



Visualize Tree-SID Policies

Crosswork Optimization Engine lets you visualize the Tree-SID policies implemented in your network. This provides the ability to view details of the Tree-SID root, transit and leaf nodes, bud nodes and allows you to easily confirm that Tree-SID is implemented correctly in your network. The P2MP SR policy also prevents transient loop and packet loss when updating the path of a P2MP SR policy.

The Root node encapsulates the multicast traffic, replicates it, and forwards it to the transit nodes. Transit nodes replicate the multicast traffic and forward it to the Leaf nodes. The Bud node, is a node that acts as a leaf (egress) node as well as a mid-point (transit) node toward the downstream sub-tree. Leaf nodes decapsulate the multicast traffic and forward it to the multicast receivers.

To configure Tree-SID in your network, see the SR Tree-SID configuration documentation for your specific device (for example: [Segment Routing Configuration Guide for Cisco NCS 540 Series Routers](#)).

COE supports visualizing the following types of Tree-SID policies:

- **Static:** A Static Tree-SID policy is configured via the PCE. All the paths are explicitly mentioned in static Tree-SID policy. The Tree-SID name is assigned during the configuration and it does not have an ID.
- **Dynamic:** A Dynamic Tree-SID policy is configured on service end-points, and require a day 0 configuration on PCE and the SEPs.



Note Static and Dynamic Tree-SID policies support fast reroute.



Note When using Crosswork Optimization Engine to visualize Tree-SID policies, always choose **Traffic Engineering > Traffic Engineering**. If you are using Crosswork Network Controller solution to visualize these policies, the navigation path is **Traffic Engineering & Services > Traffic Engineering**.

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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 network 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 two leaves. Also, bud nodes have a separate leaf node path and are displayed on the Topology map.

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 the Cisco Crosswork Network Automation interface. The main panel displays a network topology map with nodes and links. A sidebar on the right shows details for the selected Tree-SID path, including a table of nodes and their roles.

Leaf Node Name	Leaf Node IP	Role	Name	IP	Local IP	Remote IP
√ xrv9k-VM7_3_0_732_cco	192.168.4.7	Leaf	xrv9k-VM5-...	192.168.4.5	10.0.2.26	10.0.2.25
		Bud	xrv9k-VM3-...	192.168.4.3	10.0.2.41	10.0.2.42
		Leaf	xrv9k-VM7...	192.168.4.7	-	-
√ xrv9k-VM3-771-151	192.168.4.3	Leaf	xrv9k-VM5-...	192.168.4.5	10.0.2.26	10.0.2.25
		Leaf	xrv9k-VM3-...	192.168.4.3	-	-
√ xrv9k-VM8	192.168.4.9					

Before you begin

The following configurations are required for the Tree-SID policy and nodes:

- Transit node: PCEP is required.
- Bud node, Egress node, and Ingress node: PCEP, active BGP MVPN session, BGP autodiscovery segment-routing and MDT default segment-routing, MDT partitioned segment-routing

To visualize a multicast tree in the network 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.



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.

Summary

- 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

[See more](#)

Tree-SID path

Leaf Node Name	Leaf Node IP			
<input checked="" type="checkbox"/> xrv9k-VM9-732	192.168.4.10		Collapse All	
	Name	IP	Egress Link	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.

Limitations for Tree-SID Policies

Limitation

- Only visualization of Tree-SID policies is supported. You cannot create, edit or delete Tree-SID policies from the UI.
- Tree-SID policies are only supported on devices running Cisco IOS XR software.
- Tree-SID policies are not deleted from the UI when the PCE in HA mode is down and also when the PCE is removed from the Crosswork UI.
- PCE HA is not supported.
- Tree-SID policies are not supported in Label Switch Multicast (LSM) routing. In cases where LSM is enabled, IGP updates and traffic utilization data are not supported.
- Tree-SID policy is not created back in PCE, after "no vrf" under pim or "no multicast" on PCC.
- Ignore the local-hop-address if FRR=true, show value of 'next-hop-address'.
- FIB platform update fails on PE routers, when IGP configuration is updated.
- LCM will not operate in portions of the network carrying Tree-SID LSPs.
- The RestConf API is not supported.
- Tree-SID policy details do not show IPv6 router ID or Srv6 core information.

Visualization of Tree-SID Paths with Missing Nodes

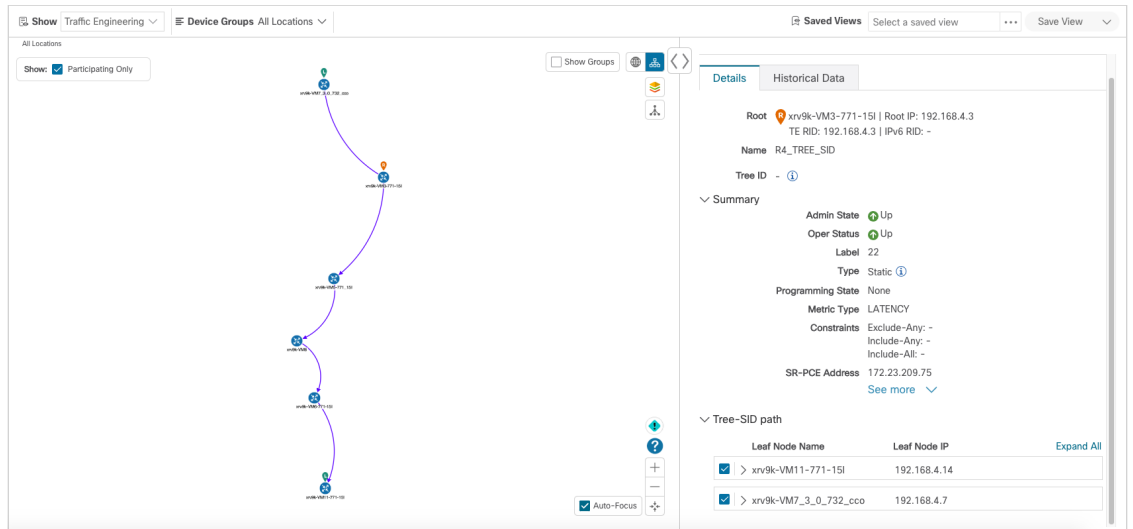
Following are the scenarios with missing Tree-SID nodes on the topology:

- You cannot visualise Tree-SID policy incase the source or root nodes are not configured on the PCE. The details for such Tree-SID policies are not populated, and the policy will be oper-down.

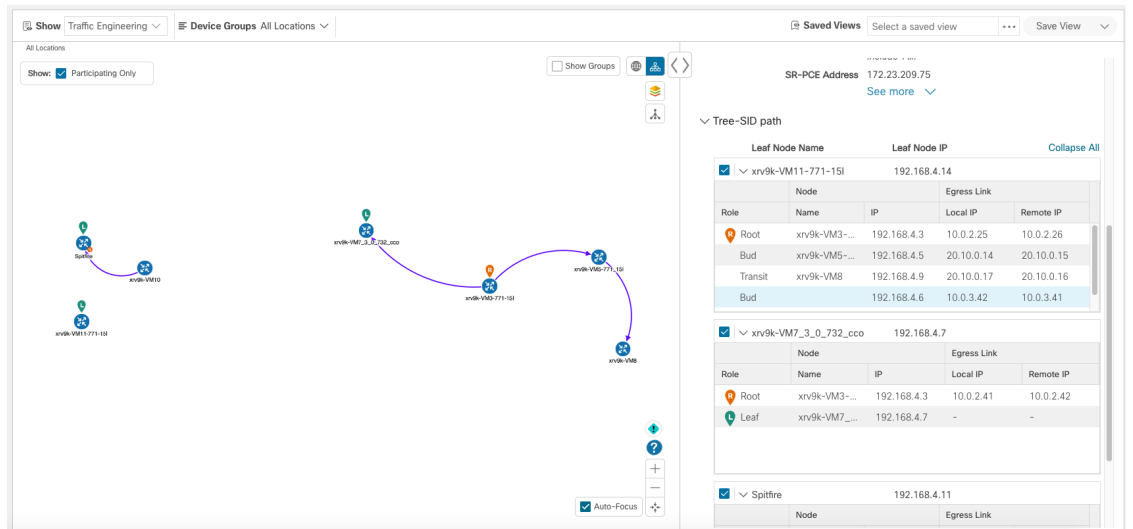
SR-MPLS	SRv6	Tree-SID	RSVP-TE
16	3	13	0
Total	Dynamic	Static	Admin Down
			Oper Up
			Oper Down

Tree-SID Policy	Root...	Root...	Name	Tree...	Label	Ad...	Op...	Actions
<input type="checkbox"/>	xrv9K...	192.1...	MY_F...	-	18		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	MY_S...	-	19		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	MY_S...	-	31		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	MY_S...	-	30		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	MY_T...	-	17		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	NEW...	-	28		● ●	...
<input type="checkbox"/>	-	-	R13...	-	32		● ●	...
<input type="checkbox"/>	Source address is not configured/available for this Tree-SID policy				22		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	TREE...	-	37		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	TREE...	-	40		● ●	...
<input type="checkbox"/>	xrv9K...	192.1...	TREE...	-	34		● ●	...

- You cannot visualize Tree-SID policy path with specific leaf nodes missing. The details for such Tree-SID policies are populated with leaf node path missing. The other Tree-SID paths in the policy are displayed in the network, if any.



- You can visualize the Tree-SID policy with missing transit or bud node with partial overlay. The details for the Tree-SID policies are populated without the hostname.



Note The below warnings are displayed in case of missing transit or bud nodes:

- Historical data tab: Some device links are missing from the policy path because they are not present in the current device inventory and topology database.
- Topology UI: Topology map reflects the current state of the network. Current device/link states do not necessarily impact Traffic Engineering policies, tunnels, or services.

- If the root or source node is removed from the UI, the root hostname will be empty and the Tree-SID policy will be oper-up with no paths available on the topology map. The root router IP is displayed from the earlier Tree-SID discovery.

Tree SID Configuration Example

To visualize Segment Routing Tree-SID, some configurations are required on the SR-PCE and on the devices involved in the Tree-SID paths. Following are some example configurations for each of the steps required in your network:

- [Static Tree-SID Policy Configuration Example, on page 6](#)
- [Dynamic Tree-SID Policy Configuration Example with VRF, on page 7](#)
- [Dynamic Tree-SID Policy Configuration Example without VRF, on page 12](#)

The following day 0 configuration is required:

Enabling the MVPN address family on all SEPs and on PCE.

Enabling p2mp on PCE.

Static Tree-SID Policy Configuration Example



Note See Tree-SID configuration documentation for your specific device to view descriptions and supported configuration commands (for example: [Segment Routing Configuration Guide for Cisco ASR 9000 Series Routers](#)).

The following steps show examples of Static Tree-SID device configuration:

Step 1 Configure the Path Computation Element Protocol (PCEP) and Path Computation Client (PCC) on all nodes involved in the Tree-SID path (root, transit/bud, and leaf).

Example:

```
pce
address ipv4 <pce-loopback0-IP>

api
user admin
password encrypted xxxx
!
!
segment-routing
traffic-eng
```

```

p2mp

  endpoint-set MY_FIRST_TREE_SID_EPS

    ipv4 <leaf or pcc1-loopback0-IP>

    ipv4 <leaf or pcc2-loopback0-IP>

  !

```

Step 2 Configure P2MP SR static policy on the SR-PCE with end-points.

Example:

```

policy MY_FIRST_TREE_SID

  source ipv4 <root or pcc3-loopback0-IP>

  color 20 endpoint-set MY_FIRST_TREE_SID_EPS

  treesid mpls 18

  candidate-paths

    preference 100

    dynamic

    metric

    type te

  !

  !

  !

  !

  !

```

Dynamic Tree-SID Policy Configuration Example with VRF

To add more dynamic policies to Tree-SID policy, create VRF on both root and leaf devices. Mention the corresponding VRF, neighbor under BGP router config on PCE, root and leaf devices. VRF under multicast routing, router pim and create route-policy for each different VRFs as mentioned below in examples.

Follow the steps for Dynamic Tree-SID policy:

Pre-req route-policies (configure on both PCE, Root and leaf) devices

Under PCE

```

route-policy PASS

  pass

end-policy

```

```

!
Under Root and Leaf
route-policy bgp_in
    pass
end-policy
!
route-policy PIM-RPF
    set core-tree sr-p2mp
end-policy
!
route-policy bgp_out
    pass
end-policy
!
route-policy PASS_ALL
    pass
end-policy
!
route-policy TREESID-CORE
    set core-tree sr-p2mp
end-policy
!

```

Step 1 Configure under pce → segment-routing traffic engineering -> p2mp-> label range <>, multi-path disable.

Example:

```

label-range min 15400 max 60000
    fast-reroute lfa
    multipath-disable

```

Step 2 Under router bgp - configure address family ipv4 mvpn at top level and under neighbor node IP <root> and <leaf> level as well with address family ipv4 mvpn.

Example:

```

router bgp 1

```

```

.....

```



```

        address-family ipv4 mvpn
        route-reflector-client
    !
        neighbor <root or pcc3-loopback0-IP>
        remote-as 1
        update-source Loopback0
        address-family ipv4 unicast
        route-policy PASS in
        route-policy PASS out
    !
        address-family ipv4 mvpn
    !
!
neighbor <leaf or pcc1-loopback0-IP>
    remote-as 1
    update-source Loopback0
    address-family ipv4 unicast
    route-policy PASS in
    route-policy PASS out
!
    address-family ipv4 mvpn
!
!

```

Step 3 Configure headend and end-points.

Note You can add end-point routers as neighbor under PCE → route BGP configuration. Router-IDs need to be updated with each PCC loopbackIP in topology.

- a) Create interface Loopback<80>

Example:

```

interface Loopback80
    ipv4 address 80.80.10.1 255.255.255.252
    ipv6 address 2001:192:168:80::1/128
!

```

- b) Create VRF <vrf-name-80>

Example:

```
vrf L3VPN_NM-MVPN-80
  address-family ipv4 unicast
    import route-target
      80:80
    !
  export route-target
    80:80
  !
  !
  !
```

- c) Mention <vrf-name-80> under routing BGP configuration

Example:

```
vrf L3VPN_NM-MVPN-80
  rd 80:80
  address-family ipv4 unicast
    redistribute connected
  !
  address-family ipv4 mvpn
  !
  neighbor 80.80.10.1 <leaf or pcc1-vrf-IP>
    remote-as 80
  address-family ipv4 unicast
    route-policy PASS_ALL in
    route-policy PASS_ALL out
  !
  !
  !
  !
```

- d) Mention <vrf-name-80> under multicast-routing configuration

Example:

```
multicast-routing
  address-family ipv4
    interface Loopback0
      enable
    !
    mdt source Loopback0
    mdt static segment-routing
  !
vrf L3VPN_NM-MVPN-80
  address-family ipv4
    interface all enable
    bgp auto-discovery segment-routing
  !
  mdt default segment-routing mpls color 80
  !
  !
  !
```

- e) Create route-policy <vrf-name-80>

Example:

```
route-policy L3VPN_NM-MVPN-80
  if destination in (232.0.0.80) then
    set on-demand-color 80
  pass
endif
end-policy
!
```

- f) Under segment routing traffic eng -> configure ODN color <80>

Example:

```
on-demand color 80
  dynamic
  pcep
  !
  metric
```

```

        type te
    !
    !
    !

```

Step 4 Configure Leaf

Note Follow step a to d to configure headend and endpoint for root nodes.

Example:

```

router pim

address-family ipv4

    rpf topology route-policy PIM-RPF

!

vrf L3VPN_NM-MVPN-80

address-family ipv4

    rpf topology route-policy TREESID-CORE

    mdt c-multicast-routing bgp

!

!

!

```

Dynamic Tree-SID Policy Configuration Example without VRF

To add dynamic policies to Tree-SID policy, without VRF on both root and leaf devices, follow the steps below:



Note The configuration for PCE are same as for Dynamic Tree-SID with VRF. See [Dynamic Tree-SID Policy Configuration Example with VRF, on page 7](#)

Step 1 Configure Root

- a) Mention <leaf-node-IP or pcc1-IP> as neighbor under router BGP configuration.
- b) Mention unique RTs under multicast-routing configuration.

Note The RTs should be unique between Root and Leaf set.

Example:

```

multicast-routing

    address-family ipv4

        import-rt 12:12

        export-rt 12:12

        mdt source Loopback0

        interface all enable

        bgp auto-discovery segment-routing

    !

    mdt default segment-routing mpls color 12 fast-reroute lfa

    mdt data segment-routing mpls 5 threshold 0

    !

```

- c) Under segment routing traffic eng -> configure ODN color <unique one>.

Step 2

Configure Leaf

- a) Mention <**root-node-IP or pcc3-IP**> as neighbor under router BGP configuration.
- b) Mention unique RTs under multicast-routing configuration.

Note The RTs should be unique between Root and Leaf set.

Example:

```

multicast-routing

    address-family ipv4

        import-rt 12:12

        export-rt 12:12

        mdt source Loopback0

        interface all enable

        bgp auto-discovery segment-routing

    !

    mdt default segment-routing mpls color 12 fast-reroute lfa

    mdt data segment-routing mpls 5 threshold 0

    !

```

- c) Configure router PIM, route-policy TREESID_CORE.

