Site Link
 - Srlg
 - Srlg Risk Resource Mtm
 - Visual Site

Note: For more details on the object types and a list of their attributes, see the *Cisco Crosswork Hierarchical Controller NBI Reference Guide*.

To create a network history report:

1. In the applications bar, select **Network History**. Alternatively, if you are already in the Network History application, click **≡ New Form**.

2. To query events for all resources, select **All Resources**.
3. To query events by SHQL query, select **By SHQL Query** and then enter an SHQL query. For more information, see the SHQL User Manual.
4. To query events by tags, select **By Tag(s)**, and then select a **Category** and the required **Values**. Use the **+** button to add the selected tags.

5. To query by specific resources, select **By Specific Resource(s)**, click to **Select Resource** and then select the required resource and click **OK**. You can add multiple items, however, if you want to add many resources, it is recommended to use SHQL or tags.

Inventory

Advanced

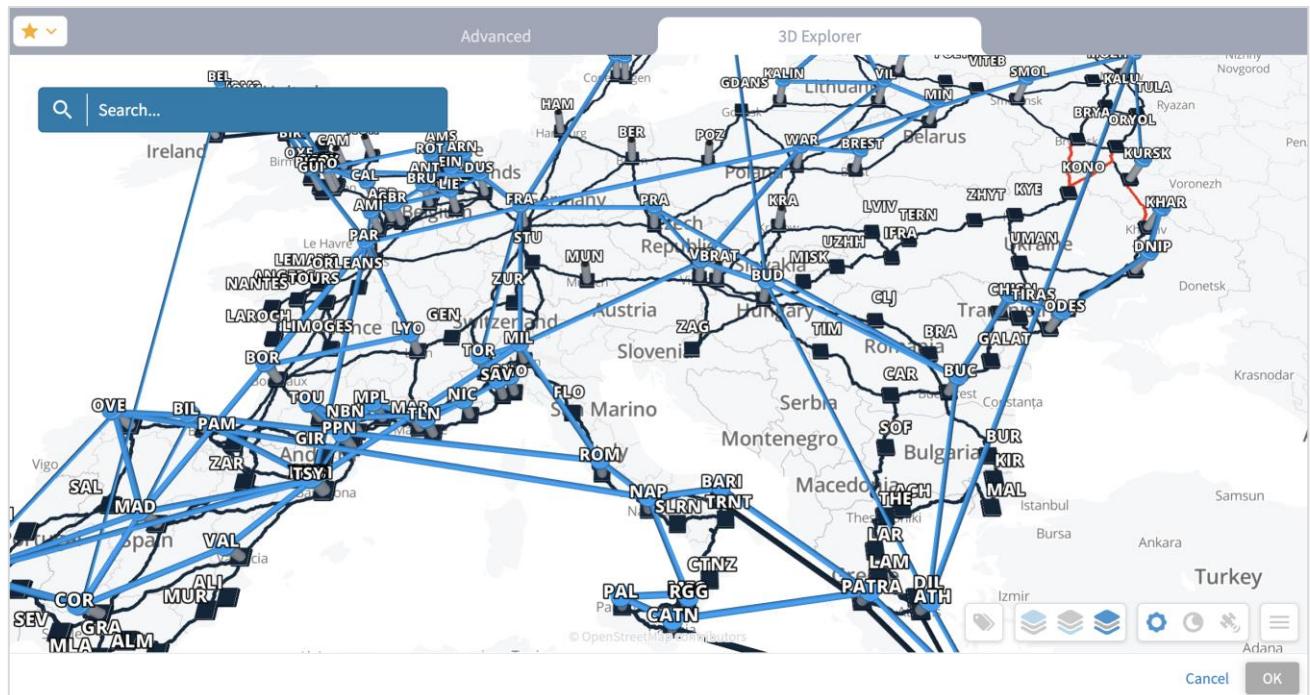
3D Explorer

SRLGs

SITES

Name	Type	LINKS	Services	SRLGs	SITES
546 ITEMS					
ILA-SD1BIR01-SD1LIV01-0	ONE			ILA-SD1BIR01-SD1LIV01-0	
ILA-SD1MAR01-SD1ML01-4	ONE			ILA-SD1MAR01-SD1ML01-4	
ILA-SD2ACH01-SD2ATH01-4	ONE			ILA-SD2ACH01-SD2ATH01-4	
ILA-SD1MAR01-SD1ML01-0	ONE			ILA-SD1MAR01-SD1ML01-0	
ILA-SD1BOR01-SD1MAR01-5	ONE			ILA-SD1BOR01-SD1MAR01-5	
ILA-SD1BIL01-SD1OVE01-1	ONE			ILA-SD1BIL01-SD1OVE01-1	
ILA-SD2ACH01-SD2ATH01-3	ONE			ILA-SD2ACH01-SD2ATH01-3	
ILA-SD2BRAT01-SD2KRA01-3	ONE			ILA-SD2BRAT01-SD2KRA01-3	
ILA-SD2MIN01-SD2WAR01-3	ONE			ILA-SD2MIN01-SD2WAR01-3	
ILA-SD1FRA01-SD1HAM01-1	ONE			ILA-SD1FRA01-SD1HAM01-1	
ILA-SD2BU01-SD2BUR01-2	ONE			ILA-SD2BU01-SD2BUR01-2	
ILA-SD2MAL01-SD2THE02-1	ONE			ILA-SD2MAL01-SD2THE02-1	
ILA-SD1FRA01-SD1PRA01-0	ONE			ILA-SD1FRA01-SD1PRA01-0	
ILA-SD2BU01-SD2CAR01-0	ONE			ILA-SD2BU01-SD2CAR01-0	
ILA-SD1GRA01-SD1MLA01-0	ONE			ILA-SD1GRA01-SD1MLA01-0	
ILA-SD2KRA01-SD2WAR01-0	ONE			ILA-SD2KRA01-SD2WAR01-0	
ILA-SD1BCN01-SD1ZAR01-2	ONE			ILA-SD1BCN01-SD1ZAR01-2	
ILA-SD1BER01-SD1FRA01-4	ONE			ILA-SD1BER01-SD1FRA01-4	
ILA-SD1COR01-SD1VAL01-2	ONE			ILA-SD1COR01-SD1VAL01-2	
ILA-SD1BER01-SD1HAM01-0	ONE			ILA-SD1BER01-SD1HAM01-0	
ILA-SD2VIL01-SD2WAR01-3	ONE			ILA-SD2VIL01-SD2WAR01-3	
ILA-SD1BOR01-SD1MAR01-6	ONE			ILA-SD1BOR01-SD1MAR01-6	
ILA-SD1BIL01-SD1OVE01-2	ONE			ILA-SD1BIL01-SD1OVE01-2	
ILA-SD1MUN01-SD1STU01-1	ONE			ILA-SD1MUN01-SD1STU01-1	

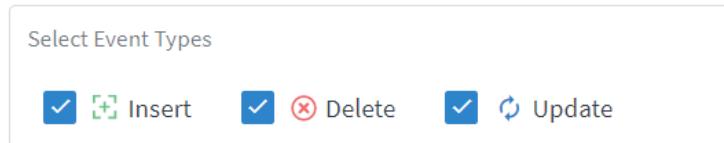
Cancel OK



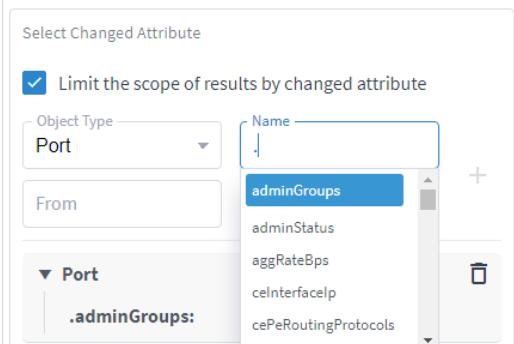
6. To select specific event types, select **Limit the scope of results by event types** and then select the required event types. You can add more than one event type.

- **Insert** – a resource was added to Cisco Crosswork Hierarchical Controller.
- **Update** – at least one of the resource attributes was changed.

- **Removed** – resource was removed from Cisco Crosswork Hierarchical Controller.



7. To select which attributes changed, select **Limit the scope of results by changed attribute** and then select the **Object Type**, in the Name field, enter. and then select the attribute property, enter **From** and **To** and then click **+**. You can add more objects and attributes.



Note: For more details on the attributes (objects) and their properties, see the *Cisco Crosswork Hierarchical Controller SHQL User Guide*.

8. Click **Get Report**.

Network Changes						Legend:
GENERAL						GROUP BY
Time	Object Name	Object Type	Ever	Changed Attributes		
60411 ITEMS						
Oct 06 2022 08:50:16	FourHundredGigE0/0/1/6	port		tags : ("Tag": ["All"], "PortType": ["ETH"]) → ("PortType": ["ETH"] View all changes (1)		
Oct 06 2022 08:50:16	R-OC-1-1-11	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	OTU-1-1-12	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	OTS-1-1-3	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	NMC-1-17_2	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	OTU-1-1-20	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	1-1-2-8_5	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	FourHundredGigE0/0/1/10	port		tags : ("Tag": ["All"], "PortType": ["ETH"]) → ("PortType": ["ETH"] View all changes (1)		
Oct 06 2022 08:50:16	FourHundredGigE0/0/1/7	port		tags : ("Tag": ["All"], "PortType": ["ETH"]) → ("PortType": ["ETH"] View all changes (1)		
Oct 06 2022 08:50:16	1-1-4_1	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	1-1-4/CHAN 2 (195.95)	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	OTS-1-1-13	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	1-1-3/LINE-1	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	CoherentDSP0/0/1/9	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	GigabitEthernet1/1/2	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	OTS-1-1-3	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	1-2-2-8_5	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	TenGigE0/0/1/8	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	TenGigE0/0/1/15	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	1-3-1	port		tags : ("Tag": ["All"]) → {} View all changes (1)		
Oct 06 2022 08:50:16	10.41.1.169	port		tags : ("Tag": ["All"]) → {} View all changes (1)		

9. For an event, click in the **Changed Attributes** column to see the changes, for example, **tags : {} {"vendor": ["Ciena"]}** means that a new tag was added to the resource with key=Vendor and value=Ciena.

Time	Object GUID	Object Type	Event	Changed Attributes
112963 ITEMS MATCHING FILTER Feb 10 2021 22:02:55	IN/272fd102a7299473	inventory_item	<>	tags : {} → ["Vendor": ["Ciena"]]

10. To view the full details of the resource as it is currently, click the row in table to get a JSON view of all attributes.

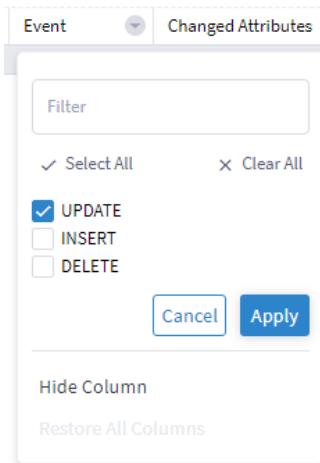


```

IN/272fd102a7299473 details at Feb 10 2021 22:02:55
1
2
3 "children": null,
4 "desc": null,
5 "deviceFamily": "ILA",
6 "deviceType": "ONE",
7 "extra": null,
8 "guid": "IN/272fd102a7299473",
9 "hasRoadm": false,
10 "managementIp": null,
11 "modelNumber": null,
12 "name": "ILA-SD1BIR01-SD1LIV01-0",
13 "parent": null,
14 "partNumber": null,
15 "provider": "Topogen",
16 "reachabilityStatus": "REACHABLE",
17 "serialNumber": null,
18 "site": {
19     "guid": "ST/272fd102a7299473"
20 },
21 "softwareVersion": null,
22 "srIgs": [],
23 "tags": {
24     "Vendor": [
25         "Ciena"
26     ]
27 },
28 "topologyId": null,
29 "type": "ONE",
30 "vendor": "Ciena"
31

```

11. (Optional) To filter the results, click ▾ next to the field name, select the required values, and then click **Apply**.



12. (Optional) To hide a column, click ▾ next to the field name, and then click **Hide Column**.

13. (Optional) To restore all columns, click ▾ next to any of the field names, and then click **Restore All Columns**.

Note: Hiding and restoring columns applies to all reports, not only to the open report.

14. (Optional) To view an object in the 3D Explorer, click in the **Object GUID** column.
15. To save the report for future use, click  **Save**.



A dialog box titled "Save Report As..." with an "X" button in the top right corner. It contains a "Report Name*" input field with the placeholder "Report Name*" and a "Save" button.

16. Enter a report name and click **Save**.

Use Network History Report

You can use an existing report, edit the report, save the report with a new name, or delete the report.

To use an existing network history report:

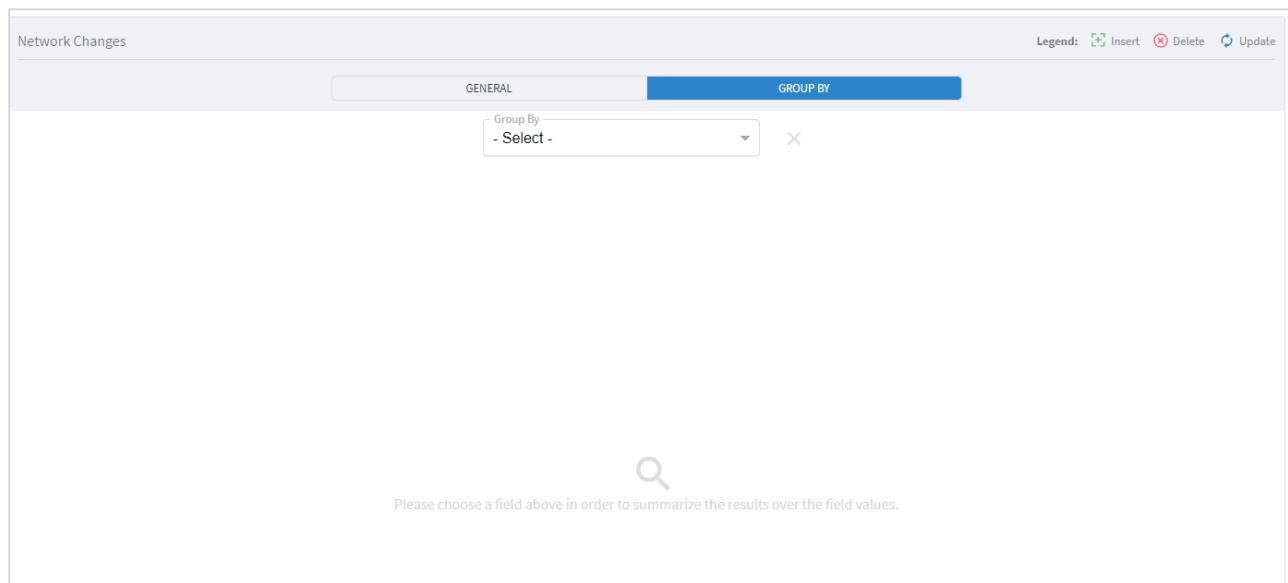
1. In the applications bar, select **Network History**.
2. Click  **Open** and select the required report.
3. (Optional) Modify the report if required.
4. Click **Get Report**.
5. (Optional) If you want to save the report with a new name, click  **Save As**.
6. (Optional) If you want to delete a report, click  **Delete**. A confirmation appears. Click **Delete Report**.

Group Network History Report

Once you have run the history query, you can group the history report by time, object type or event.

To group the network history report:

1. In the applications bar, select **Network History**.
2. Fill in the Query Form and click **Get Report**.
3. Select the **Group By** tab.



A screenshot of the "Network Changes" query form. At the top, there are tabs for "GENERAL" and "GROUP BY", with "GROUP BY" being the active tab. Below the tabs is a "Group By" dropdown menu with the placeholder "- Select -". In the bottom right corner, there is a search icon and a message: "Please choose a field above in order to summarize the results over the field values." A legend at the top right shows icons for "Insert", "Delete", and "Update".

4. Select how to group the report:

- **By Time:** Select this option to count the number of events per second.
- **By Object Type:** Select this option to count the number of events per object type.
- **By Event:** Select this option to count the number of events of type insert, delete and update.

5. To view the detail for the group, select the required item. The details appear below.

Network Changes

Legend: Insert Delete Update

GENERAL GROUP BY

Group By: **By Event**

Event 1 ITEM Count 60411

Time Object Name Object Type Ever Changed Attributes

60411 ITEMS

Oct 06 2022 08:50:16	FourHundredGigE0/0/1/6	port		tags : [{"Tag": ["All"], "PortType": ["ETH"]} → {"PortType": ["ETH"]}]	View all changes (1)
Oct 06 2022 08:50:16	R-OC-1-1-11	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	OTU-1-1-12	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	OTS-1-1-3	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	NMC-1-1-17_2	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	OTU-1-1-20	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	1-1-2-8_5	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	FourHundredGigE0/0/1/10	port		tags : [{"Tag": ["All"], "PortType": ["ETH"]} → {"PortType": ["ETH"]}]	View all changes (1)
Oct 06 2022 08:50:16	FourHundredGigE0/0/1/7	port		tags : [{"Tag": ["All"], "PortType": ["ETH"]} → {"PortType": ["ETH"]}]	View all changes (1)
Oct 06 2022 08:50:16	1-1-4_1	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	1-1-4/CHAN 2 (195.95)	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	OTS-1-1-13	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	1-1-3/LINE-1	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	CoherentDSP0/0/1/9	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)
Oct 06 2022 08:50:16	GigabitEthernet1/1/2	port		tags : [{"Tag": ["All"]} → {}]	View all changes (1)

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
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The Netherlands

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