



Cisco Crosswork Hierarchical Controller 10.0

Analytics Guide

December 2024

Introduction

This document is a how-to-use guide for the analytics applications of Cisco Crosswork Hierarchical Controller.

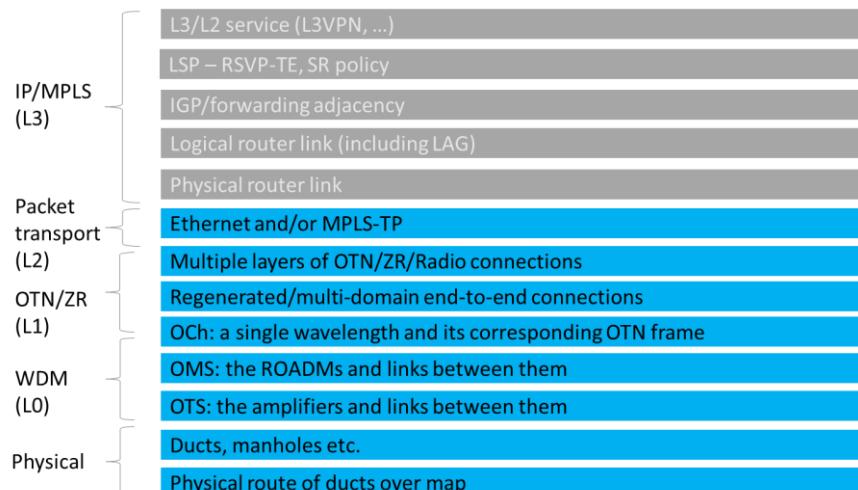
The following table lists the analytics applications. The Legend column indicates if the application falls into one of the following categories:

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

Table 1. Analytics Applications

Category	Application name	Legend	Description
Analytics	Failure Impact	Common	Enables a user to 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, hops. Supported for OTN, ETH, RSVP-TE tunnels.
	Shared Risk Analysis	Common	Find if there are commonly shared resources (node, site, link, card) between selected group of links in any layer. Group can be selected explicitly or as SHQL rule.

Layers



Terminology

Table 2. Terms

Term	Definition
Adapter	The software used by Crosswork Hierarchical Controller to connect to a device or to the manager, to collect information required by the network model and configure the device.
Agg link	Agg is Link Aggregation Group (LAG) where multiple ETH links are grouped to create higher bandwidth

Term	Definition
	and resilient link.
BGP	Border Gateway Protocol
Circuit E-Line	An Ethernet connection between two ETH client ports on Transponder or Muxponder over OTN signal.
CNC	Crosswork Network Controller.
Device	Optical network element, router, or microwave device.
Device Manager	The application that manages the deployed adapters.
eMBB	Enhanced Mobile Broadband.
ETH 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.
ETH link	ETH L2 link, spans from one ETH UNI port of an optical device to another, and rides on top of ODU.
Fiber	Chain of fiber segments that spans from one optical device to another.
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.
IGP	IGP is the link between two routers that carries IGP protocol messages. The link represents an IGP adjacency.
IP-MPLS	IP multi-protocol label switching.
L3 physical	L3 physical is the physical link connecting two router ports. It may ride on top of an ETH link if the IP link is carried over the optical layer.
L3-VPN	A virtual private network based on L3 routing for control and forwarding.
L3-VPN link	The connection between two sites of a specific L3-VPN (can be a chain of LSP connections or IGP path).
LDP Endpoint	The endpoint of the LDP path (router name). LDP is a signaled path for services between two routers in the MPLS network. The path is signaled by routers using the Label Distribution Protocol.
Logical link, IGP, LSP	Logical link connects VLANs on two IP ports.
LSP	Label Switched Path, used to carry MPLS traffic over a label-based path. LSP is the MPLS tunnel created between two routers over IGP links, with or without TE options.
NMC (OCH-NC, OTSiMC)	NMC is the link between the xPonder facing ports on two ROADMs. This link is the underlay for OCH and it is an overlay on top of OMS links. This is relevant only for disaggregation cases where the ROADM and OT box are separated.
NMS	Network Management System.
OC/OCG	SONET/SDH links that span from one optical device to another and carry SONET/SDH lower bandwidth services, the links ride on top of OCH links and terminate in TDM client ports.
OCH	OCH is a wavelength connection spanning between the client port one OT device (transponder, muxponder, regen) and another. 40 or 80 OCH links can be created on top of OMS links. The client port can be a TDM or ETH port.
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.

Term	Definition
OSPF	Open Shortest Path First, an Interior Gateway Protocol between routers.
OTN-Line	An OTN connection between two ODU client ports over OTN path.
OTS	OTS is the physical link connecting one line amplifier or ROADM to another. An OTS can be created over a fiber link.
OTU	OTU is the underlay link in OTN layer, used for ODU links. It can ride on top of an OCH.
Packet E-Line	A point-to-point connection between two routers or transponders/muxponders over MPLS-TP or IP-MPLS.
PCC	Path Computation Client. Delegated to controller. Router is responsible for initiating path setup and retains the control on path updates.
PCE	Path Computation Element. Controller-initiated.
Policy	A group of rules and shared risk resource types.
Radio Channel	Multiple radio channels can be on top of radio media, each channel represents a different ETH link with its own rate.
Radio Media	The media layer as a carrier of radio channels.
RD	Route Distinguisher.
RSVP-TE	Resource Reservation Protocol to control traffic engineered paths over MPLS network.
RT	Route Target.
Rule	A group of two or more diverse links/connections.
SCH	A super-channel is an evolution of DWDM in which multiple, coherent optical carriers are combined to create a unified channel of a higher data rate, and which is brought into service in a single operational cycle.
SDN Controller	Software that manages multiple routers or optical network elements.
Shared Risk Resource Type	The type of the resource that the shared risk analysis application checks if objects in the rule share. The types are Link, Device, Shelf, Card, and Port.
SHQL	The Sedona Hierarchical Query Language (SHQL) is used to easily query the model across all dimensions (Vendors, Topologies, Layers, Domains, Status and Time).
SR Policy	Segment Routing Policy. A segment routing path between two nodes, with mapping to the IGP links based on SIDs list.
SRLG	The Shared Risk Link Group are the links or connections that may suffer from a common failure if they share a common risk, such as a device, link or card.
STS	Large and concatenated TDM circuit frame (such as STS-3c) into which ATM cells, IP packets, or Ethernet frames are placed. Rides on top of OC/OCG as optical carrier transmission rates.
uRLLC	Ultra-Reliable Low Latency Communications.
Violation	Any case where a resource, identified by its shared risk resource type, is shared between two links/connections.
VRF	Virtual Routing Function, acts as a router in L3-VPN.
ZR Channel	Multiple ZR channels can be on top of ZR media, each channel represents a different IP link with its own rate.

Term	Definition
ZR Media	The media layer as a carrier of ZR channels, on top of OCH link.

Shared Risk Analysis

This application helps to establish diversity policy rules on predefined links or connection groups or on ad-hoc selected links/connections.

The application identifies any lower layer resources shared by a pair or group of links, or by any connection between selected endpoints. This helps you to ensure that diverse links or connections are not using the same underlying resources.

The LDP Endpoint test looks for the shortest IGP path between the two pairs of routers and then analyses the shared risk between the paths found.

You can define one or more policies and use them for testing. A policy includes the shared risk resource type, the test type and the applicable rules.

- **Shared Risk Resource Type** – The type of resource that according to policy should not be shared by the links/connections paths. One or more of the following resource types can be selected: Device, Shelf, Card, Port, Link, or SRLG.
- **Test scenario** – The test type, either multiple links or a single protected link.
- **Rules** – Groups of links or connections by specific type. Users can select links/connections to a group and give each group a name or use SHQL rule to define the group. The group is retrieved at the time of execution. If there are any network changes, you can use the time machine and network inventory app to identify these changes.

Shared Risk Analysis Tests

To run a test, you can select a policy or ad-hoc select links/connection pairs to check if they share common resources.

Results are displayed as risks, where each row in the results table is a risk found that impacts a pair of links/connection of the selected policy or ad-hoc selection. The results table displays the names of the rules, the links that are at risk, the link type, the number, or resources they share and the total bandwidth at risk.

Run Specific Links Test

You can run a test on specific links, checking for shared risk resources of type link, device, shelf, card, and port. You can select whether to check:

- Multiple links
- Single protected link

To run a specific links test:

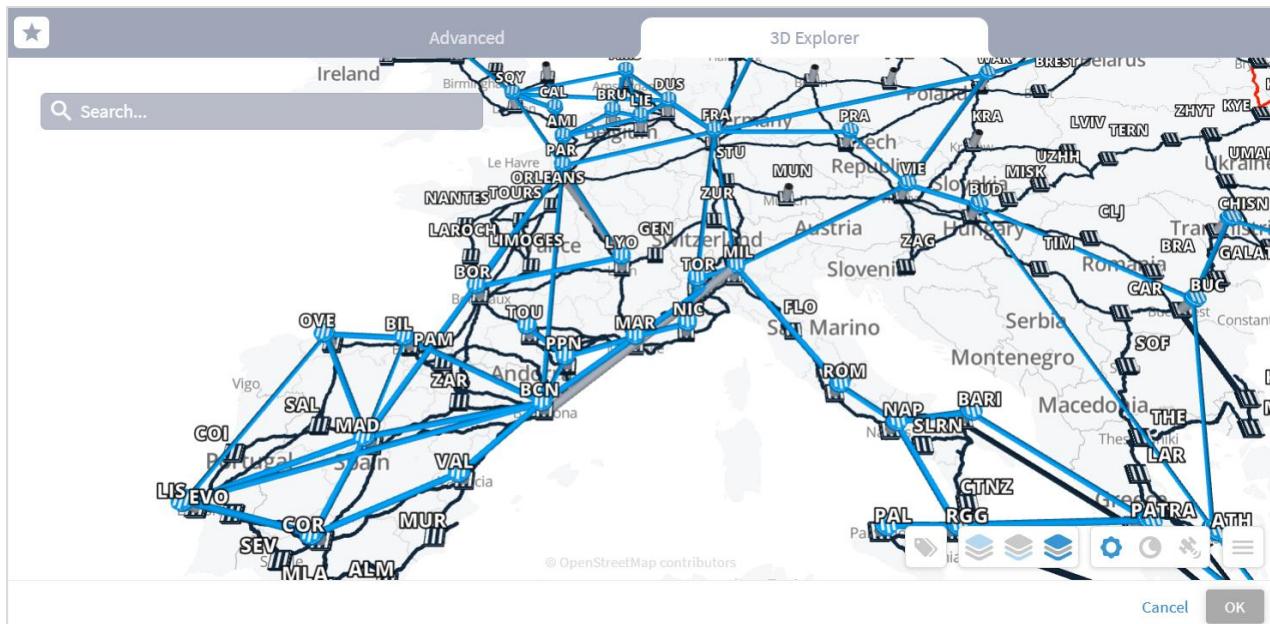
1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.

2. Select the required **Shared risk resources types**.
3. Select the **Test type (Multiple links or Single protected link)**.
4. Click **Add Resource** to add a link.

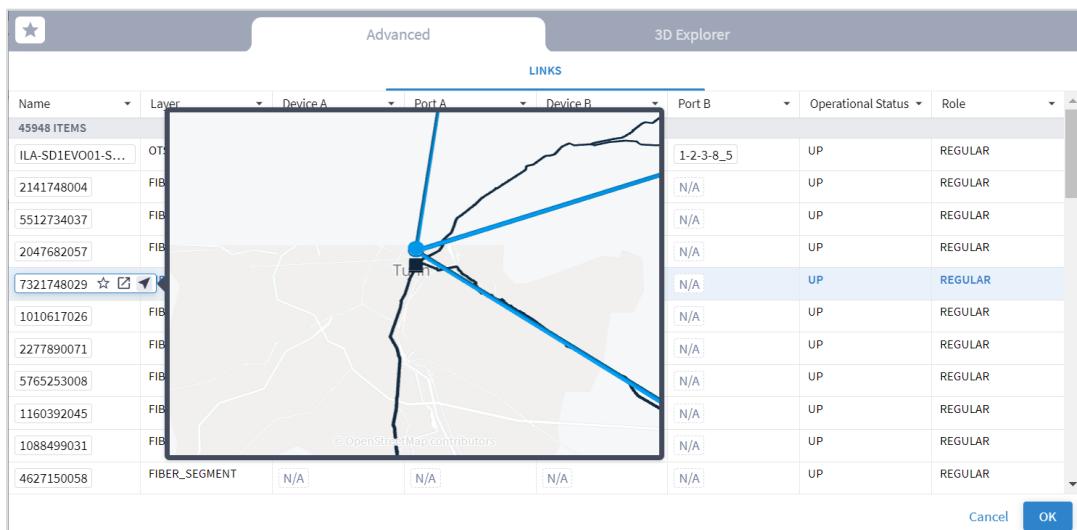
Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
ILA-SD1EVO01-S...	OTS	ILA-SD1EVO01-S...	1-1-3-8_5	SD1LIS01	1-2-3-8_5	UP	REGULAR
2141748004	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5512734037	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2047682057	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
7321748029	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1010617026	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
2277890071	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
5765253008	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1160392045	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
1088499031	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR
4627150058	FIBER_SEGMENT	N/A	N/A	N/A	N/A	UP	REGULAR

Note: The use of FIBER/FIBER_SEGMENT is for demonstration only.

Or select the **3D Explorer** tab.



In the **Advanced** tab, you can select a link and click to view the link in the popup map.



5. Select a link and click **OK**.
6. Add more links (by repeating the steps above for other links to analyze).
7. Click **Run**. In the test results, you see the **VIOLATIONS**.

Shared Risk Analysis

Specific links LDP endpoints Policy

Shared risk resources types

Link Device Shelf Card

Port

Test type

Multiple links Single protected link

Parameters

Add Resource

cr1.har:cr1.stxtopo_lsp_mesh_164250434...

10.40.0.162 to 10.40.0.161

10.40.0.157 to 10.40.0.158

Run

VIOLATIONS **CAUSES**

Rule	Link A	Link Type	Link B	Link Type	SRLG Count	Capacity At Risk (Gbps)
3 ITEMS	10.40.0.157 to 10.40.0.158	L3 Logical	cr1.har:cr1.stxtopo_lsp_mesh_164250434983	LSP	61	
	10.40.0.162 to 10.40.0.161	L3 Logical	10.40.0.157 to 10.40.0.158	L3 Logical	46	
	10.40.0.162 to 10.40.0.161	L3 Logical	cr1.har:cr1.stxtopo_lsp_mesh_164250434983	LSP	46	

8. You can select a link and view the link in the popup map and select a row (and click **▶** to expand) in the test results to see more details on the shared resources.

Shared Resources

CR2.DUS:CR2.MIL:lsp_0-
CR2.PAR:CR2.MIL:lsp_0

6 ITEMS

Rule	Link A	Link Typ	Link B	Link Typ	SRLG Col
CR2.DUS:CR2.MIL:lsp_0-	LSP	CR2.PAR:CR2.MIL:lsp_0-	LSP	17	
SD1BCN01/2-3-10...	Et...	CR2.DUS:CR2.MIL...	LSP	1	
SD1MIL01/1-16-1...	Et...	CR2.DUS:CR2.MIL...	LSP	1	
SD1BCN01/2-3-10...	Et...	CR2.PAR:CR2.MIL...	LSP	1	
SD1MIL01/1-16-1...	Et...	CR2.PAR:CR2.MIL...	LSP	1	
SD1MIL01/1-16-1...	Et...	SD1BCN01/2-3-10...	Et...	1	

Inventory (15)

Optical Node: ILA-SD1MIL01-SD1ZUR01-0
Optical Node: ILA-SD1MIL01-SD1ZUR01-2
Optical Node: ILA-SD1FRA01-SD1STU01-1
Optical Node: ILA-SD1STU01-SD1ZUR01-1
Optical Node: ILA-SD1FRA01-SD1STU01-0
Optical Node: SD1MIL01
Optical Node: SD1FRA01
Optical Node: SD1ZUR01
Optical Node: SD1STU01
Router: CR2.MIL
Router: CR1.FRA
Router: CR2.FRA
Optical Node: ILA-SD1MIL01-SD1ZUR01-3
Optical Node: ILA-SD1MIL01-SD1ZUR01-1
Optical Node: ILA-SD1STU01-SD1ZUR01-0

IGP (2)

10.40.0.146 to 10.40.0.145
10.40.0.161 to 10.40.0.162

The map displays a network topology with nodes in Strasbourg, MIL, and San Marino. Strasbourg is connected to MIL. MIL is connected to San Marino. There are also connections between Strasbourg and MIL, and between MIL and San Marino. The connections are represented by blue lines on a map of Europe, with labels indicating the links: CR2.DUS:CR2.MIL:lsp_0 and CR2.PAR:CR2.MIL:lsp_0.

Shared Resources

CR2.DUS:CR2.MIL:lsp_0
CR2.PAR:CR2.MIL:lsp_0

6 ITEMS

CR2.DUS:CR2.MI... LSP CR2.PAR:CR2.MIL... LSP 17

Inventory (15)

- Node: ILA-SD1MIL01-SD1ZUR01-0
- Node: ILA-SD1MIL01-SD1ZUR01-2
- Node: ILA-SD1FRA01-SD1STU01-1
- Node: ILA-SD1STU01-SD1ZUR01-1
- Node: ILA-SD1FRA01-SD1STU01-0
- Node: SD1MIL01
- Node: SD1FRA01
- Node: SD1ZUR01
- Node: SD1STU01
- CR2.MIL
- CR1.FRA
- CR2.FRA
- Node: ILA-SD1MIL01-SD1ZUR01-3
- Node: ILA-SD1MIL01-SD1ZUR01-1
- Node: ILA-SD1STU01-SD1ZUR01-0

.146 to 10.40.0.145
.161 to 10.40.0.162

Note: For a single protected link, the Link B and Link Type columns are empty, and the **Capacity At Risk** column is likely to be N/A.

9. To view the causes, select the **CAUSES** tab.

Violations		Causes
Resource Name	Number Of Violations	
ILA-wdmjfl01-wdmmia01-0/1-2-1	3	
wdmmia01/1-2-9	1	
10.40.0.157 to 10.40.0.158	1	
ILA-wdmjfl01-wdmmia01-5	3	
ILA-wdmjfl01-wdmmia01-3/Shelf-1	3	
ILA-wdmjfl01-wdmmia01-6/1-2-2	3	
Card-1/2 atILA-wdmjfl01-wdmmia01-4	3	
Card-1/2 atILA-wdmjfl01-wdmmia01-3	3	
ILA-wdmjfl01-wdmmia01-1/1-2-1	3	
Card-1/2 at wdmmia01	3	
ILA-wdmjfl01-wdmmia01-5/1-2-2	3	
cr1.mia/0-1-7	1	
wdmmia01/1-2-8	1	
Card-1/2 at wdmjfl01	3	
wdmmia01/1-2-10	1	
Card-1 at cr1.mia	1	
Card-1/2 atILA-wdmjfl01-wdmmia01-2	3	
wdmmia01	3	
wdmjfl01/Shelf-1	3	
ILA-wdmjfl01-wdmmia01-2	3	
ILA-wdmjfl01-wdmmia01-1/1-2-2	3	
ILA-wdmjfl01-wdmmia01-0/1-2-2	3	
wdmjfl01/1-2-7	1	

10. (Optional) For multiple links, to remove a link from the test, select  and click **Run**.

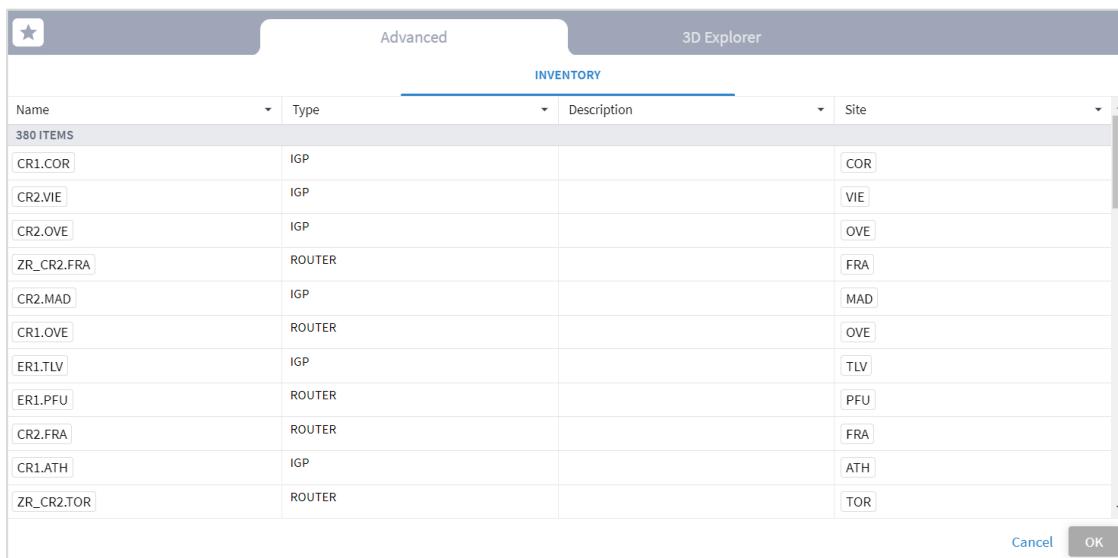
Run LDP Endpoints Test

You can run a test on two pairs of routers acting as LDP endpoints, checking for shared risk resources of type link, device, shelf, card, and port. You need to select two endpoint device pairs.

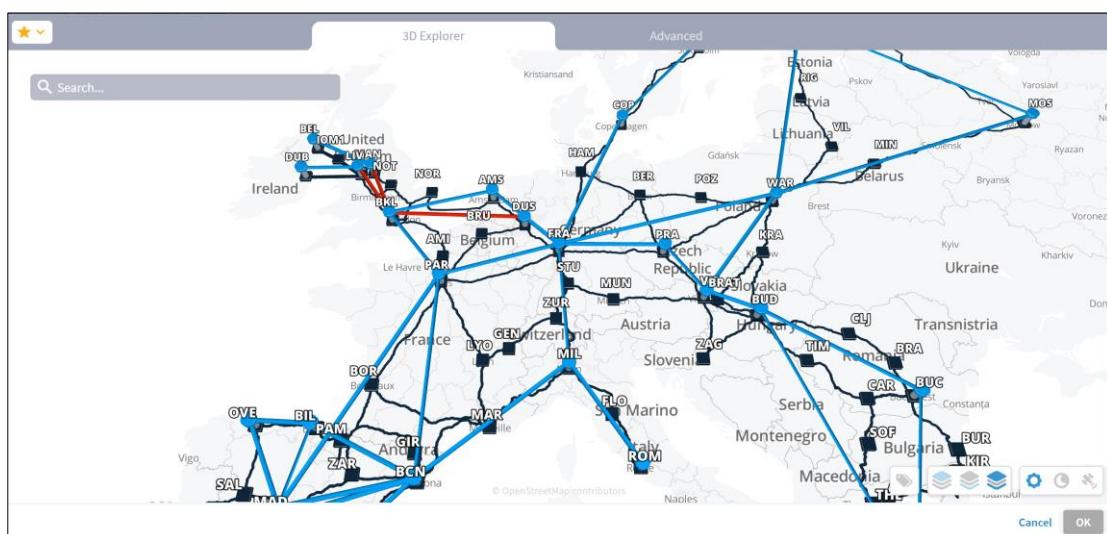
This test looks for the shortest IGP path between the two pairs of routers and then analyses the shared risk.

To run LDP endpoints test:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the **LDP endpoints** tab.
3. Select the required **Shared risk resource types**.
4. Click  to add an endpoint.



Or select the **3D Explorer** tab.



5. Select an endpoint.

6. Click **OK**.

7. Add more endpoints.

8. Click **Run**.

Rule	Link A	Link Type	Link B	Link Type	SRLG Count	Capacity At Risk [Gbps]
	10.40.0.193 to 10.40.0.194	IGP	10.40.0.201 to 10.40.0.202	IGP	14	N/A
	10.40.0.193 to 10.40.0.194	IGP	10.40.0.205 to 10.40.0.206	IGP	1	N/A
	10.40.0.198 to 10.40.0.197	IGP	10.40.0.201 to 10.40.0.202	IGP	1	N/A
	10.40.0.205 to 10.40.0.206	IGP	10.40.0.198 to 10.40.0.197	IGP	1	N/A
	10.40.0.205 to 10.40.0.206	IGP	10.40.0.201 to 10.40.0.202	IGP	2	N/A
	10.40.0.205 to 10.40.0.206	IGP	10.40.0.205 to 10.40.0.206	IGP	8	N/A
	10.40.1.41 to 10.40.1.42	IGP	10.40.0.205 to 10.40.0.206	IGP	1	N/A
	10.40.1.30 to 10.40.1.29	IGP	10.40.0.205 to 10.40.0.206	IGP	1	N/A
	10.40.1.41 to 10.40.1.42	IGP	10.40.0.205 to 10.40.0.206	IGP	1	N/A
	10.40.1.41 to 10.40.1.42	IGP	10.40.1.41 to 10.40.1.42	IGP	3	N/A
	10.40.1.30 to 10.40.1.29	IGP	10.40.1.41 to 10.40.1.42	IGP	1	N/A
	10.40.1.46 to 10.40.1.45	IGP	10.40.0.205 to 10.40.0.206	IGP	1	N/A
	10.40.1.41 to 10.40.1.42	IGP	10.40.1.46 to 10.40.1.45	IGP	1	N/A
	10.40.1.30 to 10.40.1.29	IGP	10.40.1.46 to 10.40.1.45	IGP	2	N/A

9. In the test results, you can select a link and view the link in the popup map and select a row (and click ▶ to expand) in the test results to see more details on the shared resources.

Rule	Link A	Link Typ	Link B	Link Typ	SRLG Col
	10.40.0.193 to 10...	IGP	10.40.0.201 to 10...	IGP	14
	10.40.0.193 to 10...	IGP	10.40.0.205 to 10...	IGP	1
	10.40.0.198 to 10...	IGP	10.40.0.201 to 10...	IGP	1
	10.40.0.205 to 10...	IGP	10.40.0.198 to 10...	IGP	1
	10.40.0.205 to 10...	IGP	10.40.0.201 to 10...	IGP	2
	10.40.0.205 to 10...	IGP	10.40.0.205 to 10...	IGP	8
	10.40.1.41 to 10.4...	IGP	10.40.0.205 to 10...	IGP	1
	10.40.1.30 to 10.4...	IGP	10.40.0.205 to 10...	IGP	1
	10.40.1.41 to 10.4...	IGP	10.40.0.205 to 10...	IGP	1
	10.40.1.41 to 10.4...	IGP	10.40.1.41 to 10.4...	IGP	3
	10.40.1.30 to 10.4...	IGP	10.40.1.41 to 10.4...	IGP	1
	10.40.1.46 to 10.4...	IGP	10.40.0.205 to 10...	IGP	1
	10.40.1.30 to 10.4...	IGP	10.40.1.46 to 10.4...	IGP	2

Shared Resources

10.40.0.193 to 10.40.0.194
10.40.0.201 to 10.40.0.202

▼ Inventory (11)

Optical Node: ILA-SD2BRAT01-SD2KRA01-2
Optical Node: ILA-SD2KRA01-SD2WAR01-2
Optical Node: ILA-SD2BRAT01-SD2KRA01-3
Optical Node: ILA-SD2BRAT01-SD2KRA01-1
Optical Node: ILA-SD2KRA01-SD2WAR01-0
Optical Node: SD2VIE01
Optical Node: SD2KRA01
Optical Node: SD2BRAT01
Optical Node: SD2WAR01
Optical Node: ILA-SD2BRAT01-SD2KRA01-0
Optical Node: ILA-SD2KRA01-SD2WAR01-1

▼ OMS (3)

SD2KRA01/OMS-1-0-4 to SD2WAR01/OMS-1-0-8
SD2BRAT01/OMS-1-0-4 to SD2VIE01/OMS-1-0-5
SD2BRAT01/OMS-1-0-6 to SD2KRA01/OMS-1-0-6

Export Test Results

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

A	B	C	D	E	F	G	H	I
Rule	Link A	Link A Type	Link B	Link B Type	SRLG	SRLG Type		
1	SD1FRA01/2-4-100-2 to SD1PRA01/1-5-100-2	Ethernet	SD1FRA01/2-1-100-2 to SD1PRA01/1-13-100-2	Ethernet	Optical Node: SD1FRA01	Optical Node		
3	SD1FRA01/2-5-100-2 to SD1PRA01/1-6-100-2	Ethernet	SD1FRA01/2-1-100-2 to SD1PRA01/1-13-100-2	Ethernet	Optical Node: SD1FRA01	Optical Node		
4	SD1FRA01/2-5-100-2 to SD1PRA01/1-6-100-2	Ethernet	SD1FRA01/2-4-100-2 to SD1PRA01/1-5-100-2	Ethernet	Optical Node: ILA-SD1FRA01-SD1PRA01-0	Optical Node		
5								
6								
7								

To export the test results:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Run the required test.
3. Click . The file is downloaded automatically.

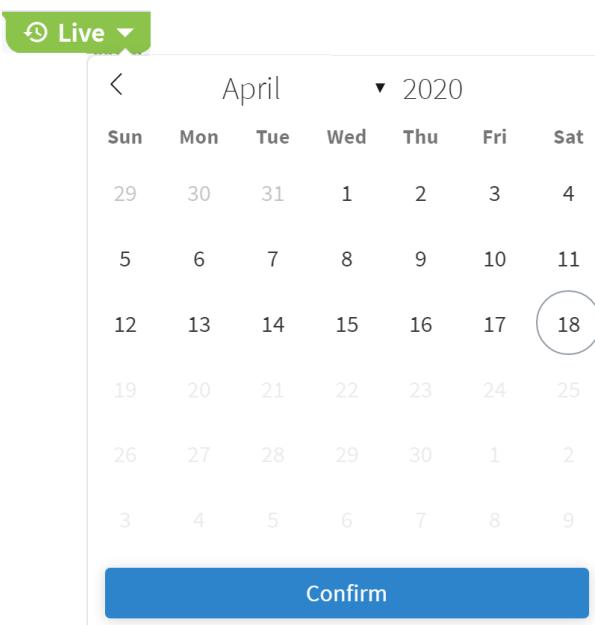
Use Time Machine

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.

You can use the time machine to execute the tests on the model as at a date in the past.

To change the model date:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Click **Live**, select a date and click **Confirm**.



3. Run the required test.

Share Risk Analysis Policies

You can define one or more policies and use them for testing. A policy includes the shared risk resource type and the applicable rules.

- **Shared Risk Resource Type** – The type of resource that according to policy should not be shared by the links/connections paths. The following resource types can be selected: Device, Shelf, Card, Port, Link, or SRLG.
- **Test type**– Either test multiple links or a single protected link.
- **Rules** – Groups of links or connections by specific type. You can select links/connections to a group and give each group a name.

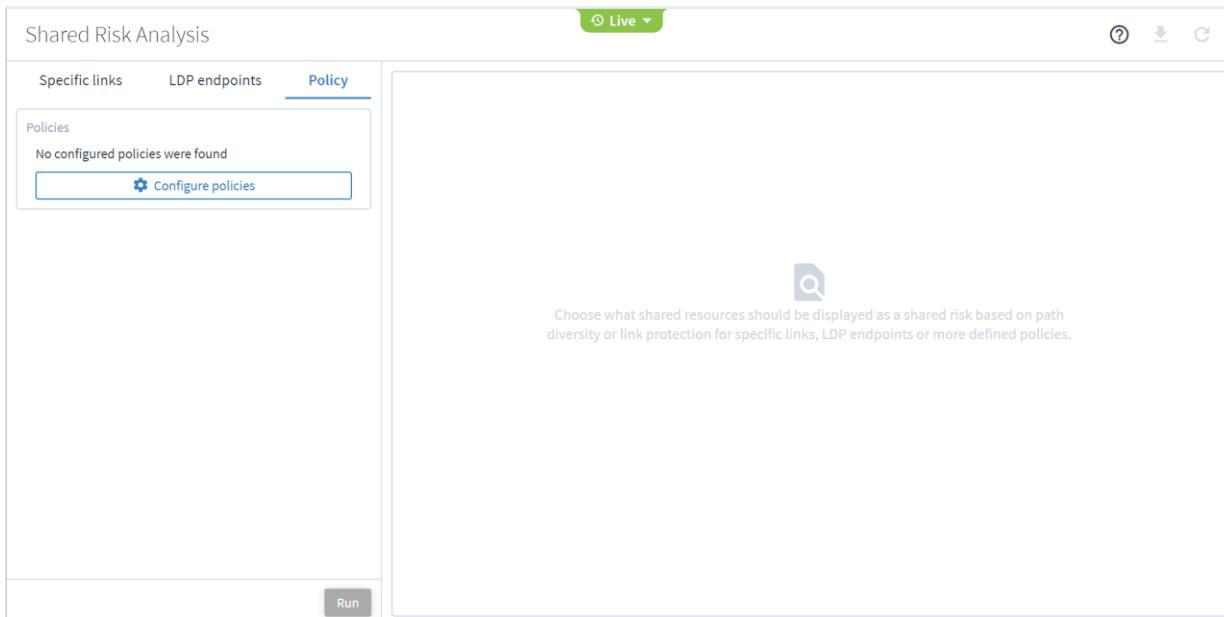
Add Policy

You can add a policy, and then add rules to it. You must add at least one rule to save a new policy.

You can add a rule to an existing policy. Alternatively, you can add rules using the Shared Risk API and SHQL query (see [Add Rules using the Shared Risk API](#)).

To add a policy:

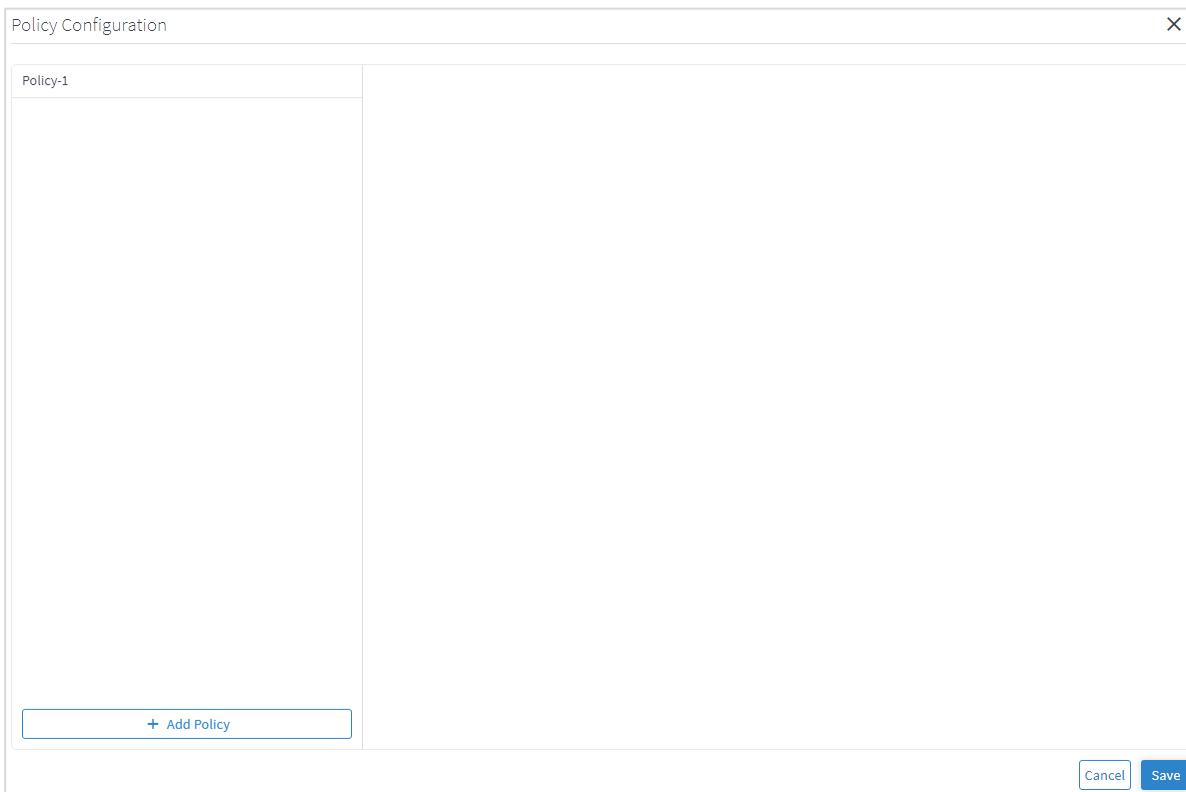
1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the Policy tab.



3. Click  **Configure Policies**.



4. In the **Policy Configuration** window, click **Add Policy**.



5. Select the policy.

Policy Configuration

Policy-1

Shared risk resource types

Link Device Shelf Card Port

Test type

Multiple links Single protected link

Rules

6. (Optional) To change the policy name, select the new policy, click , modify the policy name and then click .
7. Select the required **Shared risk resource types**.
8. Select whether you want to test **Multiple links** or **Single protected link**.
9. Click **Add Rule**.

Policy Configuration

Policy-3

Shared risk resource types

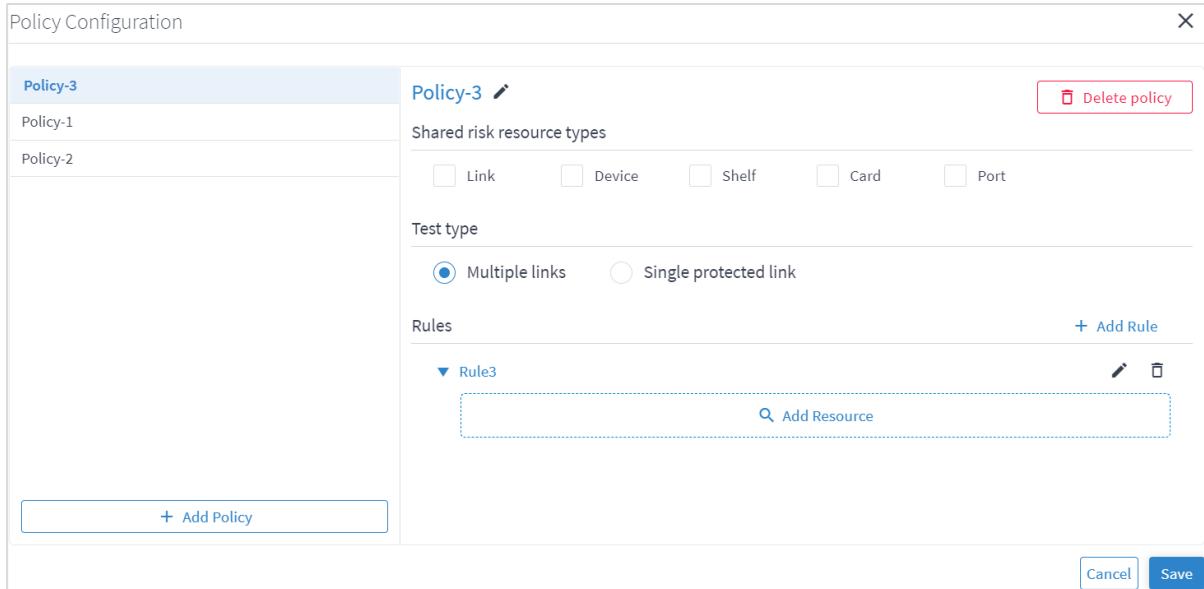
Link Device Shelf Card Port

Test type

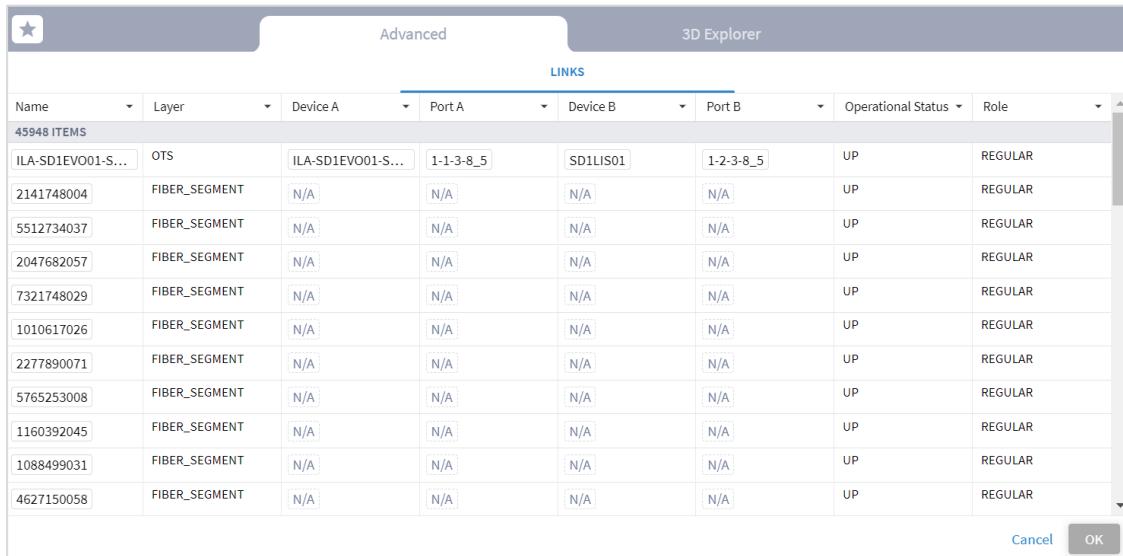
Multiple links Single protected link

Rules

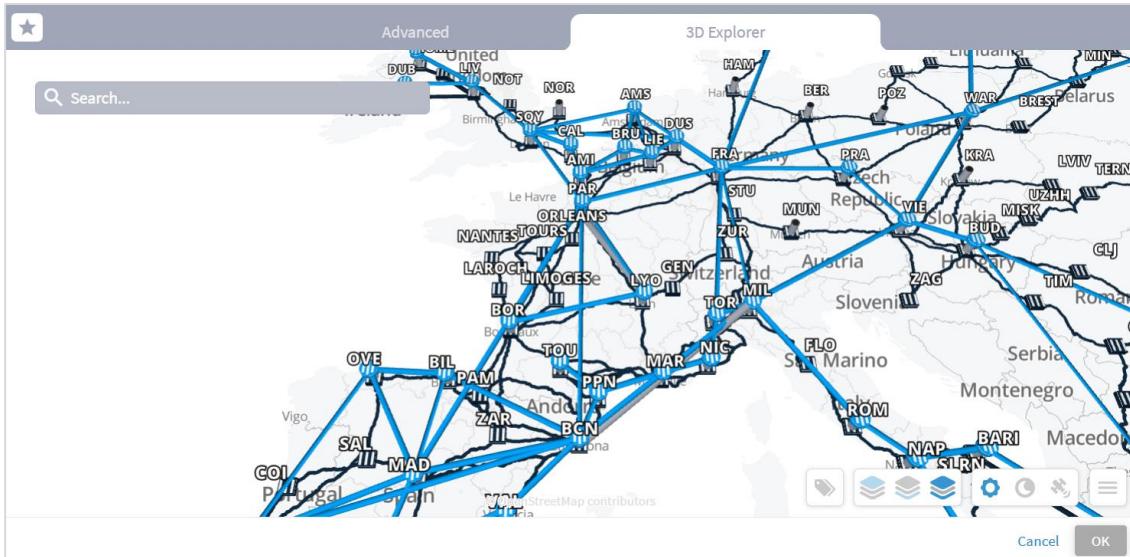
10. Enter a rule **Name**.
11. Click **✓**.
12. Click **▶** to expand the rule.



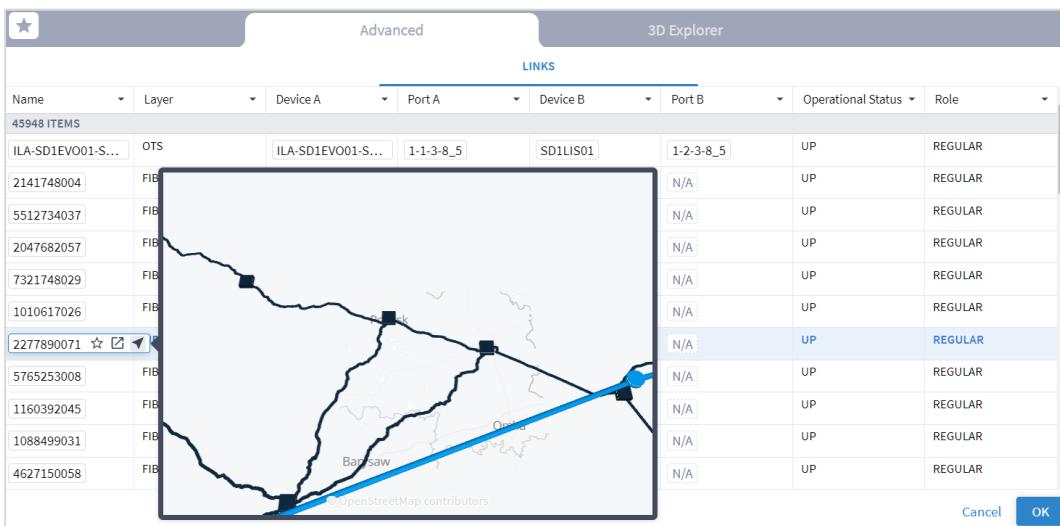
13. Click **Add Resource** to add a resource.



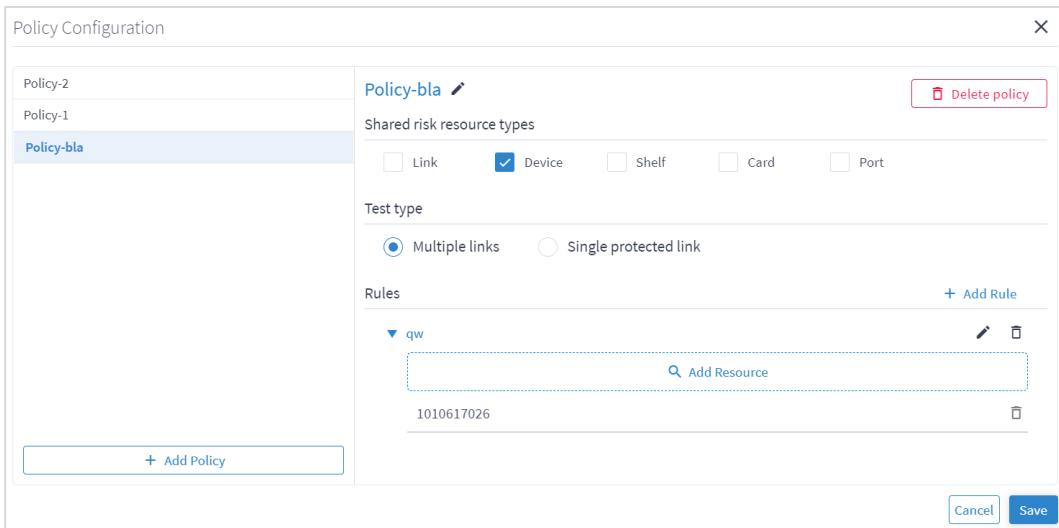
Or select the **3D Explorer** tab.



In the **Advanced** tab, you can select a link and view the link in the popup map.



14. Select a link and click **OK**.



15. If required, add more links to the rule.

16. Click **Save**.

Add Rules using the Shared Risk API

You can add a rule to an existing policy using the Policy API. This enables you to add rules using both GUIDs and/or an SHQL query. For more details, see the *Crosswork Hierarchical Controller NBI and SHQL Guide*.

To add a rule using APIs:

1. Get a list of the policies. See [Get Policies](#).
2. Add a rule to a policy. See [Add a Rule to a Policy](#).
3. You can view the SHQL query in the rule in the Policy Configuration window. See [Edit Policy](#).

Remove Rules

You can remove a rule from a policy.

To remove a rule from a policy:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the **Policy** tab.
3. Click **Configure Policies**.
4. Select the required policy.
5. In the **Rules** area, click .
6. Click **Save**.

Edit Policy

You can edit a policy.

To edit a policy:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the **Policy** tab.
3. Click  **Configure Policies**.
4. Select the required policy.
5. Modify the policy.
6. Click **Save**.

Delete Policy

You can delete a policy.

To delete a policy:

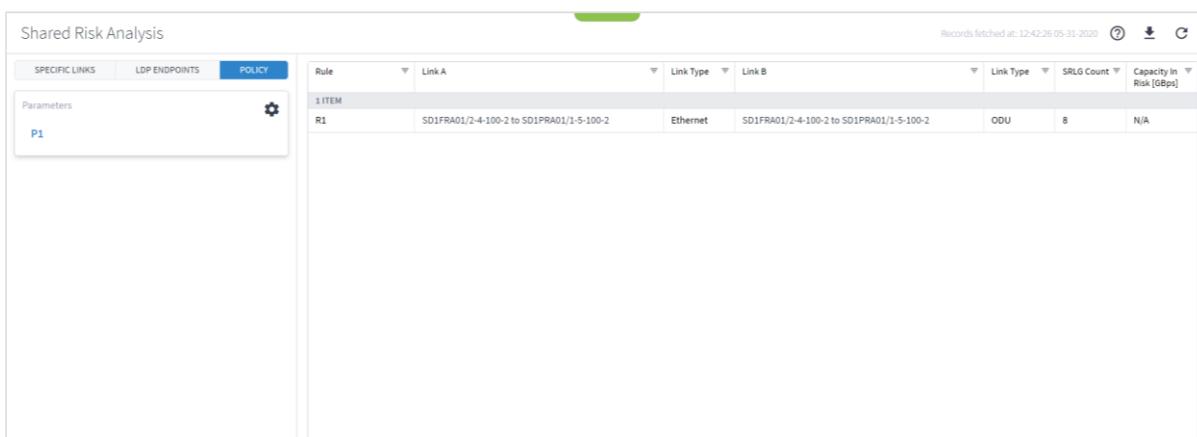
1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the **Policy** tab.
3. Click  **Configure Policies**.
4. Select the required policy.
5. Click **Delete policy**.
6. Click **Save**.

Run Policy Test

You can run a test on a policy, checking for shared risk resources of type link, device, shelf, card, and port. Each policy includes one or more rules.

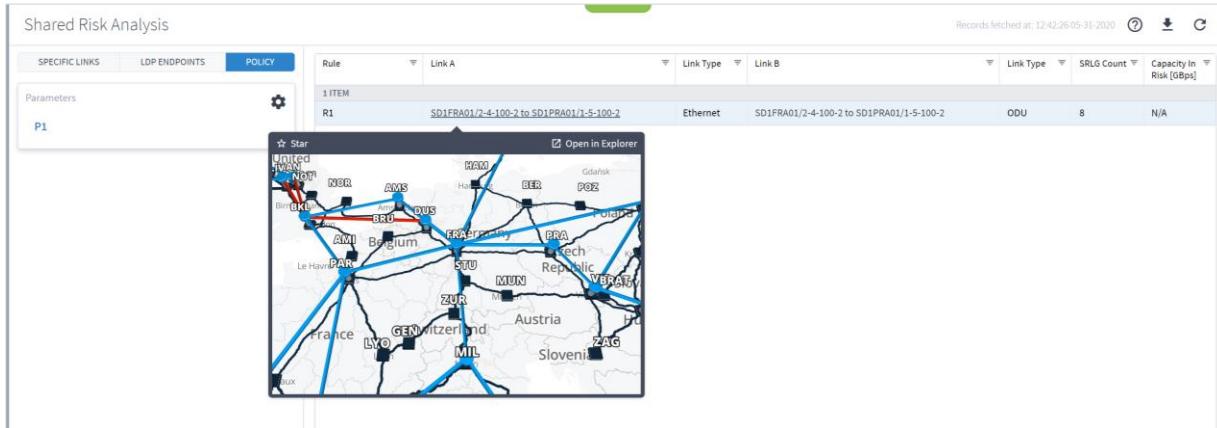
To run a policy test:

1. In the applications bar in Crosswork Hierarchical Controller, select **Shared Risk Analysis**.
2. Select the **Policy** tab.
3. Select the required policy.
4. Click **Run**.



Rule	Link A	Link Type	Link B	Link Type	SRLG Count	Capacity In Risk [Gbps]
R1	SD1FRA01/2-4-100-2 to SD1PRA01/1-5-100-2	Ethernet	SD1FRA01/2-4-100-2 to SD1PRA01/1-5-100-2	ODU	8	N/A

5. In the test results, you can select a link and view the link in the popup map and select a row (and click  to expand) in the test results to see more details on the shared resources.



Shared Risk API

Crosswork Hierarchical Controller provides APIs to administer shared risk policies and rules.

For more details, see the *Cisco Crosswork Hierarchical Controller NBI and SHQL Reference Guide*.

Failure Impact

The Crosswork Hierarchical Controller Failure Impact application allows simulation of resource failures in a multidomain network, pointing to the specific domain in which the failure originated and the impact on services and network resources.

This application simulates the impact of a failure in a selected resource (link, device or site) on one or more network objects in the network where the application searches for alternative path to links or services (both, customer-based and resource-based) over the selected resource and provides results to show the impact on the services. The alternative path can be minimized by latency, number of hops, or admin costs and it is displayed with a comparison of the current path to the alternative found path.

You can also exclude resources from the calculated alternative path by selecting specific resources (objects such as devices, ports, and links) or by using tags as reference to group of resources.

This solves the failure impact problem by providing detailed results that can be acted on. For example, additional links can be added to vulnerable points, and any required changes can be made to the topology. This results in reduced failure impact and increased network reliability.

Run Failure Impact Test

You can run a failure impact test on one or more devices, links and/or sites. The Failure Impact application creates a list of affected services/connections and, if an alternative path exists, the application shows the current and the alternative path for each service/connection.

You can set various options for the test:

- The path optimization criteria (path minimization) can be configured as the number of hops, latency, or admin cost.
- Whether to assess the failure impact by services path or by connections path.
- Depending on the path type selected:
 - Which services to filter by, either E-Line and/or OTN Line or specific services.
 - Which connection type, Ethernet, ODU, OC, and/or LSP, or specific connections.
- Whether to exclude resources from the calculated path(s) selected by:
 - Specific resources selected by the model selector.
 - Use tags.

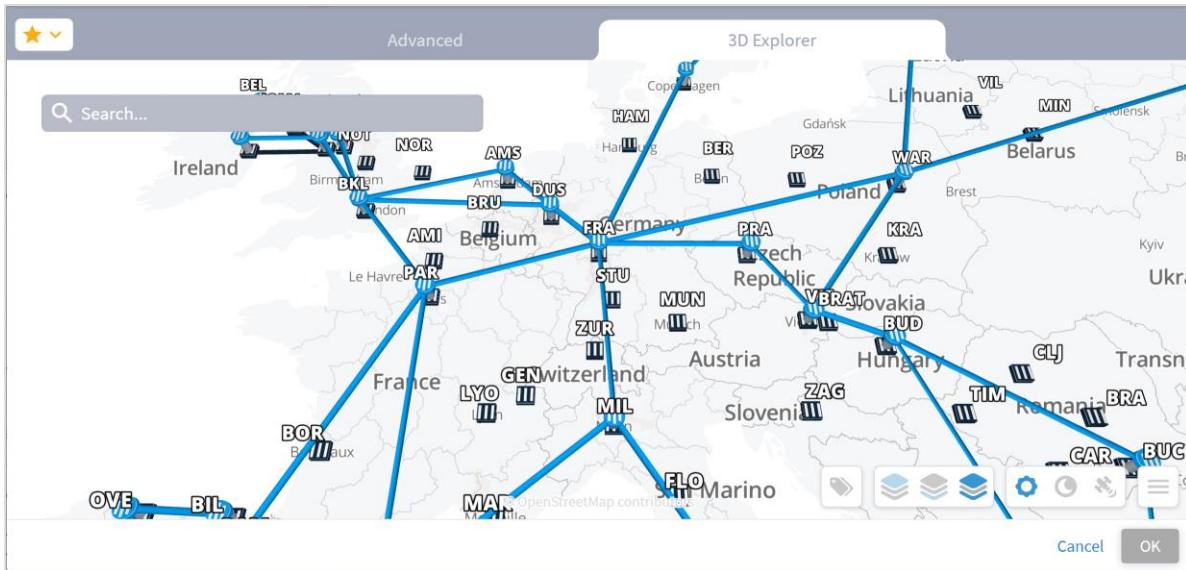
To run a failure impact test:

1. In the applications bar, select **Failure Impact**.

2. In the **Simulated Failures** area, do one of the following:

- Choose **Select specific resource(s)** and then click **Add resource**. In the **Advanced** tab, select a resource, or click on the **3D Explorer** tab to select a resource. You can add up to 10 items.

Name	Type	Description	Site
CR1.COR	IGP		COR
CR2.VIE	IGP		VIE
CR2.OVE	IGP		OVE
ZR_CR2.FRA	ROUTER		FRA
CR2.MAD	IGP		MAD
CR1.OVE	ROUTER		OVE
ER1.TLV	IGP		TLV
ER1.PFU	ROUTER		PFU
CR2.FRA	ROUTER		FRA
	IGP		



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

- Choose **Filter by tag(s)** and then click **Add Tags**, then select a tag and click **OK**. Select more tags if required.

 A screenshot of a 'Tags' dialog box. The top bar has a star icon and the word 'Tags'. Below it is a section titled 'Links' with a dropdown menu showing 'Links' and two checkboxes: 'R_LOG' (checked) and 'Purna'. A table below lists 252 items. The table has columns: Name, Source Device, Destination Device, Oper, Pro, Unc, and Role. The 'Name' column lists various network links, such as '10.40.2.166 to 10.40.2.165', 'ER1.BCN', 'CR2.BCN', 'UP', 'SIN...', '1', 'REG...', and so on. The 'Source Device' and 'Destination Device' columns list the specific device names for each link. The 'Oper' column shows 'UP' for most entries. The 'Pro' column shows 'SIN...' for most entries. The 'Unc' column shows '1' for most entries. The 'Role' column shows 'REG...' for most entries. At the bottom right of the dialog box are 'Cancel' and 'OK' buttons.

Name	Source Device	Destination Device	Oper	Pro	Unc	Role
252 ITEMS						
10.40.2.166 to 10.40.2.165	ER1.BCN	CR2.BCN	UP	SIN...	1	REG...
10.40.3.41 to 10.40.3.42	ER1.HDA	ER1.HEB	UP	SIN...	1	REG...
10.40.2.14 to 10.40.2.13	CR2.LYO	ER1.LYO	UP	SIN...	1	REG...
10.40.2.245 to 10.40.2.246	ER1.MAD	CR1.MAD	UP	SIN...	1	REG...
10.40.0.114 to 10.40.0.113	ZR_CR2.TLN	ZR_CR2.M...	UP	SIN...	1	REG...
10.40.0.41 to 10.40.0.42	ZR_CR2.BCN	ZR_CR2.BIL	UP	SIN...	1	REG...
10.40.1.153 to 10.40.1.154	CR1.MAN	CR2.SQY	UP	SIN...	1	REG...
10.40.2.242 to 10.40.2.241	ZR_CR2.H...	CR2.ATH	UP	SIN...	1	REG...
10.40.0.185 to 10.40.0.186	ZR_CR2.ARN	ZR_CR2.ROT	UP	SIN...	1	REG...
10.40.3.69 to 10.40.3.70	CR1.BIL	CR2.BIL	UP	SIN...	1	REG...
10.40.2.65 to 10.40.2.66	CR1.BIL	CR2.BIL	UP	SIN...	1	REG...

3. Select the **Select path type** (either **Services** or **Connections**).

4. Select the **Filter by type(s)**:

- For services, **E-LINE** and/or **OTN LINE**.
- For connections, **Ethernet**, **ODU**, **OC**, and/or **LSP**.

5. (Optional) For services, select the **Select specific services** and then click **Add service**. In the **Advanced** tab, select a service, or click on the **3D Explorer** tab to select a service. You can add up to 10 items.

Advanced

3D Explorer

E-LINE

OTN Line

Name	Type	Customer Name	Admin Status	Description
1 ITEM				
AcmeMAD-BCN	E_LINE	Acme Finance	UP	AcmeMAD-BCN

Cancel OK

Advanced

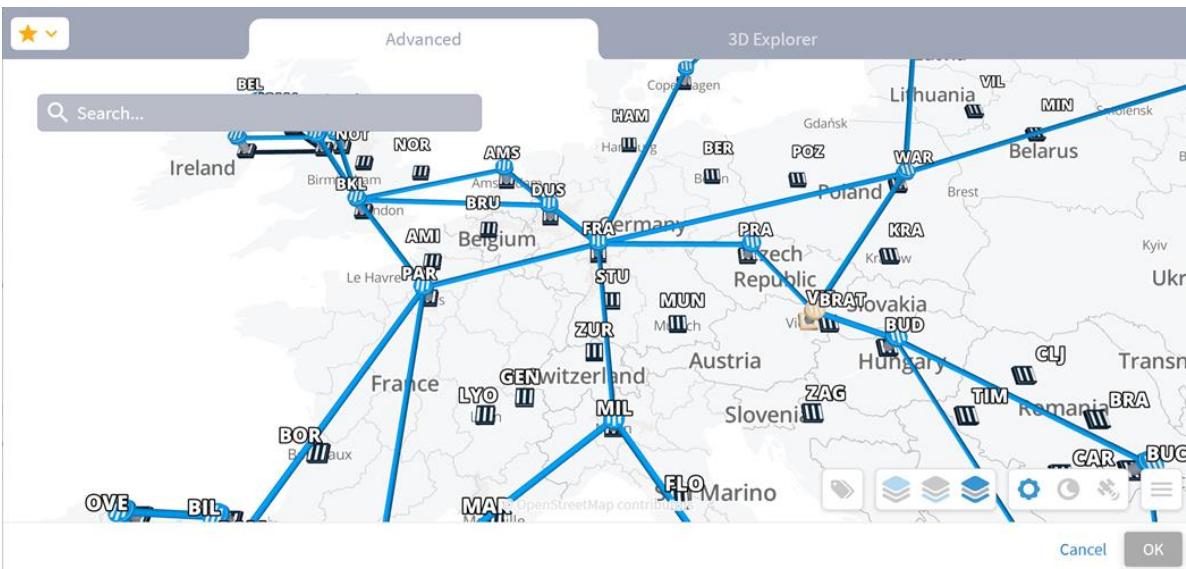
3D Explorer

Search...

Cancel OK

6. (Optional) For connections, select the **Select specific resource(s)** and then click **Add resource**. In the **Advanced** tab, select a resource, or click on the **3D Explorer** tab to select a resource. You can add up to 10 items.

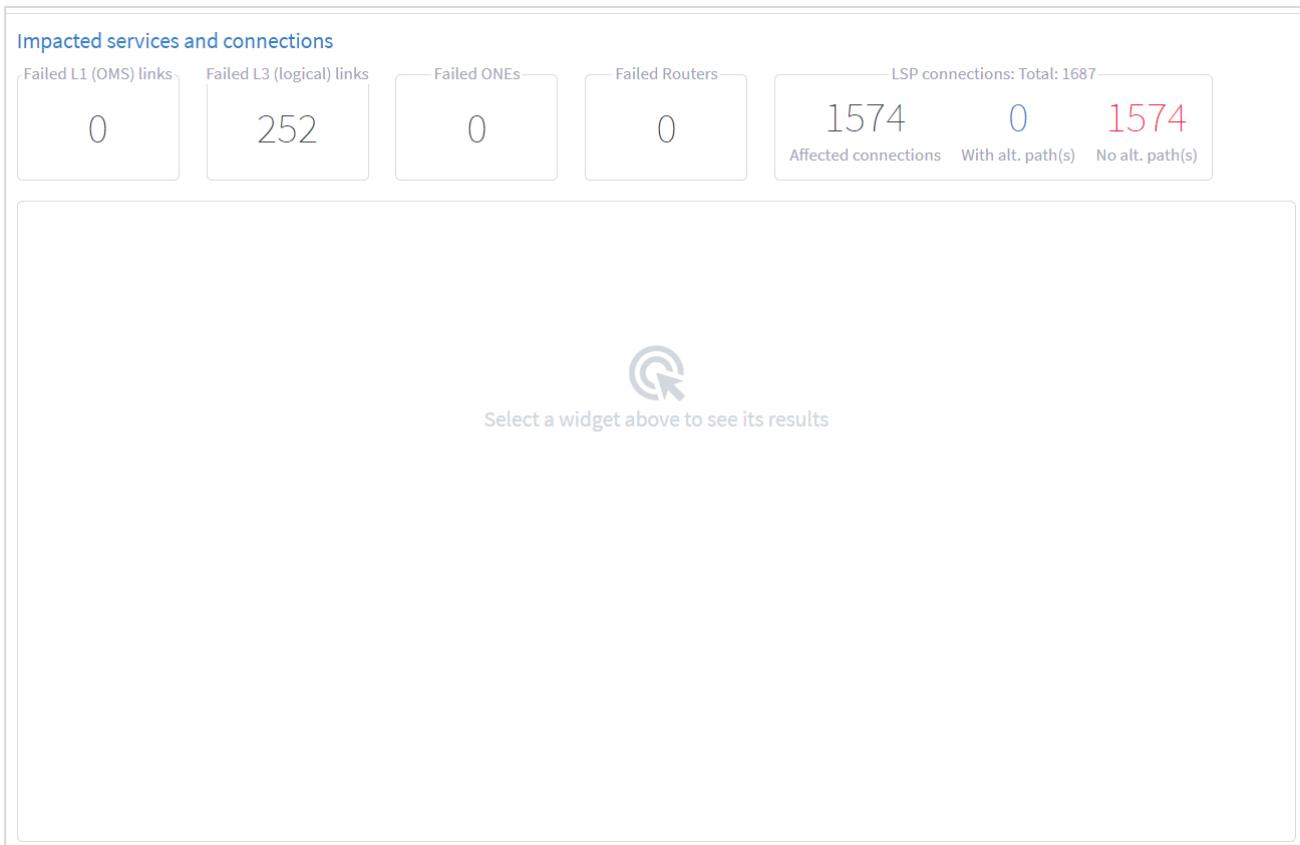
ETHERNET		ODU		OC		LSP	
Name	Layer	Device A	Port A	Device B	Port B	Operational Status	Role
444 ITEMS							
RD_PAR01_AO...	ETH	RD_PAR01_AO...	R-ETH-1-1-21	RD_PRA01_AO...	R-ETH-1-1-13	UP	REGULAR
TenGigE0/0/1...	ETH	ER1.ONO	TenGigE0/0/1/11	SD1ONO01	1-2-4	UP	CROSS_LINK
ZR_CR2.FRA/F...	ETH	ZR_CR2.FRA	FourHundred...	ZR_CR2.MIL	FourHundred...	UP	REGULAR
TenGigE0/0/1/...	ETH	CR1.MAN	TenGigE0/0/1/13	SD1MAN01	1-5-4	UP	CROSS_LINK
OTN1BOR01/1...	ETH	OTN1BOR01	1-4-4	OTN1PAR01	1-5-4	UP	REGULAR
RD_FRA01_AO...	ETH	RD_FRA01_AO...	R-ETH-1-1-17	RD_BLA01_AO...	R-ETH-1-1-17	UP	REGULAR
SD2MM001/ET...	ETH	SD2MM001	ETH-1-1-20	SD2MM002	ETH-1-1-5	UP	CROSS_SUBNET...
SD1BCN01/3-6...	ETH	SD1BCN01	3-6-1	SD1CUP01	1-2-1	UP	REGULAR
SD2HERKL01/...	ETH	SD2HERKL01	ETH-1-1-39	SD2TLV01	ETH-1-1-11	UP	REGULAR



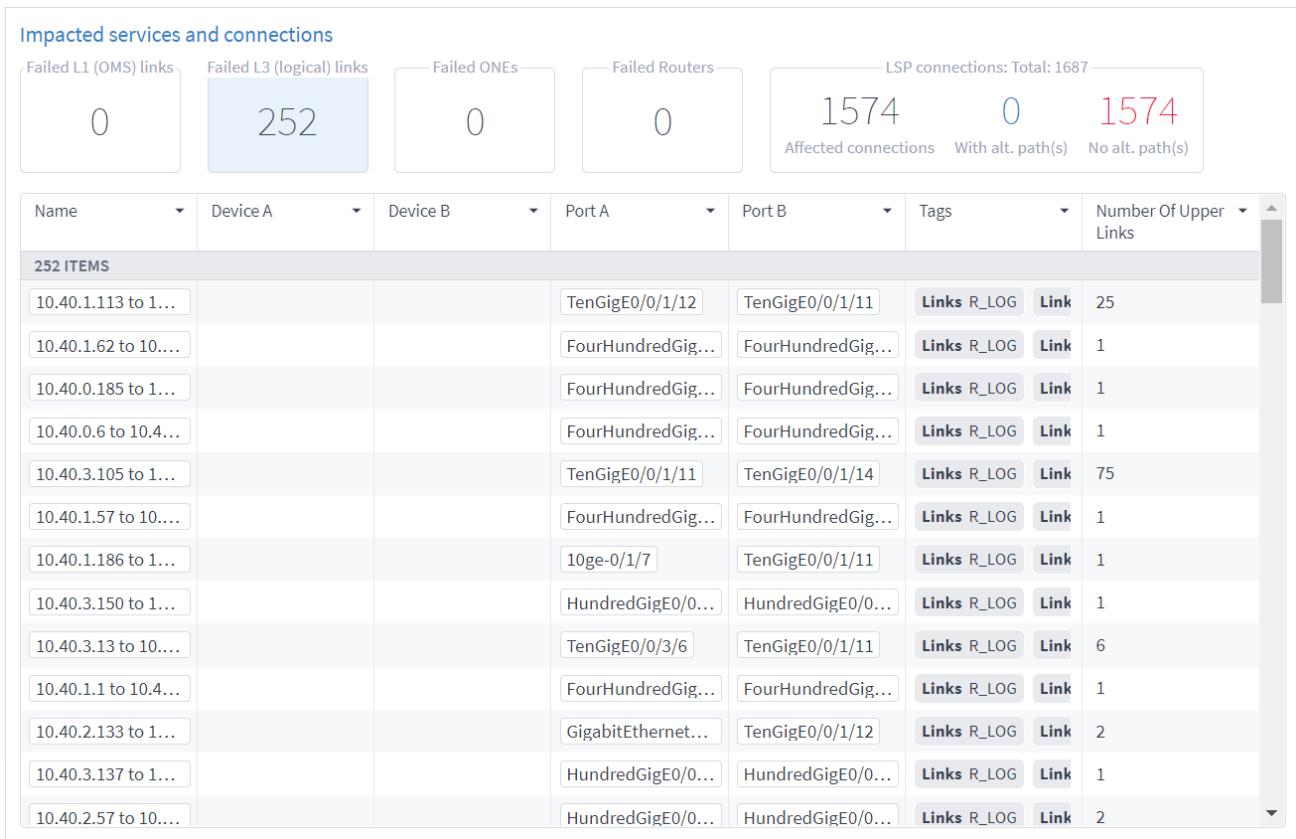
7. (Optional) In the **Exclude resources from calculated path(s)** area, and then:

- Choose **Select specific resource(s)** and then click **Add resource**. In the **Advanced** tab, select a resource, or click on the **3D Explorer** tab to select a resource. You can add up to 10 items.
- Choose **Filter by tag(s)** and then click **Add tag**, then select a tag, select the required tag value and click OK. Add more tags if required.

8. Click **Run**. The impacted services and connections appear, with the root causes listed in the lower pane.



9. Select a widget to see its results.

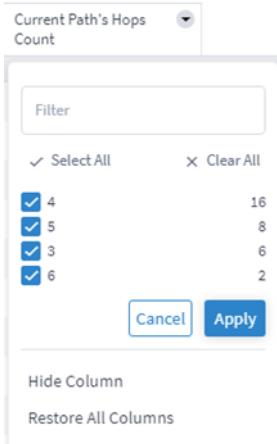


The screenshot shows a dashboard section titled 'Impacted services and connections'. At the top, there are four summary boxes: 'Failed L1 (OMS) links' (0), 'Failed L3 (logical) links' (252), 'Failed ONEs' (0), and 'Failed Routers' (0). To the right, a box displays 'LSP connections: Total: 1687' with sub-categories: 'Affected connections' (1574), 'With alt. path(s)' (0), and 'No alt. path(s)' (1574). Below these are two tables. The first table, titled '252 ITEMS', lists 252 network connections with columns for Name, Device A, Device B, Port A, Port B, Tags, and Number Of Upper Links. The second table, titled 'Affected connections', lists 1574 connections with columns for Connection Type, Connection ID, and Count.

Name	Device A	Device B	Port A	Port B	Tags	Number Of Upper Links
10.40.1.113 to 1...			TenGigE0/0/1/12	TenGigE0/0/1/11	Links R_LOG Link	25
10.40.1.62 to 10....			FourHundredGig...	FourHundredGig...	Links R_LOG Link	1
10.40.0.185 to 1...			FourHundredGig...	FourHundredGig...	Links R_LOG Link	1
10.40.0.6 to 10.4...			FourHundredGig...	FourHundredGig...	Links R_LOG Link	1
10.40.3.105 to 1...			TenGigE0/0/1/11	TenGigE0/0/1/14	Links R_LOG Link	75
10.40.1.57 to 10....			FourHundredGig...	FourHundredGig...	Links R_LOG Link	1
10.40.1.186 to 1...			10ge-0/1/7	TenGigE0/0/1/11	Links R_LOG Link	1
10.40.3.150 to 1...			HundredGigE0/0...	HundredGigE0/0...	Links R_LOG Link	1
10.40.3.13 to 10....			TenGigE0/0/3/6	TenGigE0/0/1/11	Links R_LOG Link	6
10.40.1.1 to 10.4...			FourHundredGig...	FourHundredGig...	Links R_LOG Link	1
10.40.2.133 to 1...			GigabitEthernet...	TenGigE0/0/1/12	Links R_LOG Link	2
10.40.3.137 to 1...			HundredGigE0/0...	HundredGigE0/0...	Links R_LOG Link	1
10.40.2.57 to 10....			HundredGigE0/0...	HundredGigE0/0...	Links R_LOG Link	2

Connection Type	Connection ID	Count
Link	10.40.1.113 to 1...	25
Link	10.40.1.62 to 10....	1
Link	10.40.0.185 to 1...	1
Link	10.40.0.6 to 10.4...	1
Link	10.40.3.105 to 1...	75
Link	10.40.1.57 to 10....	1
Link	10.40.1.186 to 1...	1
Link	10.40.3.150 to 1...	1
Link	10.40.3.13 to 10....	6
Link	10.40.1.1 to 10.4...	1
Link	10.40.2.133 to 1...	2
Link	10.40.3.137 to 1...	1
Link	10.40.2.57 to 10....	2

10. To filter the table, click  and select the required options.

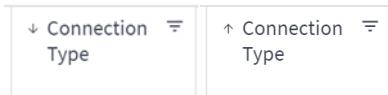


The screenshot shows a 'Current Path's Hops Count' filter dialog. It includes a 'Filter' input field, a 'Select All' checkbox, a 'Clear All' link, and a list of hop counts (4, 5, 3, 6) each with a checkbox. The checkboxes for 4, 5, 3, and 6 are checked. At the bottom are 'Cancel' and 'Apply' buttons, and links for 'Hide Column' and 'Restore All Columns'.

11. To remove a column, click **Hide Column**.

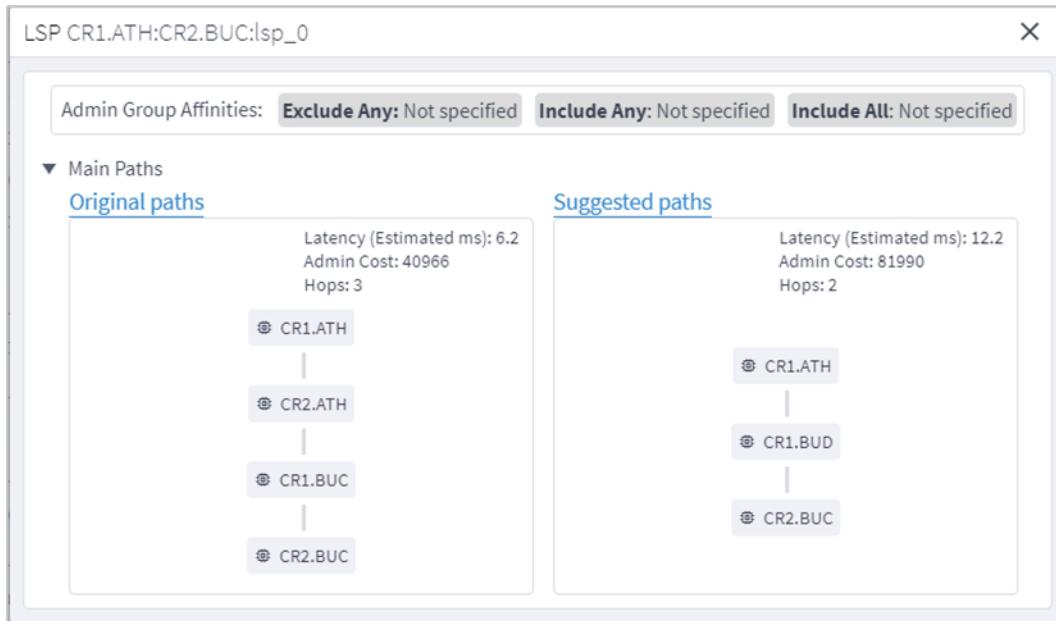
12. To restore all columns, click **Restore All Columns**.

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



The screenshot shows a table with two columns: 'Connection Type' and 'Connection ID'. Each column has a sorting icon (down arrow for descending, up arrow for ascending) at the top.

14. Click to select an item in the list. A list of the **Original paths** and **Suggested paths** appears. The simulated failed links show in purple.



15. Click a resource to view the resource in the 3D Explorer map.

Configure the Failure Impact Settings

You can configure various failure impact settings.

When the actual latency of all the links in a path is not known, a fudge factor for optimal paths latency setting is used to set a best guess distance multiplier for the links with missing latency. This multiplier is applied to the geographical distance between the endpoints of the link, and the factored distance is used to estimate the latency of the link.

Note: Setting a high value for the fudge factor means that such a path is only selected if it is significantly shorter than all other alternatives.

The algorithm for computing approximate latency only uses the fudge factor for the links in the path where the distance and latency are missing and is applied as follows:

- Let $L(X,Y)$ be the geographical distance between endpoints X and Y divided by speed of light in fiber.
- For an OTS link between X and Y, if the latency is missing, use $F*L(X,Y)$
- If a higher layer link Z between X and Y has a direct latency value – use it as it is the most accurate value. Otherwise:
 - If Z has a full path – use the sum of latencies of the links along the path (some of which may have been recursively estimated).
 - If Z has a gap in its path between site X and Y – compute the latency of the gap the same way: $F*L(X,Y)$.
 - If Z does not have a path – use $F*L(X,Y)$ for the latency.

To set the failure impact settings:

1. In the applications bar, select **Failure Impact**.
2. Select the **Settings** tab.

The screenshot shows the 'Failure Impact' settings page. At the top, there are tabs for 'Run Test' and 'Settings', with 'Settings' being the active tab. The page is divided into several sections:

- Path Optimization Criteria:** A dropdown menu is set to 'Number of Hops'.
- Administratively down objects:**
 - Check failure impact on administratively down connections and services**: If selected, the optimizer will include administratively down connections in the list of connections it will try to optimize. A connection is considered administratively down if at least one of its endpoints is in admin down state.
 - Include administratively down links in calculation of alternative path**: If selected, the optimizer evaluates alternative paths for connections, it will include paths that contain links in administratively down state. A link is considered administratively down if at least one of its endpoints is in admin down state.
- Protected Path Diversity Level:** A checkbox group for 'Link', 'Device', and 'Site'. Below it, a note says: 'Select the level in which main and protection paths must be diverse.'
- Protected Path Diversity Policy:** A dropdown menu is set to 'Diversion Policy'.

3. Select the Path Optimization Criteria:

- **Number of Hops:** Optimize by the number of hops.
- **Latency [milliseconds]:** Optimize by the latency.
- **Admin Cost:** Optimize by the admin cost

4. Select how to handle Administratively down objects:

- **Check failure impact on administratively down connections and services:** Select this option to include in recalculation, connections or services that are down (connections and services that at least one of their end ports is administratively down are considered down).
- **Include administratively down links in calculation of alternative path:** Select this option to include links that are down in the calculation of new alternative paths for impacted connections or services (links with at least one of their end ports administratively down are considered down).

5. Sets the level in which the main and protection paths must be diverse by selecting the **Protected Path Diversity Level** (Link, Device, and/or Site). The diversity level selected implies the diversity in all layers, down to fiber path. For example, if link is selected, the algorithm checks that no link is shared in all L3 to L1 layers, down to the physical fiber path (if discovered by Crosswork Hierarchical Controller).

6. Select the **Protected Path Diversity Policy**:

- **Strict:** Only find strictly diverse protection paths.
- **Best Effort:** Find the “best effort” diverse protection paths. This first tries to optimize the protected path diversity taking devices, sites and links into account. If this fails, it tries to

optimize the protected path diversity taking devices and links into account. If this fails, it tries to optimize for links only. If this fails, the protected path diversity does not take devices, sites or links into account.

7. Set the **Unknown Latency Path** options:

- **Fudge factor for the current paths latency:** This is the fudge factor for the current paths latency. Set this fudge factor to high number means that the estimated latency of some links on the current path will be high, and Crosswork Hierarchical Controller will offer potentially optimal paths even if they are not highly likely to be more optimal.
- **Fudge factor for the optimal paths latency:** This is the fudge factor for optimal paths latency. Setting this fudge factor to a high number means that these links will be selected as an alternative only when there is a high likelihood that such a path is indeed shorter than other alternatives.

8. Click **Save Changes**.

Export Test Results

The tabular test results can be exported into a zip file with one or two CSV files for offline analysis. One file includes the services (if you selected the services path type) and the other includes the connections.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1 Execution Parameter	Value													
2 Time	15:14:26 07-20-2020 UTC													
3 Optimization Goal	NUMBER_OF_HOPS													
4 Optimize down services and resources	TRUE													
5 Include down links in calculation of alternatives	TRUE													
6 Latency fudge factor a	3													
7 Latency fudge factor b	2													
8 Protection path diversity level site	FALSE													
9 Protection path diversity level device	FALSE													
10 Protection path diversity level link	FALSE													
11 Protection path diversion policy	Best Effort													
12 Ldp enabled	FALSE													
13 Affected connections	Ethernet													
14 Affected Services	E-Line													
15														
16 Service	Service Type Customer Connector Connector Original Pa Original Pa Original Pa Original Pa Suggested Suggested Suggested Suggested Hops diff [%] Latency diff Admin													
17 AcmeMAD-BCN	E-Line Acme Final Acme MAC Ethernet Main 3 (Main), 9.2 486 Main 3 (Main), 6.1 486 0.0 -33.7 0.0													

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1 Execution Parameter	Value													
2 Time	15:14:26 07-20-2020 UTC													
3 Optimization Goal	NUMBER_OF_HOPS													
4 Optimize down services and resources	TRUE													
5 Include down links in calculation of alternatives	TRUE													
6 Latency fudge factor a	3													
7 Latency fudge factor b	2													
8 Protection path diversity level site	FALSE													
9 Protection path diversity level device	FALSE													
10 Protection path diversity level link	FALSE													
11 Protection path diversion policy	Best Effort													
12 Ldp enabled	FALSE													
13 Affected connections	Ethernet													
14 Affected Services	E-Line													
15														
16 Connection	Connector Protected Original Pa Original Pa Original Pa Original Pa Suggested Suggested Suggested Suggested Hops diff [%] Latency diff Admin Cos Comments													
17 Acme MAD - BCN	Ethernet Yes Main 3 (Main), 9.2 486 Main 3 (Main), 6.1 486 0.0 -33.7 0.0 Protection pa													
18 OTN1MAD01/ to OTN1BCN01/	ODU Yes Main 3 (Main), 9.2 486 Main 3 (Main), 6.1 486 0.0 -33.7 0.0 Protection pa													

Network Vulnerability

A key challenge for operators is how to identify network vulnerabilities and the risk of isolation of routers in case of failures.

This type of problem may arise due to discrepancies between the design and implementation, or simply from design failures. This may cause a whole network domain to be disconnected due to a single failure. These gaps are difficult to identify, leaving the network vulnerable, with a major impact on business.

The Crosswork Hierarchical Controller Network Vulnerability application checks for router segmentation in the event of any combination of L1-3 device/link failures.

The testing can be executed for current conditions, as well as for simulated failures (single and dual), and identifies very specific failures.

This solves the network vulnerability problem by providing detailed results that can be acted on. For example, additional links can be added to vulnerable points, and any required changes can be made to the topology. This results in reduced network vulnerability and increased network reliability.

The Network Vulnerability application discovers routers that are disconnected from the rest of the network, under current network conditions, or those that would be disconnected under one or more simulated resource failures. These conditions are called "network segmentation" or "clustering".

The application finds segmentations that are caused by current network failures. It also uses simulated resource failures to identify potential segmentations that would be caused by these failures.

The application keeps the historical simulations for further analysis.

Run Vulnerability Test

You can run the Network Vulnerability application in real time and select whether to:

- Identify current segmentations in the entire network.
- Check if a single failure will cause a segmentation in the network.
- Test if a dual failure will cause a segmentation.

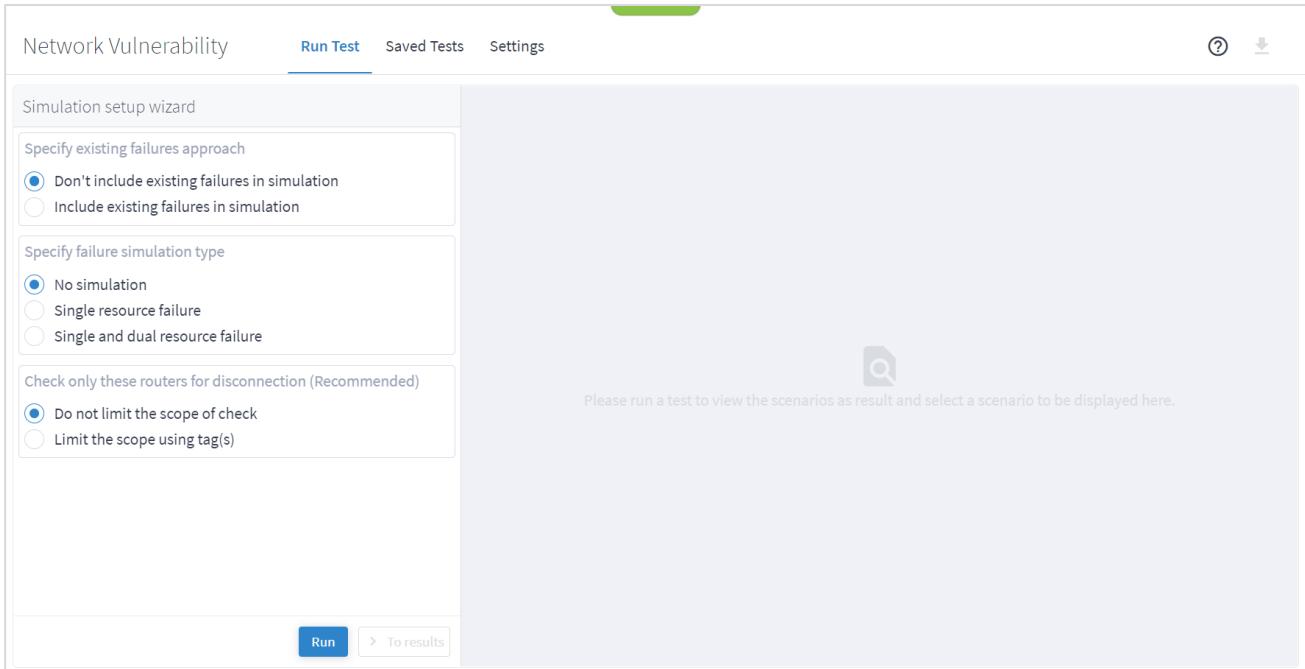
Each failure can be a simulation of a failure for resource types or for specific resources. You can choose whether to test all routers, optical nodes, IP links, and/or optical links, or you can specify a list of up to 20 resources to test by adding their entity names.

The test, based on the selected options, returns a list of scenarios. A scenario is a specific group of one or more routers that will be disconnected due to one or more failed resources. Each scenario may include a list of routers that currently are disconnected or would be isolated/disconnected due to simulated failures (single or dual), given the selected resources types or resources. Scenarios are ordered by the total number of disconnected routers per scenario and the total bandwidth lost. For a specific scenario, the causes list the resources that were they to fail, would cause the routers to be disconnected.

Tests are run on the network as it appears in the network model. Networks that are already segmented and split into isolated islands with no links between them, are not considered a failure. The largest group of linked routers is 'the' network and any smaller groups that are vulnerable to being parted from the network are counted as disconnected.

To run the vulnerability test:

1. In the applications bar, select **Network Vulnerability**.



2. In the **Run Test** left pane, choose the existing failures approach for simulations:

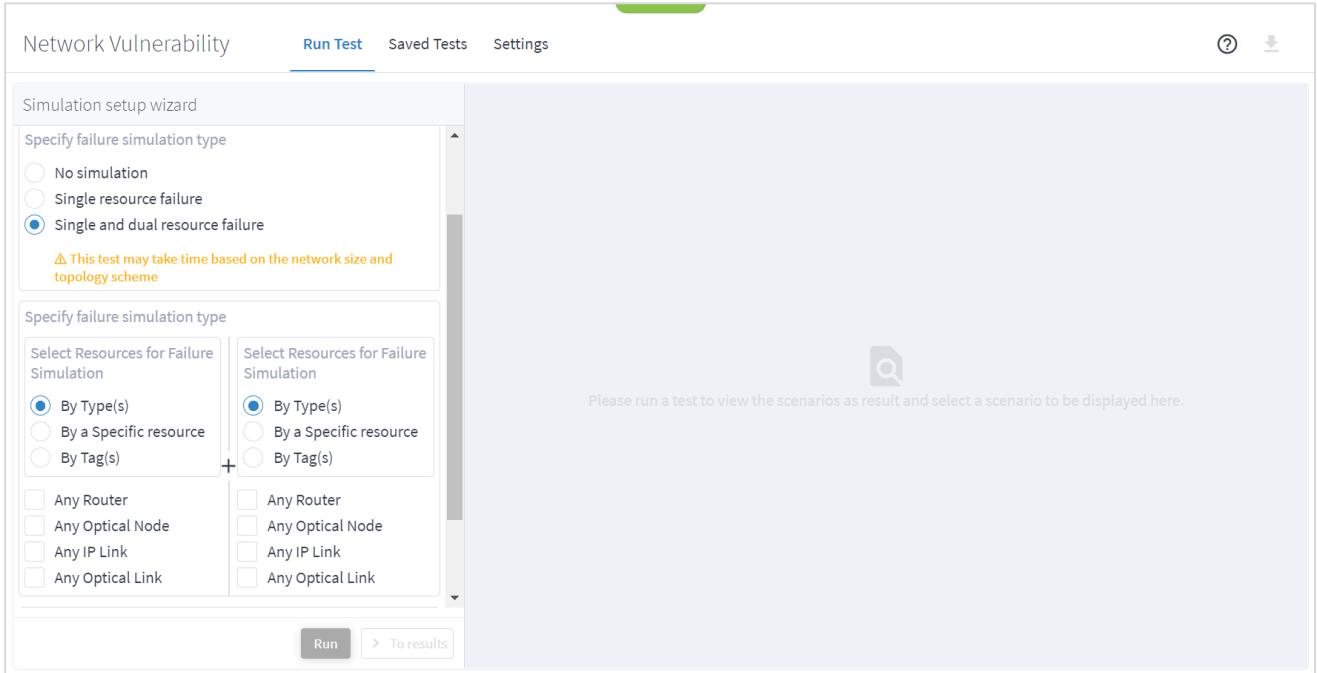
- **Don't include existing failures in simulations:** Select this option to treat all routers or links as "up" for the purposes of the simulation.
- **Include existing failures in simulation:** Select this option to check if there are routers that are currently isolated/disconnected due to any IP or optical link with operational state down and include them as such in the simulation.

For example, if there is a router with two links, and the status of one of the links is down, if the Include existing failures in simulation option is selected, the router is isolated. If the Don't include existing failures in simulation option is selected, and the Single resource failure or Single and dual resource failure option is selected, the router is connected.

3. Select the type of test and which resources to run the test on:

- **No simulation:** Only run current failures.
- **Single resource failure:** Checks if there is any router or group of routers that will be disconnected from the network on failure of a single resource of the selected types (routers, optical nodes, IP links, and/or optical links).
- **Single and dual resource failure:** Checks if there is any router or group of routers that will be disconnected from the network on failure of a single resource or dual resources of the selected types (routers, optical nodes, IP links, and/or optical links). You can select different types for the first and second failure.

4. If you selected **Single resource failure** or **Single and dual resource failure** select the required inventory types.



Network Vulnerability

Run Test Saved Tests Settings

Simulation setup wizard

Specify failure simulation type

No simulation
 Single resource failure
 Single and dual resource failure

⚠ This test may take time based on the network size and topology scheme

Specify failure simulation type

Select Resources for Failure Simulation

By Type(s)
 By a Specific resource
 By Tag(s)

+ Select Resources for Failure Simulation

By Type(s)
 By a Specific resource
 By Tag(s)

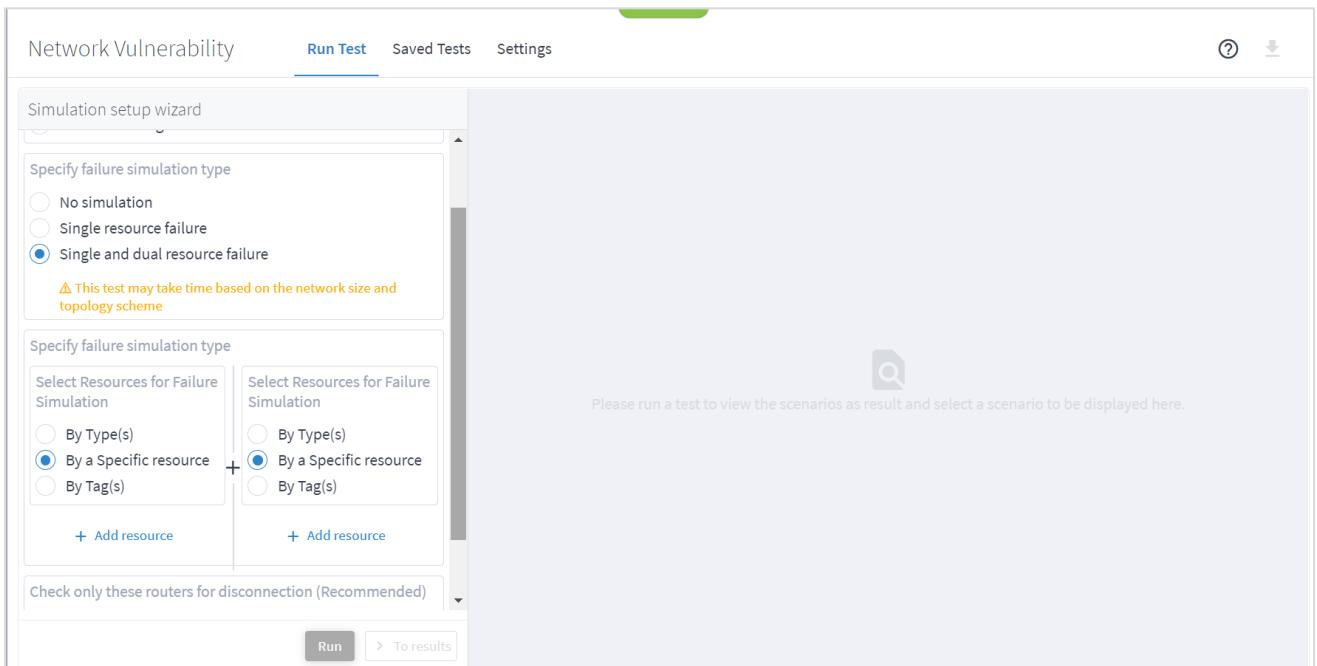
+ Any Router
 Any Optical Node
 Any IP Link
 Any Optical Link

+ Any Router
 Any Optical Node
 Any IP Link
 Any Optical Link

Please run a test to view the scenarios as result and select a scenario to be displayed here.

Run To results

5. (Optional) Select **By a specific resource**. You can add up to 20 resources. This checks if there are routers that will be disconnected from the network on failure of the selected resources.



Network Vulnerability

Run Test Saved Tests Settings

Simulation setup wizard

Specify failure simulation type

No simulation
 Single resource failure
 Single and dual resource failure

⚠ This test may take time based on the network size and topology scheme

Specify failure simulation type

Select Resources for Failure Simulation

By Type(s)
 By a Specific resource
 By Tag(s)

+ Select Resources for Failure Simulation

By Type(s)
 By a Specific resource
 By Tag(s)

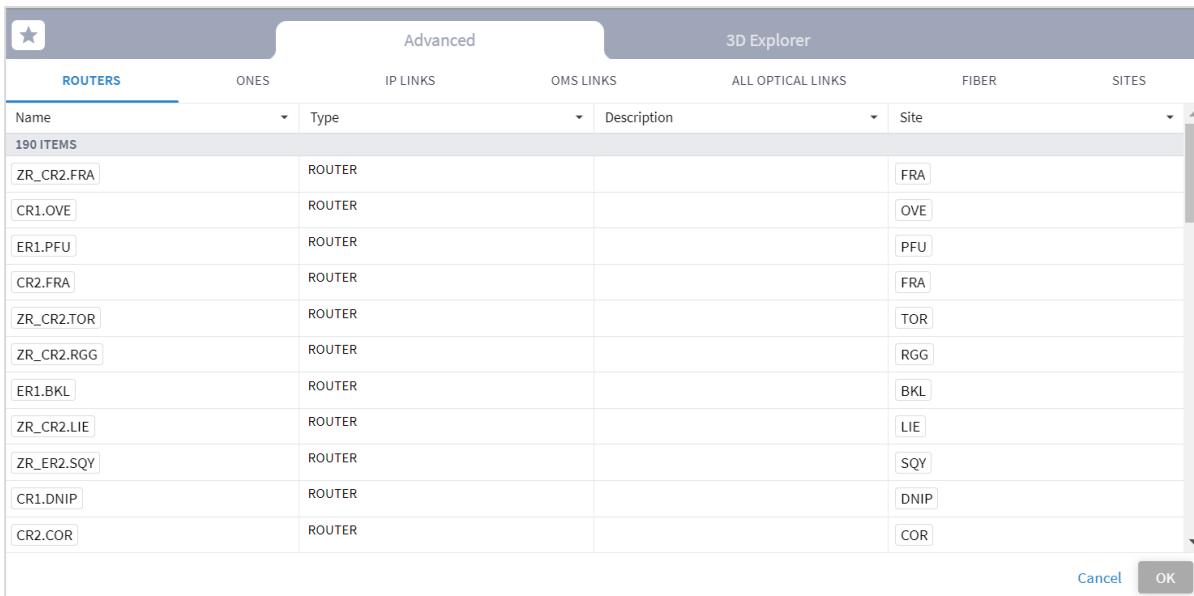
+ Add resource + Add resource

Check only these routers for disconnection (Recommended)

Please run a test to view the scenarios as result and select a scenario to be displayed here.

Run To results

6. Click **Add resource** to select the required resources.



The screenshot shows a dialog box with the title 'Add resource'. At the top, there are tabs for 'Advanced' and '3D Explorer'. The 'Advanced' tab is selected, displaying a table with the following columns: Name, Type, Description, and Site. The table contains 190 items, all of which are routers. The routers are categorized by site: FRA (5 items), OVE (3 items), PFU (2 items), FRA (2 items), TOR (2 items), RGG (1 item), BKL (1 item), LIE (1 item), SQY (1 item), DNIP (1 item), and COR (1 item). The '3D Explorer' tab is visible at the top right. At the bottom right of the dialog box are 'Cancel' and 'OK' buttons.

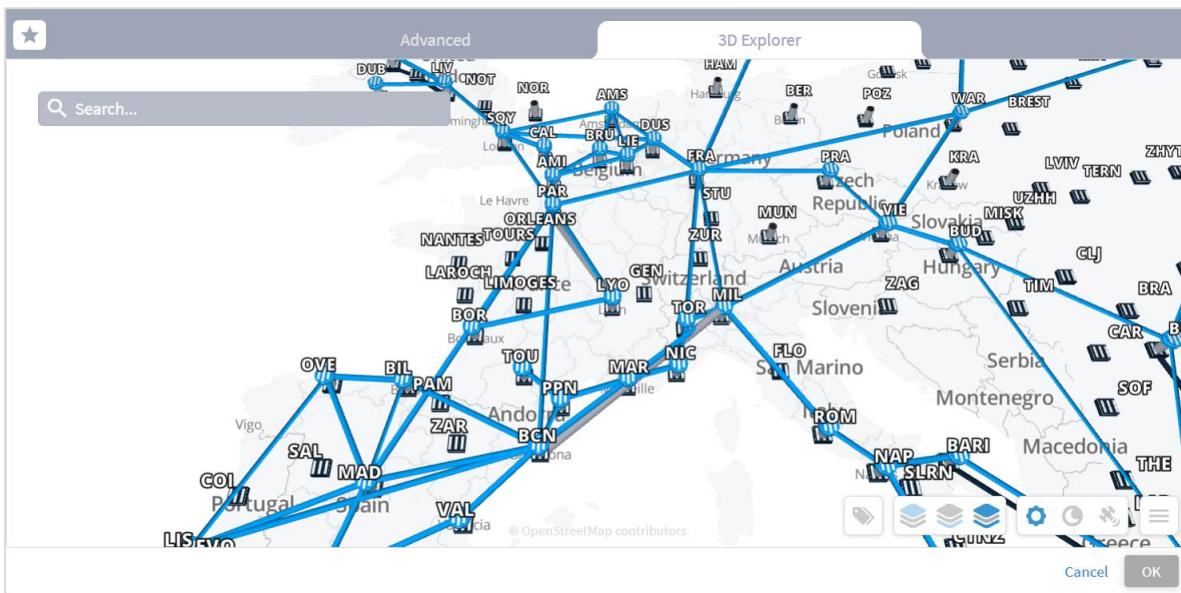
Name	Type	Description	Site
ZR_CR2.FRA	ROUTER		FRA
CR1.OVE	ROUTER		OVE
ER1.PFU	ROUTER		PFU
CR2.FRA	ROUTER		FRA
ZR_CR2.TOR	ROUTER		TOR
ZR_CR2.RGG	ROUTER		RGG
ER1.BKL	ROUTER		BKL
ZR_CR2.LIE	ROUTER		LIE
ZR_ER2.SQY	ROUTER		SQY
CR1.DNIP	ROUTER		DNIP
CR2.COR	ROUTER		COR

7. Select a resource and click **OK**.

Or

Select the **3D Explorer** tab and select the required resource and click **OK**.

Note: You cannot run the test on an LSP link or an L3 Logical link.



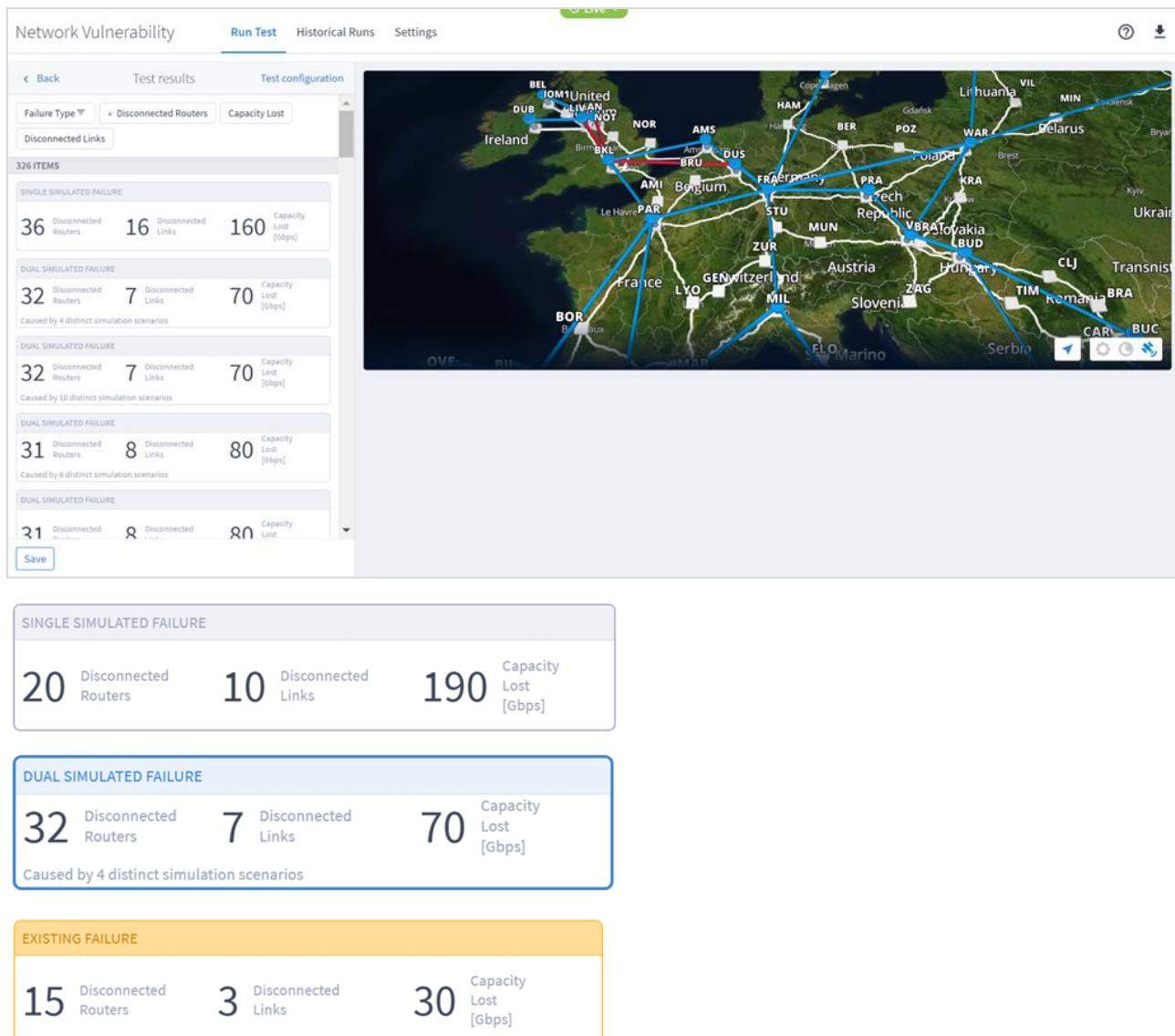
The screenshot shows the '3D Explorer' tab of the dialog box. It displays a map of Europe with numerous routers represented by blue icons and labeled with three-letter codes. The routers are interconnected by a network of blue lines, forming a complex mesh. The map includes labels for major cities and countries. At the bottom of the map, there are several icons representing different types of resources. The 'Advanced' tab is visible at the top left. At the bottom right of the dialog box are 'Cancel' and 'OK' buttons.

8. (Optional) You can add up to 20 items. Click **Add resource** and repeat the steps above.

9. (Optional) To delete a failed item, click .

10. Click **Run Test**. The test runs and a list of scenarios appears. A scenario is any group of one or more routers that will be disconnected due to one or more failed resources.

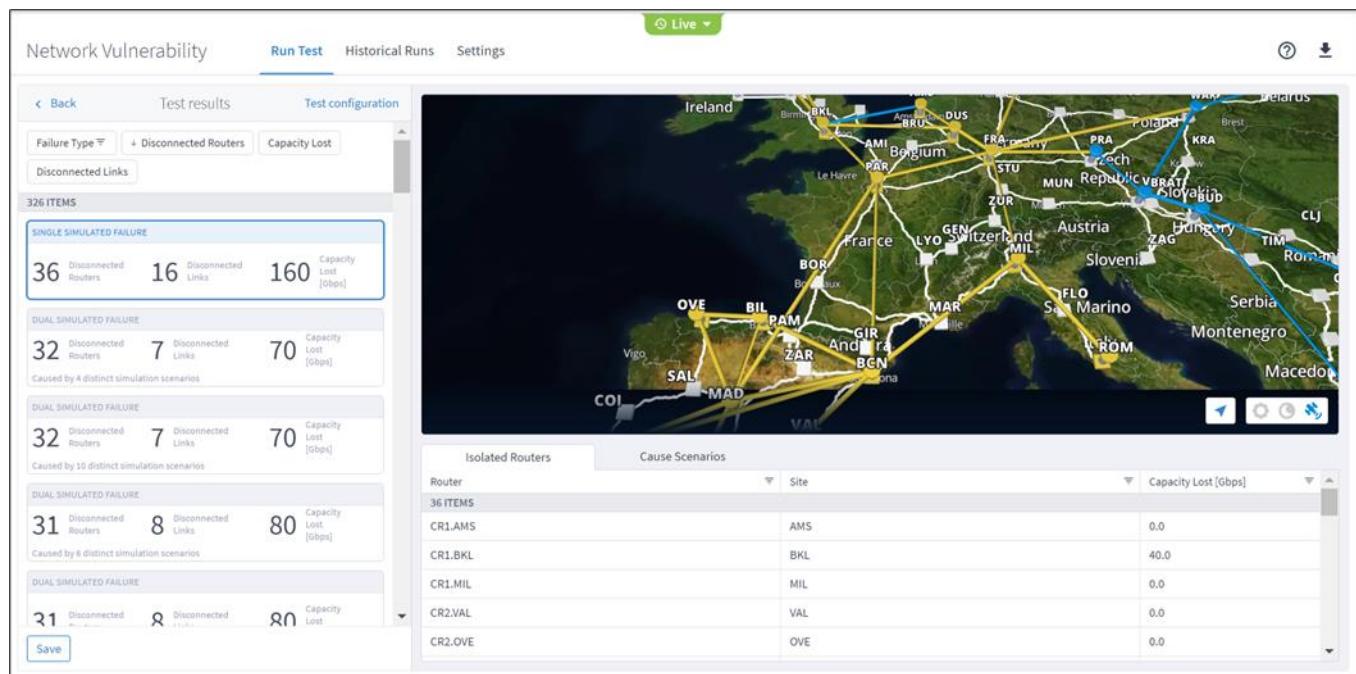
Note: If you close the application or log out while the test is running, the test continues running and is saved in the test list (with the results) so that you can see it when you log in the next time.



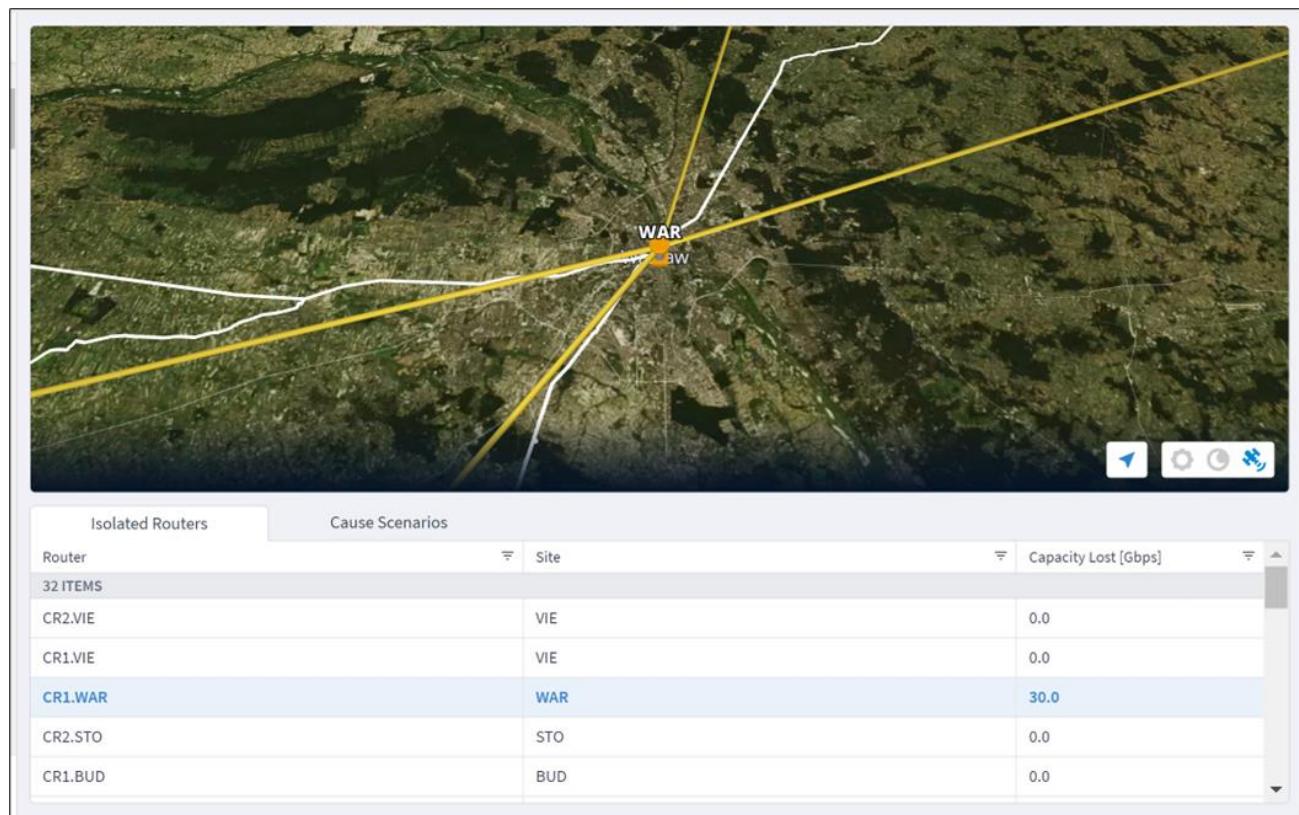
A simulated failure lists the following:

- The failure type – **Dual Simulated Failure** or **Single Simulated Failure** or **Existing Failure**.
- The number of disconnected routers.
- The number of disconnected links.
- The capacity lost (Gbps).
- The number of distinct simulation scenarios.

11. Click an item to view the details for the required scenario.

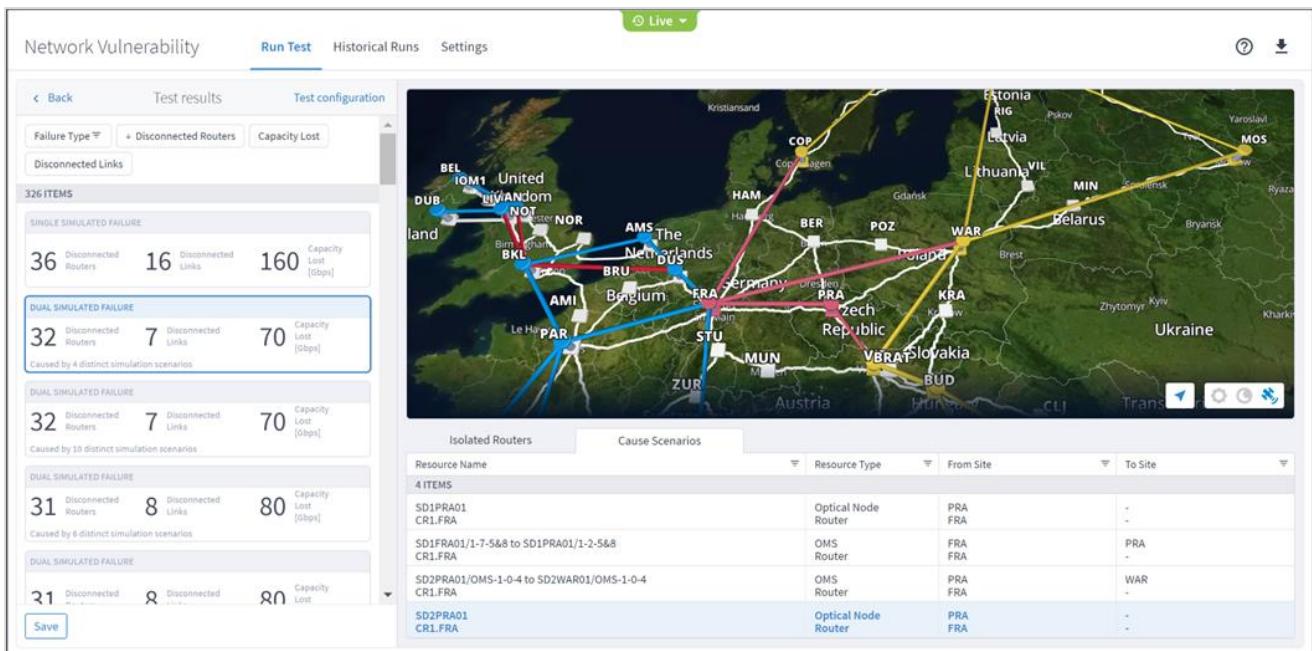


12. The **Isolated Routers** tab lists the routers, sites and lost capacity. Click on a router to zoom in on the Explorer map.



13. Select the **Cause Scenarios** tab to view a list of the scenarios with the resource names, resource type, from site and to site.

14. Click to select a scenario in the list. The isolated routers are shown in yellow and the underlying scenario that causes the failure is shown in pink.



15. To filter the table, click and select the required options.

Resource Type

Select All Clear All

<input checked="" type="checkbox"/> Optical Node	Optical Node	2
<input checked="" type="checkbox"/> OMS Optical Node	Optical Node	2
<input checked="" type="checkbox"/> Optical Node OMS	Optical Node	2
<input checked="" type="checkbox"/> OMS OMS	Optical Node	2

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

17. To return to the test setup, click **Back**.

Save Vulnerability Test

You can save your test. Enter a unique name for the test. You can then view the test results or use it as a basis for an automatic periodic test. See [Network Vulnerability Settings](#). You can save up to 20 historical tests.

To save a test:

1. In the applications bar, select **Network Vulnerability**.
2. Run the test. See [Run Vulnerability Test](#).
3. Click **Save**.
4. Enter a unique test name.

5. Click **Save**.

View Saved Tests

Up to 20 tests can be saved and displayed. If you apply the time machine in Explorer, the list of the runs includes tests that were saved before the selected time.

To view historical runs:

1. Click **Saved Tests**. A list of the tests appears in the left pane.

Test Name	Date	Scenarios	Disconnected Routers	Description
New Test 5 (Completed)	2022-11-08 19:52	1 Scenarios	32 Disconnected Routers	Current Failures: Find which routers are currently disconnected, Failures Simulation: Single
2	2022-11-08 18:16	0 Scenarios	0 Disconnected Routers	Current Failures: Find which routers are currently disconnected, Failures Simulation: No simulation
1	2022-11-08 18:16	0 Scenarios	0 Disconnected Routers	Current Failures: Ignore operational status of links, Failures Simulation: No simulation

The list details:

- Test name
 - Test date and time
 - No. of scenarios
 - Total no. of disconnected routers (for all scenarios)
 - Test type
2. Select a test to view the test details. The same details appear for the historical runs as for the real time test. For details on this page, see [Run Vulnerability Test](#).
 3. To view the test configuration, click **Test configuration**.

4. To return to the list of tests, click **Back**.
5. To re-run the test, click **Re-run test**.
6. To delete the test, click **Remove Test**.

Export Test Results

The tabular test results can be exported into a zip file with one summary CSV file and one CSV file per failure.

Name	Size	Pac...	Type	Modified	CRC32
...					Local Disk
summary_2020-07-26_18-37-48.csv	1,958	615	Microsoft Excel C...	26/07/2020 18...	66F3B9D4
failure_id_78_2020-07-26_18-37-48.csv	1,133	541	Microsoft Excel C...	26/07/2020 18...	5C7DE1F4
failure_id_77_2020-07-26_18-37-48.csv	1,233	566	Microsoft Excel C...	26/07/2020 18...	5534B960
failure_id_76_2020-07-26_18-37-48.csv	1,584	631	Microsoft Excel C...	26/07/2020 18...	66899CA6
failure_id_75_2020-07-26_18-37-48.csv	1,596	620	Microsoft Excel C...	26/07/2020 18...	5DC65BC6
failure_id_74_2020-07-26_18-37-48.csv	1,133	539	Microsoft Excel C...	26/07/2020 18...	3D31681E
failure_id_73_2020-07-26_18-37-48.csv	1,137	534	Microsoft Excel C...	26/07/2020 18...	18B62AE6
failure_id_72_2020-07-26_18-37-48.csv	1,121	528	Microsoft Excel C...	26/07/2020 18...	29439AF4
failure_id_71_2020-07-26_18-37-48.csv	1,137	546	Microsoft Excel C...	26/07/2020 18...	A39BD130
failure_id_70_2020-07-26_18-37-48.csv	1,225	577	Microsoft Excel C...	26/07/2020 18...	3AEC8222
failure_id_69_2020-07-26_18-37-48.csv	1,021	491	Microsoft Excel C...	26/07/2020 18...	8B22E1FE
failure_id_68_2020-07-26_18-37-48.csv	1,085	526	Microsoft Excel C...	26/07/2020 18...	473AA068
failure_id_67_2020-07-26_18-37-48.csv	1,125	534	Microsoft Excel C...	26/07/2020 18...	5AAC1375
failure_id_66_2020-07-26_18-37-48.csv	1,137	545	Microsoft Excel C...	26/07/2020 18...	819F5691
failure_id_65_2020-07-26_18-37-48.csv	1,149	538	Microsoft Excel C...	26/07/2020 18...	82ACC708
failure_id_64_2020-07-26_18-37-48.csv	1,139	540	Microsoft Excel C...	26/07/2020 18...	1A4AF376
failure_id_63_2020-07-26_18-37-48.csv	1,117	528	Microsoft Excel C...	26/07/2020 18...	99BFF760
failure_id_62_2020-07-26_18-37-48.csv	1,135	539	Microsoft Excel C...	26/07/2020 18...	7B1774BE
failure_id_61_2020-07-26_18-37-48.csv	1,125	533	Microsoft Excel C...	26/07/2020 18...	3240322B
failure_id_60_2020-07-26_18-37-48.csv	1,311	588	Microsoft Excel C...	26/07/2020 18...	7AB2A217
failure_id_59_2020-07-26_18-37-48.csv	1,285	572	Microsoft Excel C...	26/07/2020 18...	D42997D0
failure_id_58_2020-07-26_18-37-48.csv	1,275	555	Microsoft Excel C...	26/07/2020 18...	B0DC10FB
failure_id_57_2020-07-26_18-37-48.csv	1,535	630	Microsoft Excel C...	26/07/2020 18...	89F26EFD

A	B	C	D	E	F	G	H
1	Execution	Value					
2	Test Name	REALTIME					
3	Test Type	Current Failures: Find which routers are currently disconnected, Failures Simulation: Single					
4	Time	26/07/2020 18:37					
5							
6	Failure ID	Disconnected Routers	Failure Type	Cause	Scrn Total	Capa	Disconnected Physical Links
7	0	15	Existing	1	30	3	
8	1	12	Single	1	20	2	
9	2	5	Single	1	200	2	
10	3	1	Single	1	10	1	
11	4	2	Single	1	110	2	
12	5	14	Single	1	110	2	
13	6	1	Single	1	100	1	
14	7	6	Single	1	10	1	
15	8	15	Single	1	10	1	
16	9	2	Single	1	10	1	
17	10	2	Single	1	110	2	
18	11	3	Single	1	20	2	
19	12	2	Single	1	110	2	
20	13	2	Single	1	150	6	
21	14	3	Single	1	50	5	
22	15	3	Single	1	10	1	

summary_2020-07-26_18-37-48 

A	B	C	D	E	F	G	H
1	Execution	Value					
2	Test Name	REALTIME					
3	Test Type	Current Failures: Find which routers are currently disconnected, Failures Simulation: Single					
4	Time	26/07/2020 18:37					
5	Failure ID	78					
6	Disconnect	1					
7							
8	Case	Case Type	Largest Seg	Isolated Seg	Caused By	Simulated Down Links	
9		0 Simulated Dual Failure	65	Group #1: Router	Phys.		
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
failure_id_78_2020-07-26_18-37-		⊕					

To export the test results:

1. In the applications bar, select **Network Vulnerability**.
2. Run the required test or locate the historical test.
3. Click . The file is downloaded automatically.

Delete Test

You can save up to 20 historical tests. If you try to save a test once 20 tests are saved, you will be required to delete a test before you can save another one.

To delete a test:

1. In the applications bar, select **Network Vulnerability**.
2. Click **Historical Runs**.
3. Select a test.
4. Click to delete the test.

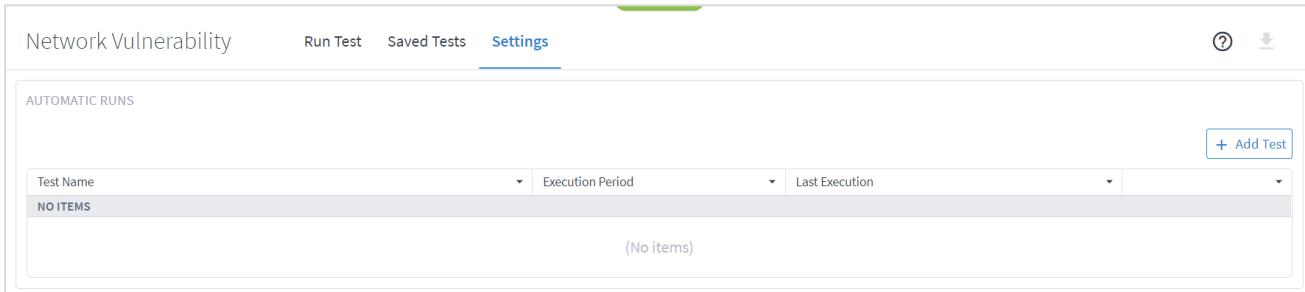
Network Vulnerability Settings

You can select a historical test and automatically execute it periodically (once a day or once a week). The test results are automatically saved, overwriting the previous automatic test results. You can view a list of automatic tests. The list details the test name, execution period and last execution time.

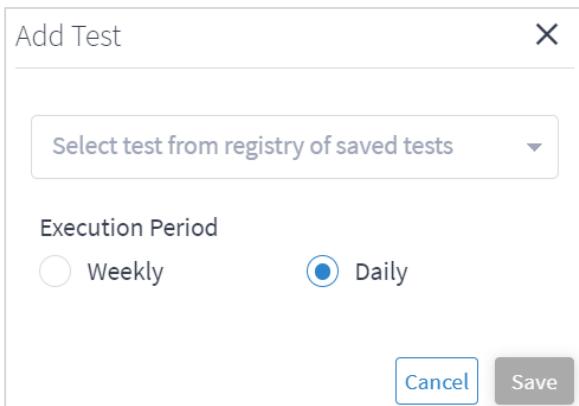
The test runs at the time of day that it was created, for example, if a test is added at 14:31:07, it will be executed on a daily base starting at 14:31:07.

To add an automatic test:

1. In the applications bar, select **Network Vulnerability**.
2. Click **Settings**.



3. Click **Add Test**.



4. Select the test.
5. Select whether to execute the test **Weekly** or **Daily**.
6. Click **Save**.

To delete an automatic test:

1. In the applications bar, select **Network Vulnerability**.
2. Click **Settings**.
3. Click .

To export the test results:

1. In the applications bar, select **Failure Impact**.
2. Run the required test.

3. Click . The file is downloaded automatically

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

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

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at <https://www.cisco.com/go/offices>.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <https://www.cisco.com/go/trademarks>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)