



SR-MPLS and SRv6

This section describes the SR-MPLS and SRv6 policy features that Crosswork Optimization Engine supports. For a list of known limitations and important notes, see the [Cisco Crosswork Optimization Engine Release Notes](#) [Cisco Crosswork Network Controller Release Notes](#).

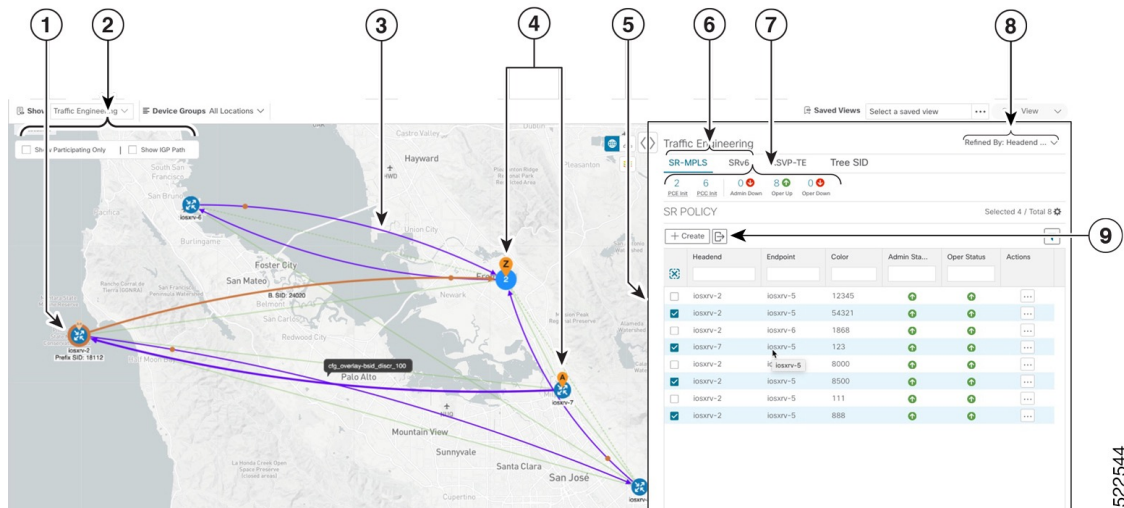
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View SR-MPLS and SRv6 Policies on the Topology Map

Crosswork Optimization Engine visualization provides the most value by giving you the ability to easily view and manage SR-MPLS and SRv6 policies. By visually examining your network, the complexity of provisioning and managing these SR-TE policies is significantly reduced.

To get to the Traffic Engineering topology map, choose **Traffic Engineering** > **Traffic Engineering** > **Traffic Engineering**.

Figure 1: Traffic Engineering UI : SR-MPLS and SRv6 Policies



Callout No.	Description
1	A device with an orange () outline indicates there is a node SID associated with that device or a device in the cluster.
2	Click the appropriate check box to enable the following options: <ul style="list-style-type: none"> • Show IGP Path—Displays the IGP path for the selected SR-TE policy. • Show Participating Only—Displays only links that belong to selected SR-TE policy. All other links and devices disappear.
3	When SR-TE policies are selected in the SR-MPLS or SRv6 tables, they show as purple directional lines on the map indicating source and destination. An adjacency segment ID (SID) is shown as an orange circle on a link along the path ()
4	SR-MPLS and SRv6 Policy Origin and Destination: If both A and Z are displayed in a device cluster, at least one node in the cluster is a source and another is a destination. The A+ denotes that there is more than one SR-TE policy that originates from a node. The Z+ denotes that the node is a destination for more than one SR policy.
5	The content of this window depends on what has been selected or filtered. In this example, the SR-MPLS tab is selected and the SR Policy table is displayed.
6	Click on either the SR-MPLS or SRv6 tabs to view the respective list of SR-TE policies.
7	The Mini Dashboard provides a summary of the operational SR-MPLS or SRv6 policy status. If filters are applied, the Mini Dashboard is updated to reflect what is displayed in the SR Policy and SRv6 Policy tables. In addition to the policy status, the SR-MPLS Mini Dashboard table displays the number of PCC and PCE initiated tunnels that are <i>currently</i> listed in the SR Policy table.

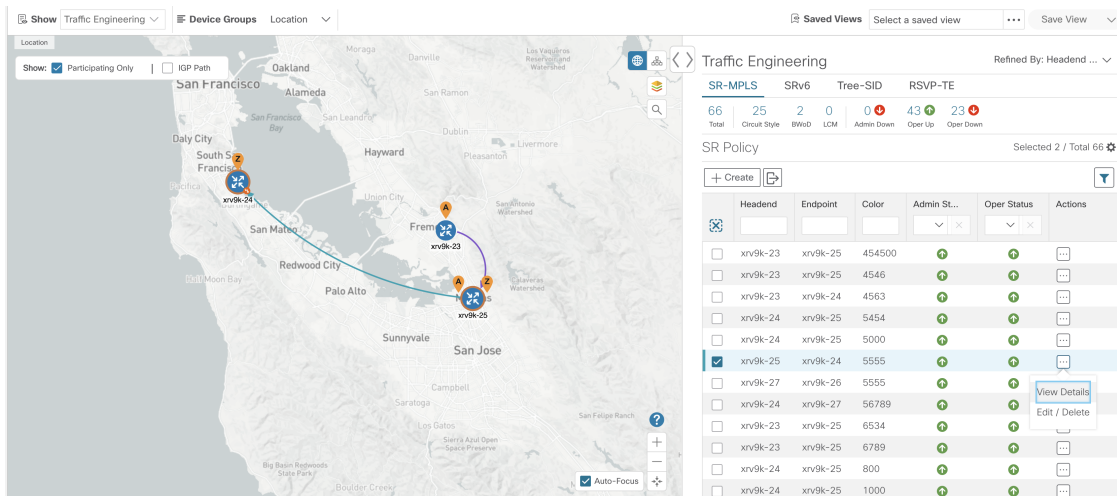
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Callout No.	Description
8	<p>This option allows you to choose how the group filter (when in use) should be applied on the table data. For example, if Headend only was selected, then it would only display policies where the headend device of the policy is in the selected group. This filter allows you to see specific configurations and is useful when you have a large network.</p> <p>Filter options:</p> <ul style="list-style-type: none"> • Headend or Endpoint—Show policies with either the headend or endpoint device in the selected group. • Headend and Endpoint—Show policies if both the headend and endpoint are in the group. • Headend only—Show policies if the headend device of the policy is in the selected group. • Endpoint only—Show policies if endpoint device of the policy is in the selected group.
9	Exports <i>all</i> data into a CSV file. You cannot export selected or filtered data.

View SR-MPLS and SRv6 Policy Details

View SR-MPLS or SRv6 TE policy level details as well segment lists and any path computation constraints configured on a per-candidate path basis.

Step 1 From the **Actions** column, click  > **View Details** for one of the SR-MPLS or SRv6 policies.



The screenshot shows the Traffic Engineering interface. On the left is a map of the San Francisco Bay Area with several nodes marked. On the right is a table of SR Policies. The table has the following columns: Headend, Endpoint, Color, Admin St..., Oper Status, and Actions. The policy with Headend 'xrv9k-25' and Endpoint 'xrv9k-24' is selected, and a 'View Details' tooltip is visible over its Actions column.

SR-MPLS	SRv6	Tree-SID	RSVP-TE
66	25	2	0
Total	Circuit Style	BW/d	LCM
		Admin Down	Oper Up
		43	23
		Oper Down	

Headend	Endpoint	Color	Admin St...	Oper Status	Actions
<input type="checkbox"/>	xrv9k-23	xrv9k-25	454500	●	●
<input type="checkbox"/>	xrv9k-23	xrv9k-25	4546	●	●
<input type="checkbox"/>	xrv9k-23	xrv9k-24	4563	●	●
<input type="checkbox"/>	xrv9k-24	xrv9k-25	5454	●	●
<input type="checkbox"/>	xrv9k-24	xrv9k-25	5000	●	●
<input checked="" type="checkbox"/>	xrv9k-25	xrv9k-24	5555	●	●
<input type="checkbox"/>	xrv9k-27	xrv9k-26	5555	●	●
<input type="checkbox"/>	xrv9k-24	xrv9k-27	56789	●	●
<input type="checkbox"/>	xrv9k-23	xrv9k-25	6534	●	●
<input type="checkbox"/>	xrv9k-23	xrv9k-25	6789	●	●
<input type="checkbox"/>	xrv9k-24	xrv9k-25	800	●	●
<input type="checkbox"/>	xrv9k-24	xrv9k-25	1000	●	●

Step 2 View SR-MPLS or SRv6 policy details.

Note The Delay value is calculated for all policies every 10 minutes. Hover your mouse over the "i" icon (next to the Delay value) to view the last time the value was updated.

< >
SR Policy Details
⋮ | ✕

Current

History

Endpoint ⚡ xrv9k-24 | Dest IP: 192.168.0.24
 TE RID: 192.168.0.24 | IPv6 RID: 2001:192:168::24

Color 5555

∨ Summary

Admin State	↑ Up
Oper State	↑ Up
Binding SID	24027
Policy Type	Regular
Profile ID	-
Description	-
Traffic Rate	0 Mbps
Unused	True ⓘ
Delay	532 ⓘ
Bandwidth Constraint	0 Mbps
Accumulated Metric	1
Delegated PCE	172.27.226.126
Non-delegated PCEs	-
PCE Computed Time	06-Feb-2023 03:11:16 PM GMT+5:30
Last Update	07-Mar-2023 11:45:11 AM GMT+5:30

Last Updated ✕
 09-Mar-2023 02:22:54 PM GMT+5:30

[See less](#) ^

Visualize SR-MPLS or SRv6 Policies Example

This example walks you through several SR-TE (SR-MPLS and SRv6) policy visualization features that are available from the topology map.

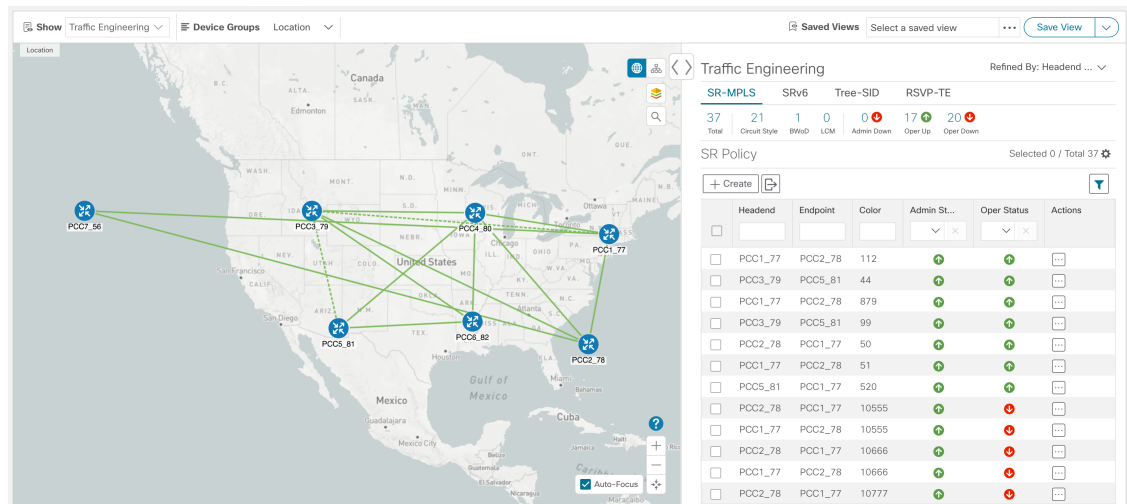
In this example, we assume that devices and SR-MPLS policies have been added and device groups have been created.



Note Although this example uses SR-MPLS policies, the basic functionality of the maps for both SR-MPLS policies and SRv6 policies is the same.

Click images to zoom in for a closer look.

Figure 2: Topology Map Example



Step 1

Select SR-MPLS policies for visualization and isolate them on the map.

- From the main menu, choose **Traffic Engineering > Traffic Engineering**.
- From the **SR Policy** table, check the check box next to the SR-MPLS policies you are interested in.
- Check the check box next to **Show Participating Only** so that other links and devices that are not part of the selected SR-TE policies are hidden.

In the following example, the topology map displays the following:

- Four SR-MPLS policies are selected.
- SR-MPLS policies appear as purple links with arrows that indicate the path direction.
- The **PCC1_77** node is the destination for two of the selected policies. Both **PCC5_81** and **PCC3_79** are destinations for the selected policies. SR-MPLS policy origin and destination are marked with **A** and **Z**, respectively. The **A+** denotes that there is more than one policy that originates from a device. A **Z+** denotes that the device is a destination for more than one policy.

Visualize SR-MPLS or SRv6 Policies Example

Traffic Engineering

SR-MPLS SRv6 Tree-SID RSVP-TE

37 Total 21 Circuit Style 1 BWoD 0 LCM 0 Admin Down 17 Oper Up 20 Oper Down

SR Policy Selected 3 / Total 37

	Headend	Endpoint	Color	Admin St...	Oper Status	Actions
<input type="checkbox"/>	PCC1_77	PCC2_78	112	▶	▶	...
<input type="checkbox"/>	PCC3_79	PCC5_81	44	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	879	▶	▶	...
<input type="checkbox"/>	PCC3_79	PCC5_81	99	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	50	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	51	▶	▶	...
<input checked="" type="checkbox"/>	PCC5_81	PCC1_77	520	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	10555	▶	▶	...
<input checked="" type="checkbox"/>	PCC1_77	PCC2_78	10555	▶	▶	...
<input checked="" type="checkbox"/>	PCC2_78	PCC1_77	10666	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	10666	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	10777	▶	▶	...

Step 2

Highlight and view more details for a particular SR-MPLS policy.

- a) From the **SR Policy** table, *hover* over a selected policy. The topology map displays the following details:

- The path is emphasized on the map. The path goes through **PCC5_81 > PCC3_79 > PCC1_77**.
- The prefix SID for PCC3_79 and PCC1_77 is displayed.

Traffic Engineering

SR-MPLS SRv6 Tree-SID RSVP-TE


37 Total 21 Circuit Style 1 BWoD 0 LCM 0 Admin Down 17 Oper Up 20 Oper Down

SR Policy Selected 3 / Total 37

	Headend	Endpoint	Color	Admin St...	Oper Status	Actions
<input type="checkbox"/>	PCC1_77	PCC2_78	112	▶	▶	...
<input type="checkbox"/>	PCC3_79	PCC5_81	44	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	879	▶	▶	...
<input type="checkbox"/>	PCC3_79	PCC5_81	99	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	50	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	51	▶	▶	...
<input checked="" type="checkbox"/>	PCC5_81	PCC1_77	520	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	10555	▶	▶	...
<input checked="" type="checkbox"/>	PCC1_77	PCC2_78	10555	▶	▶	...
<input checked="" type="checkbox"/>	PCC2_78	PCC1_77	10666	▶	▶	...
<input type="checkbox"/>	PCC1_77	PCC2_78	10666	▶	▶	...
<input type="checkbox"/>	PCC2_78	PCC1_77	10777	▶	▶	...

Step 3

View the physical path and metrics between the endpoints of the selected SR-MPLS policies.

- a) Check the **Show IGP Path** check box. The IGP paths for the selected SR-MPLS policies are displayed, with straight lines, instead of the segment hops.
- b) Click .
- c) Click the **Metrics** tab.
- d) Toggle applicable metrics to **ON**.

Note You must check the **Show IGP Path** check box in order to view metrics.

The screenshot shows the Traffic Engineering interface. On the left, a map displays various SR-MPLS policies across North America, with nodes labeled PCC1_77, PCC2_78, PCC3_79, PCC5_81, and PCC2_78. On the right, the 'SR Policy' table is visible, showing a list of policies with their respective headend and endpoint nodes, colors, and operational states.

Headend	Endpoint	Color	Admin St...	Oper Status	Actions	
<input type="checkbox"/>	PCC1_77	PCC2_78	112	↑	↑	[...]
<input type="checkbox"/>	PCC3_79	PCC5_81	44	↑	↑	[...]
<input type="checkbox"/>	PCC1_77	PCC2_78	879	↑	↑	[...]
<input type="checkbox"/>	PCC3_79	PCC5_81	99	↑	↑	[...]
<input type="checkbox"/>	PCC2_78	PCC1_77	50	↑	↑	[...]
<input type="checkbox"/>	PCC1_77	PCC2_78	51	↑	↑	[...]
<input checked="" type="checkbox"/>	PCC5_81	PCC1_77	520	↑	↑	[...]
<input type="checkbox"/>	PCC2_78	PCC1_77	10555	↑	↓	[...]
<input checked="" type="checkbox"/>	PCC1_77	PCC2_78	10555	↑	↓	[...]
<input checked="" type="checkbox"/>	PCC2_78	PCC1_77	10666	↑	↓	[...]
<input type="checkbox"/>	PCC1_77	PCC2_78	10666	↑	↓	[...]
<input type="checkbox"/>	PCC2_78	PCC1_77	10777	↑	↓	[...]

Step 4

View SR-MPLS policy details such as disjoint groups, metric type, segment hop information, delay (calculated for all policies every 10 minutes), and so on.

- From the **Actions** column, click > **View Details** for one of the SR-MPLS policies. The **SR Policy Details** window is displayed in the side panel. Note that only the selected policy is displayed on the topology map.

The screenshot shows the Traffic Engineering interface with a detailed view of an SR-MPLS policy. The right panel displays the 'Current' and 'History' tabs for the selected policy, showing details like Headend, Endpoint, Color, Summary, and Candidate Path.

Path Name	Preference	Path Type	State
<input checked="" type="checkbox"/> > 1111_path	100	Unknown	↑ ↑

Step 5

Customize and save a logical view of the topology.

- Click to display the logical view of selected SR-MPLS policies.
- Arrange the nodes to your preference.
- To save the topology layout (*not SR-MPLS policy selection*), clear all selected SR-MPLS policies, and click **Save View**.

Example:

Figure 3: Logical Map (Save Without SR-MPLS Policies Selected)

The screenshot shows the Traffic Engineering interface. On the left, a logical map displays several SR-MPLS policies (iosxrv-2 through iosxrv-7) connected to a central node (iosxrv-3). The interface includes a 'Show Groups' checkbox, a 'Saved Views' dropdown, and a 'Save View' button. The right-hand panel shows the 'SR POLICY' table with columns for Headend, Endpoint, Color, Admin Status, and Oper Status.

Headend	Endpoint	Color	Admin St...	Oper Sta...	Actions
iosxrv...	iosxrv-6	1868	+	+	...
iosxrv...	iosxrv-5	123	+	+	...
iosxrv...	iosxrv-6	8000	+	+	...
iosxrv...	iosxrv-5	8500	+	+	...
iosxrv...	iosxrv-5	111	+	+	...
iosxrv...	iosxrv-5	888	+	+	...

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Step 6 Close (X) the current view to return to the **SR Policy** table.

Step 7 To understand how device groups are displayed with the selection of SR-MPLS policies, uncheck any SR-MPLS policies that might be selected and check **Show Groups**.

The screenshot shows the Traffic Engineering interface. On the left, a logical map displays several SR-MPLS policies (S1AG1E1, S8AG1-1, S5AG1-1, S5C1, S10C1, S10AG2E3, S2AG1-1, S10AG1-1, S2AG1E3, S10AG1-1, SSC2, S1C2, S2AG1-1, S1AG2E1) connected to a central node (S1AG1E2). The interface includes a 'Show Groups' checkbox, a 'Saved Views' dropdown, and a 'Save View' button. The right-hand panel shows the 'SR POLICY' table with columns for Headend, Endpoint, Color, Admin Status, and Oper Status.

Headend	Endpoint	Color	Admin St...	Oper Sta...	Actions
S1AG1E1	S5AG1E2	63212	+	+	...
S8AG1-1	S6C1	5522	+	+	...
S5AG1-1	S3AG1-1	102	+	+	...
S5C1	S7C1	22332	+	+	...
S10C1	S3C1	5123	+	+	...
S10AG2E3	S6AG2E1	3215	+	+	...
S2AG1-1	S2AG2-2	106	+	+	...
S10AG1-1	S10AG2E2	434	+	+	...
S2AG1E3	S2C1	6325	+	+	...
S10AG1-1	S10AG1E1	6325	+	+	...
SSC2	P-TOPRIGHT	100	+	+	...
S1C2	S2C1	100	+	+	...
S2AG1-1	S2AG2E3	100	+	+	...
S1AG2E1	S1AG1E2	100	+	+	...

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Step 8 Selecting a specific group from the **Device Groups** drop-down list, will only display that group in the map. In this example, **Australia** is selected and the associated SR-MPLS policy is selected and displayed.

The screenshot shows the Traffic Engineering interface. On the left, a network diagram displays various devices (S1AG1E1, S1AG1E2, S1AG1E3, S1AG1-1, S1AG1-2, S1C1, S1AG2-1, S1AG2-2, S1AG2E1, S1AG2E2) connected in a mesh. On the right, the 'SR POLICY' table is visible, showing a list of policies with their headend, endpoint, color, and status.

Headend	Endpoint	Color	Admin St...	Oper Stat...	Actions
<input type="checkbox"/>	S1AG1E1	SSAG1E2	63212	✔	✔
<input type="checkbox"/>	S1C2	S2C1	100	✔	✔
<input checked="" type="checkbox"/>	S1AG2E1	S1AG1E2	100	✔	✘
<input type="checkbox"/>	SSC1	S1C2	111	✔	✘
<input type="checkbox"/>	S7C1	S1C2	202	✔	✘
<input checked="" type="checkbox"/>	S1AG1-2	S1C2	4521	✔	✘
<input type="checkbox"/>	S10AG1-1	S1AG1-1	3256	✔	✘

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Step 9

If you select a policy where participating devices are not part of the selected group, then a dialog appears giving you an option to switch the group view. This is the default behavior. If this window does not appear, then the administrator has configured the display to automatically switch view or stay in the current view. For more information, see [Configure How Device Groups Are Displayed for Traffic Engineering](#).

The screenshot shows the same Traffic Engineering interface as in Step 9, but with a dialog box overlaid. The dialog box contains the following text: "Some of the participating devices are not in the current device group. Click 'Switch Device Group' to automatically switch to the device group that will show all participating devices." Below the text are two buttons: "Switch Device Group" and "Don't Switch". There is also a checkbox for "Don't show this message again".

Step 10

If you select **Switch Device Group**, then the group will change and you will see all participating devices for the SR-MPLS policies you have selected.

Find Multiple Candidate Paths (MCPs)

To go back to the previous group view, click **Back** (this link appears later in the yellow text area indicated in the following figure).

The screenshot shows the Cisco Crosswork Network Automation interface. On the left, there is a navigation sidebar with options like Home, Topology, Traffic Engineering, Device Management, and Administration. The main area displays a network topology with nodes representing different regions: United Kingdom, Australia, South Africa, US Canada, Japan, India, and China. A path is highlighted from the United Kingdom to Australia. On the right, the 'Traffic Engineering' section is visible, showing a summary for SR-MPLS, SRv6, RSVP-TE, and Tree SID. Below this is an 'SR POLICY' table with columns for Headend, Endpoint, Color, Admin St., Oper Stat., and Actions. The table lists various policies such as S1AG1E1, S8AG1-1, S3AG1-1, etc.

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Step 11 You can also use the Mini Dashboard to drill down and focus on certain SR-TE policies.

To filter the SR Policy table to show only PCE-initiated policies, click the value for PCE Init from the SR-MPLS Mini Dashboard. Note that the **Filters Applied** text appears.

The screenshot shows the Cisco Crosswork Network Automation interface with a filtered view of SR policies. The network topology on the left shows a mesh of nodes representing different providers like PEA-ASRtk, P3-NCS5501, PE1-ASRtk, etc. The 'Traffic Engineering' section on the right shows the 'SR-MPLS' summary with 'PCE Init' highlighted in red. Below the summary, the 'SR POLICY' table is filtered to show only PCE-initiated policies. The table has columns for Headend, Endpoint, Color, Admi..., Oper..., and Actions. The filtered policies are: PE1-AS..., P3-NCS... (345); PE4-AS..., PE7-XR... (123); PE7-XR..., P4-NCS... (234); and PE4-AS..., PE2-AS... (2258). A 'Filters Applied (1)' dropdown is visible above the table.

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Step 12 To remove filter criteria, click **Filters Applied > Clear All Filters**. You can also select individual filters if more than one filter has been applied.

Find Multiple Candidate Paths (MCPs)

Visualizing MCPs gives you insight into which paths might be a better alternative to the currently active one. If you determine to do so, you can then manually configure the device and change which path becomes active.

Important Notes

- Only PCC-initialized SR-TE policies with MCPs are supported.
- Crosswork Optimization Engine does not distinguish dynamic paths versus explicit paths. The Policy Type field value displays as 'Unknown'.
- You can view active explicit paths, but not inactive candidate explicit paths in the UI.

Before you begin

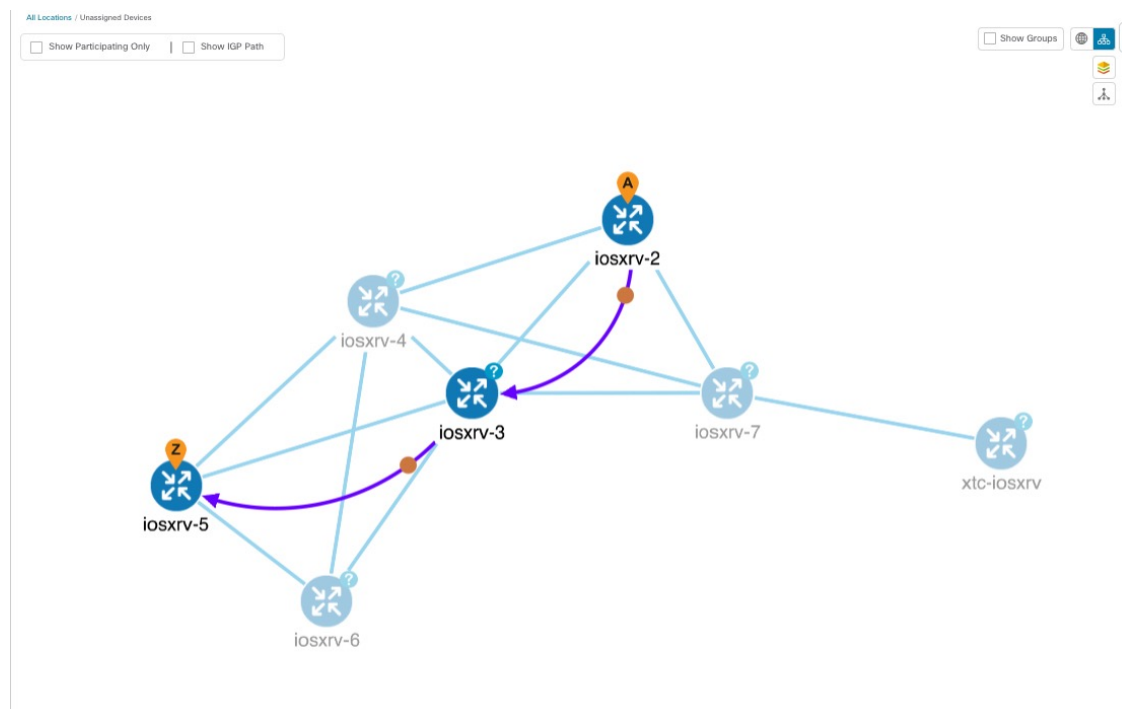
A policy must be configured with MCPs on devices before visualizing them on the Traffic Engineering topology map. This configuration can be done manually or within Crosswork Network Controller.

Step 1 From the main menu, choose **Traffic Engineering > Traffic Engineering > SR-MPLS** or **SRv6** tab.

Step 2 Navigate to the active SR-TE policy that has MCPs configured and view it on the topology map.


- Check the check box next to the SR-TE policy that has MCPs configured.
- View the SR-TE policy that is highlighted on the topology map.

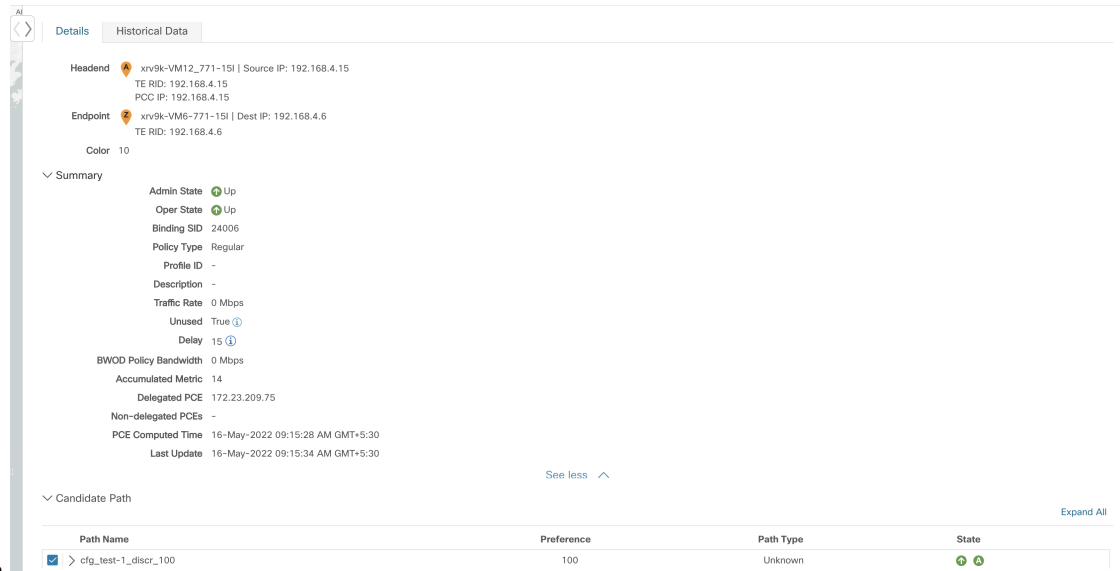
In this example, you see that the active path is going from **iosxrv-2 > iosxrv-3 > iosxrv-5**.



Step 3 View the list of candidate paths.

Find Multiple Candidate Paths (MCPs)

- a) From the SR-TE Policy table **Actions** column, click  > **View Details**. A list of candidate paths appear along with policy details in the **SR Policy Details** window. The green A in the state column indicates the active



The screenshot shows the 'SR Policy Details' window with the following information:

- Headend:** xrv9k-VM12_771-151 | Source IP: 192.168.4.15
TE RID: 192.168.4.15
PCC IP: 192.168.4.15
- Endpoint:** xrv9k-VM6-771-151 | Dest IP: 192.168.4.6
TE RID: 192.168.4.6
- Color:** 10
- Summary:**
 - Admin State: Up
 - Oper State: Up
 - Binding SID: 24006
 - Policy Type: Regular
 - Profile ID: -
 - Description: -
 - Traffic Rate: 0 Mbps
 - Unused: True
 - Delay: 15
 - BWOD Policy Bandwidth: 0 Mbps
 - Accumulated Metric: 14
 - Delegated PCE: 172.23.209.75
 - Non-delegated PCEs: -
 - PCE Computed Time: 16-May-2022 09:15:28 AM GMT+5:30
 - Last Update: 16-May-2022 09:15:34 AM GMT+5:30
- Candidate Path Table:**

Path Name	Preference	Path Type	State
<input checked="" type="checkbox"/> > cfg_test-1_discr_100	100	Unknown	Up A

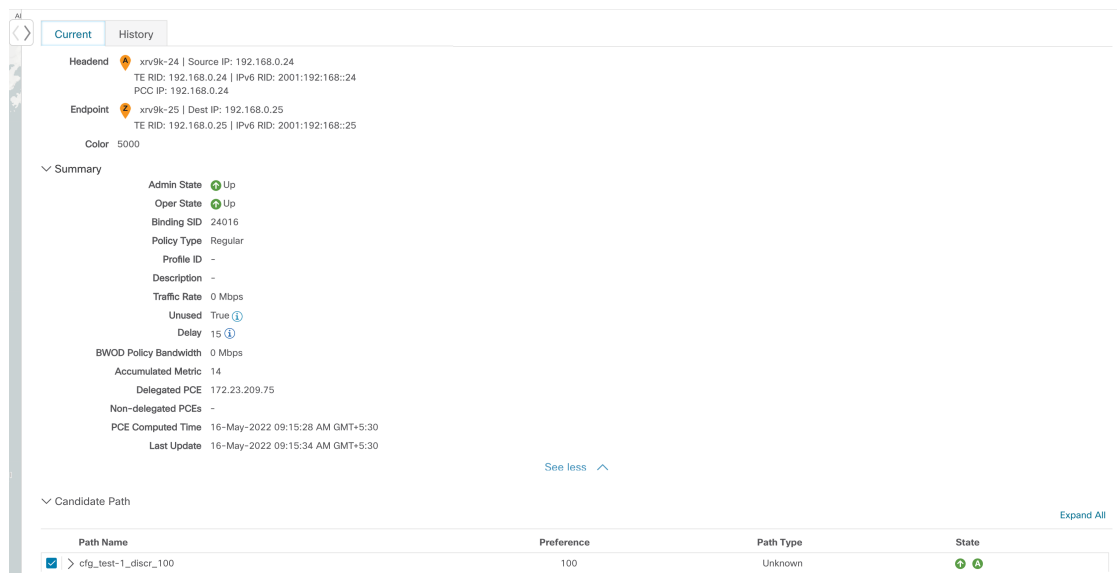
path.

Step 4 You can expand individual paths or click **Expand All** to view details of each path. As you hover each segment, the segment is highlighted on the map.

Step 5 Visualize the candidate path on the topology map.

- a) Check the check box next to any candidate path.

Note You will not be able to select or view explicit candidate paths.



The screenshot shows the 'SR Policy Details' window with the following information:

- Headend:** xrv9k-24 | Source IP: 192.168.0.24
TE RID: 192.168.0.24 | IPv6 RID: 2001:192:168::24
PCC IP: 192.168.0.24
- Endpoint:** xrv9k-25 | Dest IP: 192.168.0.25
TE RID: 192.168.0.25 | IPv6 RID: 2001:192:168::25
- Color:** 5000
- Summary:**
 - Admin State: Up
 - Oper State: Up
 - Binding SID: 24016
 - Policy Type: Regular
 - Profile ID: -
 - Description: -
 - Traffic Rate: 0 Mbps
 - Unused: True
 - Delay: 15
 - BWOD Policy Bandwidth: 0 Mbps
 - Accumulated Metric: 14
 - Delegated PCE: 172.23.209.75
 - Non-delegated PCEs: -
 - PCE Computed Time: 16-May-2022 09:15:28 AM GMT+5:30
 - Last Update: 16-May-2022 09:15:34 AM GMT+5:30
- Candidate Path Table:**

Path Name	Preference	Path Type	State
<input checked="" type="checkbox"/> > cfg_test-1_discr_100	100	Unknown	Up A

- b) From the **Candidate Path** area, hover your mouse over the candidate path name. The candidate path is highlighted on the topology map.

In this example, you see that the alternate path goes directly from **iosxrv-2** > **iosxrv-5**.

The screenshot displays a network topology map on the left and a detailed view of an SR Policy on the right. The topology map shows several nodes (iosxrv-2, iosxrv-3, iosxrv-4, iosxrv-5, iosxrv-6, iosxrv-7, xtc-iosxrv) connected by lines. A path is highlighted in orange, starting from iosxrv-5 and ending at iosxrv-2. A callout box points to this path with the text 'Candidate Path' and 'cfg_test_mcp_diff_paths_discr_5000'. The SR Policy Details panel on the right shows a table of candidate paths. The path 'cfg_test_mcp_diff_paths_discr_5000' is selected and highlighted in red. Below the table, the details for this path are shown, including the path name, policy type, metric type, disjoint group, PCE initiated status, and affinity settings.

Path Name	Preference	Path Type
cfg_test_mcp_diff_paths_discr_10000	10000	Unknown
cfg_test_mcp_diff_paths_discr_5000	5000	Unknown

Visualize Underlying Paths Associated with a Defined Binding-Segment ID (B-SID) Label

Crosswork Optimization Engine allows you to visualize the underlying path of a B-SID hop that you have manually configured on a device or configured using Crosswork Network Controller. In this example, we have assigned **15700** as a B-SID label on an SR-MPLS policy hop.

To view the B-SID underlying path for an SR-MPLS or SRv6 policy, do the following:

- Step 1** From the main menu, choose **Traffic Engineering > Traffic Engineering > SR-MPLS** or **SRv6** tab.
- Step 2** Check the check box next to the SR-MPLS policy that contains a hop assigned with a B-SID label and hover your mouse over any part of the SR-MPLS row to see the B-SID name. The B-SID path is highlighted in **orange** on the topology map.

In this example, you see that the B-SID path is going from **cw-xrv51** to **cw-xrv52**.

Note Click image examples to zoom in for a closer look.

Visualize Underlying Paths Associated with a Defined Binding-Segment ID (B-SID) Label

The screenshot shows the Traffic Engineering interface. On the left, a map of the United States displays network paths between various locations. A path is highlighted from a headend in the West to an endpoint in the East, passing through several intermediate nodes. A specific path is labeled with a B-SID of 15700. On the right, the SR Policy table is visible, showing a list of policies with columns for Headend, Endpoint, Color, Admin State, Oper State, and Actions. The policy 'cw-xrv23' is selected, and its details are shown in a red box.

Headend	Endpoint	Color	Admin...	Oper ...	Actions	
<input type="checkbox"/>	cw-xrv51	cw-xrv52	3333	↑	↑	...
<input type="checkbox"/>	cw-asr23	cw-xrv62	4455	↑	↓	...
<input type="checkbox"/>	cw-xrv52	cw-xrv54	2700	↑	↑	...
<input type="checkbox"/>	cw-xrv61	cw-xrv58	2900	↑	↑	...
<input checked="" type="checkbox"/>	cw-asr23	cw-xrv52	2222	↑	↑	...
<input type="checkbox"/>	cw-xrv51	cw-xrv52	300	↑	↑	...
<input type="checkbox"/>	cw-xrv50	cw-xrv52	2022	↑	↓	...
<input type="checkbox"/>	cw-xrv62	cw-xrv53	2001	↑	↑	...
<input type="checkbox"/>	cw-xrv60	cw-xrv61	2001	↑	↑	...

Step 3 From the **Actions** column, click **...** > **View Details**.

Step 4 From the **SR Policy Details** window, expand the active path name and click the **B-SID label**. In this example, the B-SID label is **15700**.

The screenshot shows the SR Policy Details window. The 'Current' tab is active, displaying the headend and endpoint information. The 'Summary' section shows the policy's state and configuration. The 'Candidate Path' section is expanded, showing a table of paths. The path 'cfg_test-bsid-policy_discr_100' is selected, and its segments are displayed in a table below. The B-SID label '15700' is highlighted in a red box.

SR Policy Details

Current History

Headend A xrv9k-24 | Source IP: 192.168.0.24
TE RID: 192.168.0.24 | IPv6 RID: 2001:192:168::24
PCC IP: 192.168.0.24

Endpoint Z xrv9k-25 | Dest IP: 192.168.0.25
TE RID: 192.168.0.25 | IPv6 RID: 2001:192:168::25

Color 5000

Summary

- Admin State ↑ Up
- Oper State ↑ Up
- Binding SID 24016
- Policy Type Regular
- Profile ID -
- Description -
- Traffic Rate 0 Mbps
- Unused True i

See more v

Candidate Path Collapse All

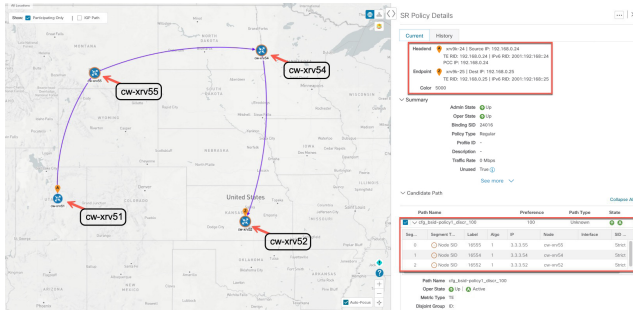
Path Name	Preference	Path Type	State				
<input checked="" type="checkbox"/> v cfg_test-bsid-policy_discr_100	100	Unknown	↑ A				
S...	Segme...	L...	Algo	IP	N...	Interf...	S...
0	O Nod...	16...	1	3.3.3.50	cw...		Strict
1	O IGP ...	24...	0	11.1.2...	cw...	GigabitEthr	U
2	O B-Sid	15700		3.3.3.51	cw...		

Path Name cfg_test-bsid-policy_discr_100

Oper State ↑ Up | A Active

Metric Type TE

- Step 5** In the **SR Policy Details** window for the underlying path, expand the active path name to view more details. In this example, you see the underlying path actually goes from **cw-xrv51 > cw-xrv55 > cw-xrv54 > cw-xrv52**.



Visualize Native SR Paths

Visualizing the native path will help you in OAM (Operations, Administration and Maintenance) activities to monitor label-switched paths (LSPs) and quickly isolate forwarding problems to assist with fault detection and troubleshooting in the network. Since this feature uses multipaths, all ECMP paths are shown between the source and destination. You can visualize only SR-MPLS policies.

Before you begin

Confirm that device requirements are met. See [Visualize Native Path Device Prerequisites](#), on page 17.

To create a path query, do the following:

- Step 1** From the main menu, choose **Traffic Engineering > Path Query**.
- Step 2** On the Query Path Dashboard, click **New Query**.
- Step 3** Under the New Path Query, select the required values and click **Get Paths**.
- Step 4** Click **View Result** to view the query result.
- Step 5** (Optional) On the result pop-up click, **View Past Result**. Check the query ID to view the available results.

Example:

In the below example, you can view the available paths : **Path 0**

Figure 4: Path Details

The screenshot shows a web interface for visualizing Native SR IGP Paths. On the left, a map of the United States displays a path between two devices: PE-A (San Francisco) and PE-B (Boston). The path is highlighted in purple. On the right, the 'Path Details' panel is open, showing the following configuration:

- Select Service: Select Type, Select Instance
- Headend: PE-A (100.100.100.5)
- Endpoint: PE-B (100.100.100.6)
- Get Paths button

Below the configuration, the 'Available Paths' section shows 'Path 0' expanded with the following details:

```

Output tunnel-te220
Nexthop 20.20.10.2
Source 100.100.100.5
Destination 127.0.0.0

Hop Details
Hop Index:0 | Hop Origin IP:100.100.100.5 | Hop Destination IP:20.20.10.2 | MRU:1500 | Labels: [24007/implicit-null] | ret code:0 | return char: | multipaths:0
Hop Index:1 | Hop Origin IP:20.20.10.2 | Hop Destination IP:20.20.10.14 | MRU:1500 | Labels: [24022/implicit-null] | ret code:8 | return char:L | multipaths:1
Hop Index:2 | Hop Origin IP:20.20.10.14 | Hop Destination IP:20.20.10.26 | MRU:1500 | Labels:[implicit-null/implicit-null] | ret code:8 | return char:L | multipaths:1
Hop Index:3 | Hop Origin IP:20.20.10.26 | MRU:0 | ret code:3 | return char:! | multipaths:0

```

Step 6 From the **Actions** column, click **View Details**.

If you have not provided the longitude and latitude information for your devices, the path is visualized in the logical view.

Step 7 From the available paths, click **Path 0** to expand and view the active path.

Example:

Figure 5: Path Details

The screenshot shows a close-up of the 'Path Details' panel. The configuration is as follows:

- Select Service: Select Type, Select Instance
- Headend: PE-A (100.100.100.5)
- Endpoint: PE-B (100.100.100.6)
- Get Paths button

The 'Available Paths' section shows 'Path 0' expanded with the following details:

```

Output tunnel-te220
Nexthop 20.20.10.2
Source 100.100.100.5
Destination 127.0.0.0

Hop Details
Hop Index:0 | Hop Origin IP:100.100.100.5 | Hop Destination IP:20.20.10.2 | MRU:1500 | Labels: [24007/implicit-null] | ret code:0 | return char: | multipaths:0
Hop Index:1 | Hop Origin IP:20.20.10.2 | Hop Destination IP:20.20.10.14 | MRU:1500 | Labels: [24022/implicit-null] | ret code:8 | return char:L | multipaths:1
Hop Index:2 | Hop Origin IP:20.20.10.14 | Hop Destination IP:20.20.10.26 | MRU:1500 | Labels:[implicit-null/implicit-null] | ret code:8 | return char:L | multipaths:1
Hop Index:3 | Hop Origin IP:20.20.10.26 | MRU:0 | ret code:3 | return char:! | multipaths:0

```


Visualize Native Path Device Prerequisites

Confirm the following device software and configurations are met prior to visualizing native paths.

1. Devices should be running Cisco IOS XR 7.3.2 or higher. Run `show version` command to verify it.
2. Devices should have GRPC enabled.
 - a. Run `show grpc` to confirm GRPC configuration. You should see something similar to this:

```
tpa
vrf default
address-family ipv4
default-route mgmt
!
address-family ipv6
default-route mgmt
!
!
!


or

linux networking
vrf default
address-family ipv4
default-route software-forwarding
!
address-family ipv6
default-route software-forwarding
!
!
!
```



Note

- `address-family` is only required in an IPv4 topology.
 - To enable GRPC with a secure connection, you must upload security certificates to connect to the device.
-

3. Devices should have GNMI capability enabled and configured.
 - a. From **Device Management**, click on a device and view device details (.
 - b. Confirm that GNMI capability and connectivity details are configured.

Connectivity Details

Protocol *	IP Address / Subnet Mask *	Port *	Timeout	Encoding Type
TELNET	172.29.105.236 / 24	23	30	
SNMP	172.29.105.236 / 24	161	30	
SSH	172.29.105.236 / 24	22	30	
GNMI	172.29.105.236 / 24	57400	30	JSON

+ Add Another

Capability*

YANG MDT
 TL1
 YANG CLI
 YANG EPNM
 SNMP
 GNMI



Note Based on the type of devices, the following device encoding type are available:

- JSON
- BYTES
- PROTO
- ASCII
- JSON IETF

4. Devices should have the CDG router static address. Static route should be added from the device to the southbound CDG IP address. For example:

```
RP/0/RP0/CPU0:xrvr-7.3.2#config
```

```
RP/0/RP0/CPU0:xrvr-7.3.2(config)#router static
```

```
RP/0/RP0/CPU0:xrvr-7.3.2(config-static)#address-family ipv4 unicast <CDG Southbound interface IP: eg. 172.24.97.110> <Device Gateway eg: 172.29.105.1>
```

```
RP/0/RP0/CPU0:xrvr-7.3.2(config-static)#commit
```

Configure TE Link Affinities

If you have any affinities you wish to account for when provisioning an SR policy, Tree-SID, or RSVP-TE tunnel, then you must define them on the Cisco Crosswork UI. Affinity names defined on devices are not collected by Cisco Crosswork. The affinity mapping is only used for visualization. For this reason, you should collect affinities on the device, then define affinity mapping in Cisco Crosswork UI with the same name and bits that are used on the device. Crosswork Optimization Engine will only send bit information to SR-PCE during provisioning. If an affinity mapping is not defined in the UI, then the affinity name is displayed as "UNKNOWN".

The affinity configuration on interfaces simply turns on some bits. It is a 32-bit value, with each bit position (0 - 31) representing a link attribute. Affinity mappings can be colors representing a certain type of service profile (for example: low delay, high bandwidth, and so on). This makes it easier to refer to link attributes.

See SR, Tree-SID, or RSVP-TE configuration documentation for your specific device to view descriptions and supported configuration commands (for example: [Segment Routing Configuration Guide for Cisco ASR 9000 Series Router](#))

The following example shows the affinity configuration (`affinity-map`) on a device:

```
RP/0/RP0/CPU0:c12#sh running-config segment-routing traffic-eng affinity-map
Wed Jul 27 12:14:50.027 PDT
segment-routing
 traffic-eng
  affinity-map
    name red bit-position 1
    name blue bit-position 5
    name green bit-position 4
  !
!
```

Step 1 From the main menu choose **Administration > Settings > System Settings > Traffic Engineering > Affinity > TE Link Affinities**. You can also define affinities while creating an SR-TE policy, Tree-SID, or RSVP-TE tunnel by clicking **Manage Mapping**.

Step 2 To add a new affinity mapping, click **+ Create**.

Step 3 Enter the name and the bit it will be assigned. For example (using the above configuration):

Example:

Name ?	Bit Position (0-31) ?	Actions
red	1	Edit Delete
blue	5	Edit Delete
green	4	Edit Delete

Step 4 Click **Save** to save the mapping.


Note You should remove the TE tunnel before removing the affinity to avoid orphan TE tunnels. If you have removed an affinity associated to a TE tunnel, the affinity is shown as "UNKNOWN" in the **SR Policy / RSVP-TE Tunnel Details** window.


Create Explicit SR-MPLS Policies

This task creates SR-MPLS policies using an explicit (fixed) path consisting of a list of prefix or adjacency Segment IDs (SID list), each representing a node or link along on the path.



Tip If you plan to use affinities, collect affinity information from your devices and then map them in Cisco Crosswork before creating an explicit SR-MPLS policy. For more information, see [Configure TE Link Affinities, on page 18](#).

-
- Step 1** From the main menu, choose **Traffic Engineering > Traffic Engineering > SR-MPLS** tab.
- Step 2** From the **SR Policies** table, click **+ Create**. If you are using Crosswork Network Controller, select either **PCE init** or **PCC init**.
- Step 3** Enter or select the required SR-MPLS policy values. Hover the mouse pointer over  to view a description of the field.
- Tip** If you have set up device groups, you can select the device group from the **Device Groups** drop-down menu. Then navigate and zoom in on the topology map to click the device for headend or endpoint selection.
- Step 4** Under Policy Path, click **Explicit Path** and enter a path name.
- Step 5** Add segments that will be part of the SR-MPLS policy path.
- Step 6** Click **Preview** and confirm that the policy you created matched your intent.
- Step 7** If you want to commit the policy path, click **Provision** to activate the policy on the network or exit to abort the configuration process.
- Step 8** Validate the SR-MPLS policy creation:
- a. Confirm that the new SR-MPLS policy appears in the SR Policy table. You can also click the check box next to the policy to see it highlighted in the map.

Note The newly provisioned SR-TE policy may take some time, depending on the network size and performance, to appear in the **SR Policy** table. The **SR Policy** table is refreshed every 30 seconds.
 - b. View and confirm the new SR-MPLS policy details. From the **SR Policy** table, click  and select **View**.

Note On a setup with high node, policy, or interface counts, a timeout may occur during policy deployment. To configure timeout options, see [Configure TE Timeout Settings](#).
-

Create Dynamic SR-MPLS Policies Based on Optimization Intent


This task creates an SR-MPLS policy with a dynamic path. SR-PCE computes a path for the policy based on metrics and path constraints (affinities or disjointness) defined by the user. A user can select from three available metrics to minimize in path computation: IGP, TE, or latency. The SR-PCE will automatically re-optimize the path as necessary based on topology changes. In the event of a link or interface failing, the network will find an alternate path that meets all the criteria specified in the policy and raise an alarm. The alarm is also raised in case no path is found, the packets are then dropped.



Tip If you plan to use affinities, collect affinity information from your devices and then map them in Cisco Crosswork before creating a dynamic SR-MPLS policy. For more information, see [Configure TE Link Affinities, on page 18](#) or [Configure Flexible Algorithm Affinities](#).

Before you begin


If you have affinities configured on your devices, define an affinity mapping using the Cisco Crosswork UI prior to provisioning an SR-MPLS policy (see [Configure TE Link Affinities, on page 18](#)).

- Step 1** From the main menu, choose **Traffic Engineering > Traffic Engineering > SR-MPLS** tab.
- Step 2** From the **SR Policy** table, click + **Create**. If you are using Crosswork Optimization Engine within Crosswork Network Controller, select either **PCE Init** or **PCC Init**.
- Step 3** Under **Policy Details**, enter or select the required SR-MPLS policy values. Hover the mouse pointer over  to view a description of each field.
- Tip** If you have set up device groups, you can select the device group from the **Device Groups** drop-down menu. Then navigate and zoom in on the topology map to click the device for headend or endpoint selection.
- Step 4** Under **Policy Path**, click **Dynamic Path** and enter a path name.
- Step 5** Under **Optimization Objective**, select the metric you want to minimize.
- Step 6** Define any applicable constraints and disjointness.
- Note**
- Affinity constraints and disjointness cannot be configured on the same SR-MPLS policy. Also, there cannot be more than two SR-MPLS policies in the same disjoint group or subgroup. The configuration will not be allowed during Preview.
 - If there are existing SR-MPLS policies belonging to a disjoint group that you define here, all SR-MPLS policies that belong to that same disjoint group are shown during Preview.
- Step 7** Under **Segments**, select whether or not protected segments should be used when available.
- Step 8** If applicable, enter a SID constraint in the **SID Algorithm** field. Cisco Crosswork will try to find a path with this SID. If a path with the SID constraint cannot be found, the provisioned policy will remain operationally down until the conditions are met.
- Note**
- Flexible Algorithm: The values correspond to the Flexible Algorithm that are defined on the device and the 128-255 range is enforced by Cisco IOS XR.
 - Algorithm 0: This is a Shortest Path First (SPF) algorithm based on link metric. This shortest path algorithm is computed by the Interior gateway protocol (IGP).
 - Algorithm 1: This is a Strict Shortest Path First (SSPF) algorithm based on link metric. The algorithm 1 is identical to algorithm 0 but requires that all nodes along the path honor the SPF routing decision. Local policy does not alter the forwarding decision. For example, a packet is not forwarded through locally engineered path.
- Step 9** Click **Preview**. The path is highlighted on the map.
- Step 10** If you want to commit the policy path, click **Provision**.

Step 11 Validate the SR-MPLS policy creation:

- a. Confirm that the new SR-MPLS policy appears in the SR Policy table. You can also click the check box next to the policy to see it highlighted in the map.

Note The newly provisioned SR-MPLS policy may take some time, depending on the network size and performance, to appear in the **SR Policy** table. The **SR Policy** table is refreshed every 30 seconds.

- b. View and confirm the new SR-MPLS policy details. From the **SR Policy** table, click  and select **View**.

Note On a scaled setup with high node, policy, or interface counts, a timeout may occur during policy deployment. To configure timeout options, see [Configure TE Timeout Settings](#).

Modify SR-MPLS Policies

To view, modify, or delete an SR-MPLS policy, do the following:

Step 1 From the main menu, choose **Traffic Engineering > Traffic Engineering > SR-MPLS** tab.

Step 2 From the SR Policy table, locate the SR-MPLS policy you are interested in and click .

Step 3 Choose **View** or **Edit/Delete**.

- Note**
- You can only modify or delete SR-MPLS policies that have been created with the UI.
 - After updating the SR-MPLS policy details, you can preview the changes on the map before saving it.
-