



# Tree Segment Identifier (Tree-SID) Multicast Traffic Engineering

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Tree-SID is a method of implementing tree-like multicast flows over a segmented routing network. Using Tree-SID, an SDN controller (a device running SR-PCE using PCEP), calculates the tree. Each node (device) in the tree has a specific role in routing the multicast data through the tree. These roles include Ingress for the root or headend node, Transit or Bud for midpoint nodes that are not leaf nodes, and Egress for destination leaf nodes. The tree itself is assigned a single SID label, which represents all of the tree segments and devices in it. The SDN controller is highly flexible, as it understands the segmentation and can construct routing paths using any kind of constraints that network architects can specify.

The most interesting use case for constraint-based Tree-SID use is where routers are configured to deliver two P2MP streams with the same content over different paths. Here, the multicast flow is forwarded twice through the network, each copy following a unique path. The two copies never use the same node or link to reach the destination, reducing packet loss due to network failures on any one of the paths.

For detailed information on Tree-SID, see the Segment Routing Tree-SID configuration documentation for your specific device (for example: [Segment Routing Configuration Guide for Cisco NCS 540 Series Routers](#)).

This section contains the following topics.

- [Visualize Tree-SID Policies, on page 1](#)
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- [Create Static Tree-SID Policies, on page 3](#)
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## Visualize Tree-SID Policies

Crosswork UI provides the ability to view details of the Tree-SID root, transit, leaf nodes and bud nodes in the UI and allows you to easily confirm that Tree-SID is implemented correctly in your network (see [View a Point-to-Multipoint Tree on the Topology Map, on page 2](#)).

The Tree-SID policy has the following nodes:

- Root node—Encapsulates the multicast traffic, replicates it, and forwards it to the transit nodes.
- Transit node—Acts as a leaf (egress) node as well as a mid-point (transit) node toward the downstream sub-tree.
- Leaf node—Decapsulates the multicast traffic and forward it to the multicast receivers.

- Bud Node—Has a separate leaf node path and is displayed separately in the topology map.

You can visualize the following Tree-SID policies:

- **Static:** A Static Tree-SID policy is configured via SR-PCE, either directly using SR-PCE CLI or from the Crosswork UI. You can refer to the Tree-SID configuration documentation for your specific device to find out more information and examples of the supported configuration commands. (for example: [Segment Routing Configuration Guide for Cisco ASR 9000 Series Routers](#))
- **Dynamic:** A Dynamic Tree-SID policy is not explicitly configured, it is configured as part of a L3VPN/mVPN service.



**Note** Static and Dynamic Tree-SID policies support fast reroute (FRR).

## View a Point-to-Multipoint Tree on the Topology Map

Crosswork allows you to visualize Tree-SID policies configured in your network.

The following example shows a representation of a Tree-SID policy in the Crosswork topology map. The root node (R) and leaf nodes (L) are clearly marked, and the arrows denote the path through the transit nodes from the root to the leaf nodes.

You can drill down on the nodes and the links to see more details about the Tree-SID policy and validate the configuration.

The screenshot shows a topology map of the San Francisco Bay Area with a Tree-SID policy visualization. The root node (R) is at the top left, and leaf nodes (L) are at the bottom right. The path is indicated by arrows. The 'Tree-SID Policy Details' panel on the right shows the following configuration:

Leaf Node Name	Leaf Node IP	Expand All		
✓ xrv9k-27	192.168.0.27			
Role	Name	IP	Local IP	Remote IP
Root	xrv9k-26	192.168.0.26	10.0.0.30	10.0.0.29
Transit	xrv9k-23	192.168.0.23	10.0.0.41	10.0.0.42
Leaf	xrv9k-27	192.168.0.27	-	-
✓ xrv9k-22	192.168.0.22			
Role	Name	IP	Local IP	Remote IP
Root	xrv9k-26	192.168.0.26	10.0.0.81	10.0.0.82
Bud	xrv9k-24	192.168.0.24	10.0.0.14	10.0.0.13
Leaf	xrv9k-22	192.168.0.22	-	-
> xrv9k-24	192.168.0.24			

### Before you begin

To visualize a multicast tree in the topology map, Tree-SID policies must be configured in your network. For more information, see the SR Tree-SID configuration documentation for your specific device (for example: [Segment Routing Configuration Guide for Cisco NCS 540 Series Routers](#)).

**Step 1** From the main menu, select **Traffic Engineering > Traffic Engineering > Tree-SID** tab.

**Step 2** Select the Tree-SID policies you want to view on the topology map.

**Note** You can view a maximum of two policies on the topology map at the same time.

The screenshot shows the Traffic Engineering interface. On the left, a topology map displays various nodes (labeled cw-xrv50 through cw-xrv60) connected by lines, representing a network structure. On the right, a panel titled 'Traffic Engineering' shows a summary of policies: SR-MPLS (3 Total, 0 Dynamic, 3 Static), SRV6 (3 Total, 0 Admin Down, 3 Open Up, 0 Open Down), and RSVP-TE (0 Total, 0 Admin Down, 3 Open Up, 0 Open Down). Below this, a table lists 'Tree-SID Policy' with columns for Root N..., Root IP, Name, Tre..., Label, Admi..., Oper..., and Ac. Three policies are listed: cw-xrv50 (tree50-54-52), cw-xrv52 (tree52-62), and cw-xrv58 (tree58-53). The first two are selected.

**Note** Any change in end-points is captured as an event in the historical data tab. For information on Tree-SID Historical Data see, [View TE Event and Utilization History](#)

**Step 3** To view the Tree-SID Details, from the **Actions** column, click > **View Details** for one of the Tree-SID policies.

The screenshot shows the 'Tree-SID Details' page. It includes a 'Summary' section with the following details:

- Admin State: Up
- Oper Status: Up
- Label: 18
- Type: Static
- Programming State: None
- Metric Type: TE
- Constraints: Exclude-Any: -, Include-Any: -, Include-All: -
- SR-PCE Address: 172.23.209.75

Below the summary is the 'Tree-SID path' section, which shows a table of nodes and their connections:

Leaf Node Name	Leaf Node IP	Egress Link		
xrv9k-VM9-732	192.168.4.10			
Role	Name	IP	Local IP	Remote IP
Root	xrv9k-VM2_751_151	192.168.4.2	10.0.2.18	10.0.2.17
Bud	xrv9k-VM7_3_0_732_cco	192.168.4.7	10.0.2.90	10.0.2.91
Leaf	xrv9k-VM9-732	192.168.4.10	-	-

**Step 4** You can view the Tree-SID details, and verify the path and node details to ensure that the Tree-SID is configured correctly.

## Create Static Tree-SID Policies

This task will explain how to create a static Tree-SID policy each representing a leaf or a root node.

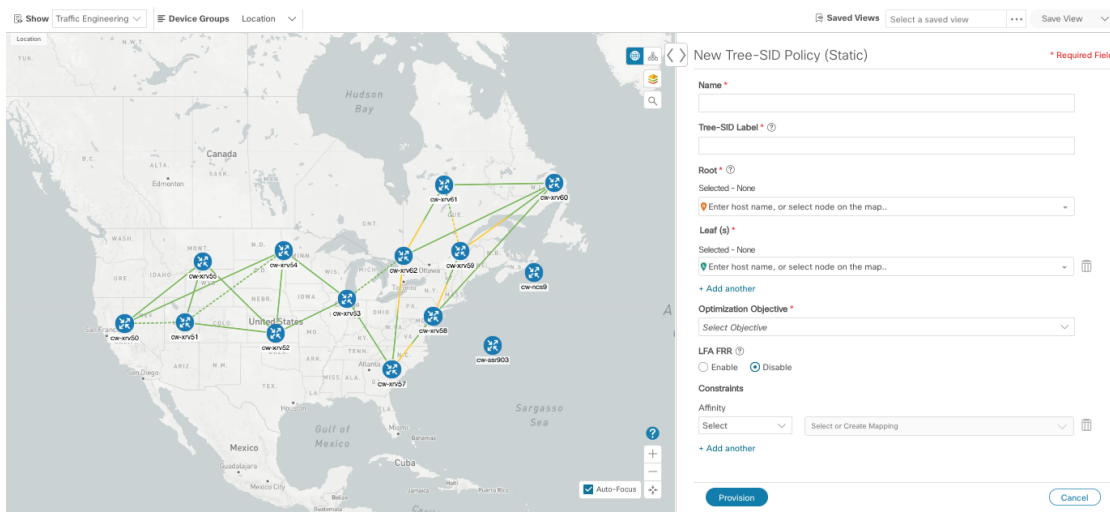


**Tip** If you plan to use affinities, collect affinity information from your devices and then map them in Cisco Crosswork before creating a static Tree-SID policy. For more information, see [Configure TE Link Affinities](#).

**Step 1** From the main menu, choose **Traffic Engineering > Traffic Engineering > Tree-SID** tab and click **Create**.

**Step 2** Enter or select the required Tree-SID policy values. Hover the mouse pointer over to view a description of the field.

**Note** You can only add PCC nodes with a PCEP session to PCE as root nodes.



**Step 3** Add leaf nodes that will be part of the Tree-SID policy.

**Step 4** Under **Affinity**, define any applicable affinities. For more information on Affinities, see [Configure TE Link Affinities](#)

**Step 5** To commit the policy, click **Provision**.

**Step 6** Validate the Tree-SID policy creation:

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

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

- b. View and confirm the new Tree-SID policy details. From the topology map click **Tree-SID**, click and select **View**.

## Static Tree-SID Policy Configuration Example through Crosswork UI

The output below shows the static Tree-SID policy, configured from Crosswork UI, on the compute SR-PCE.

```
RP/0/RP0/CPU0:cw-xrv56#sh pce lsp p2mp
```

```

Tree: 50-52-54, Root: 3.3.3.50
PCC: 3.3.3.50
Label: 505254
Operational: up Admin: up Compute: Yes
Local LFA FRR: Disabled
Metric Type: IGP
Transition count: 1
Uptime: 00:01:45 (since Thu Apr 27 10:54:49 PDT 2023)
Destinations: 3.3.3.52, 3.3.3.54
Nodes:
Node[0]: 3.3.3.50 (cw-xrv50)
  Delegation: PCC
  PLSP-ID: 205
  Role: Ingress
  Hops:
    Incoming: 505254 CC-ID: 1
    Outgoing: 505254 CC-ID: 1 (11.1.28.54) [cw-xrv54]
    Outgoing: 505254 CC-ID: 1 (11.1.1.51) [cw-xrv51]
Node[1]: 3.3.3.54 (cw-xrv54)
  Delegation: PCC
  PLSP-ID: 148
  Role: Egress
  Hops:
    Incoming: 505254 CC-ID: 2
Node[2]: 3.3.3.51 (cw-xrv51)
  Delegation: PCC
  PLSP-ID: 187
  Role: Transit
  Hops:
    Incoming: 505254 CC-ID: 3
    Outgoing: 505254 CC-ID: 3 (11.1.2.52) [cw-xrv52]
Node[3]: 3.3.3.52 (cw-xrv52)
  Delegation: PCC
  PLSP-ID: 247
  Role: Egress
  Hops:
    Incoming: 505254 CC-ID: 4

```

The output below shows the same static Tree-SID policy on the High Availability (HA) peer SR-PCE.

```
RP/0/RP0/CPU0:cw-xrv63#sh pce lsp p2mp
```

```

Tree: 50-52-54, Root: 3.3.3.50
PCC: 3.3.3.50
Label: 505254
Operational: standby Admin: up Compute: No
Local LFA FRR: Disabled
Metric Type: IGP
Transition count: 0
Destinations: 3.3.3.52, 3.3.3.54
Nodes:
Node[0]: 3.3.3.54 (cw-xrv54)
  Delegation: PCE (3.3.3.56)
  PLSP-ID: 148
  Role: Egress
  Hops:
    Incoming: 505254 CC-ID: 2
Node[1]: 3.3.3.52 (cw-xrv52)
  Delegation: PCE (3.3.3.56)
  PLSP-ID: 247
  Role: Egress
  Hops:
    Incoming: 505254 CC-ID: 4

```

```

Node[2]: 3.3.3.51 (cw-xrv51)
  Delegation: PCE (3.3.3.56)
  PLSP-ID: 187
  Role: Transit
  Hops:
    Incoming: 505254 CC-ID: 3
    Outgoing: 505254 CC-ID: 3 (11.1.2.52)
Node[3]: 3.3.3.50 (cw-xrv50)
  Delegation: PCE (3.3.3.56)
  PLSP-ID: 205
  Role: Ingress
  Hops:
    Incoming: 505254 CC-ID: 1
    Outgoing: 505254 CC-ID: 1 (11.1.28.54)
    Outgoing: 505254 CC-ID: 1 (11.1.1.51)

```

## Modify a Tree-SID Policy

To modify a Tree-SID policy, do the following:




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**Note** You cannot modify the name, label and root of a Tree-SID policy.

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**Step 1** From the main menu, choose **Traffic Engineering > Traffic Engineering**.

**Step 2** From the **Traffic Engineering** window, click the **Tree-SID** tab.

**Step 3** Locate the Tree-SID policy you are interested in and click .

**Step 4** Choose **Edit**.

- Note**
- You can only modify or delete a static Tree-SID policy that is created using the Crosswork UI or API as opposed to one created using SR-PCE CLI
  - After updating the Tree-SID policy details, you can preview the changes on the map before saving it.
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## Tree-SID Important Notes

### Limitation

- Tree-SID policies are only supported on devices running Cisco IOS XR software.
- PCE high-availability (HA) is supported for static Tree-SID policies configured via the Cisco Crosswork UI, but not supported if configured directly on the SR-PCE CLI.
- Tree-SID policy details based on SRv6 are not supported.
- If a single instance of SR-PCE is used, and the SR-PCE restarts, all static Tree-SID policies that were configured from the Crosswork UI are deleted.
- IPV4 unnumbered interfaces are not supported.

### Visualization of Tree-SID Paths with Missing Nodes

Missing Tree-SID nodes can cause the following to happen:

A node on a Tree-SID policy path may not be available in the Crosswork topology information for various reasons. For example, the node is not added to the Crosswork device inventory. This affects how the Tree-SID policy path is displayed on the topology map. The unavailable node will cause one or more root-to-leaf paths to look broken on the map, as shown in the figure below. However, the path details in the right panel will still show the full path.

