



# Segment Routing Tree Segment Identifier

Tree Segment Identifier (Tree-SID) is a tree-building solution that uses a Segment Routing Path Computation Element (SR-PCE) using path computation element protocol (PCEP) to calculate the point-to-multipoint (P2MP) tree using SR policies. Tree-SID uses a single MPLS label for building a multicast replication tree in an SR network. Tree-SID does not require multicast control protocols such as RSVP, mLDP, and PIM.

A P2MP SR policy provides an SR-based TE solution for transporting multicast traffic. It works on existing data-plane (MPLS and IP) and supports TE capabilities and single/multi routing domains. At each node of the tree, the forwarding state is represented by the same segment (using a global Tree-SID specified from the SRLB range of labels). P2MP SR policy prevents transient loop and packet loss when updating the path of a P2MP SR policy.

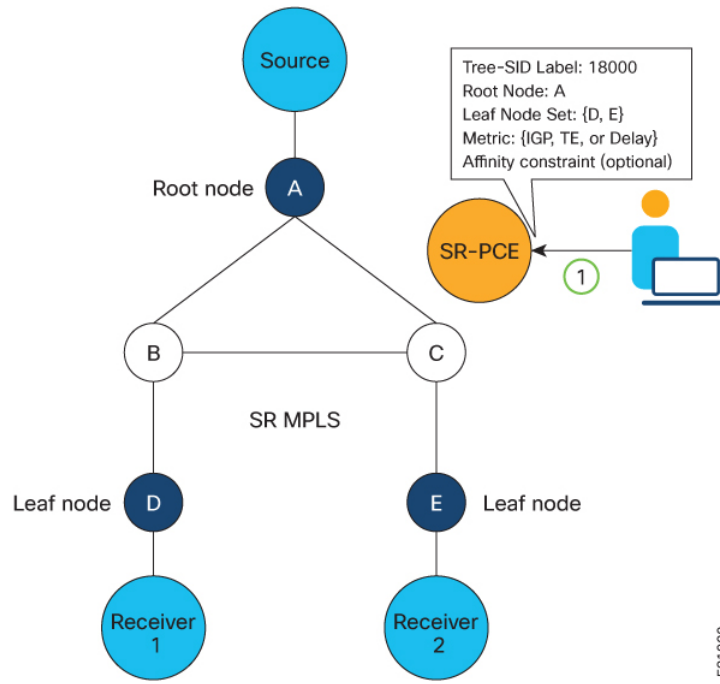
A P2MP SR policy request contains the following:

- Policy name
- SID for the P2MP Tree (Tree-SID)
- Address of the root node
- Addresses of the leaf nodes
- Optimization objectives (TE, IGP metric)
- Constraints (affinity)

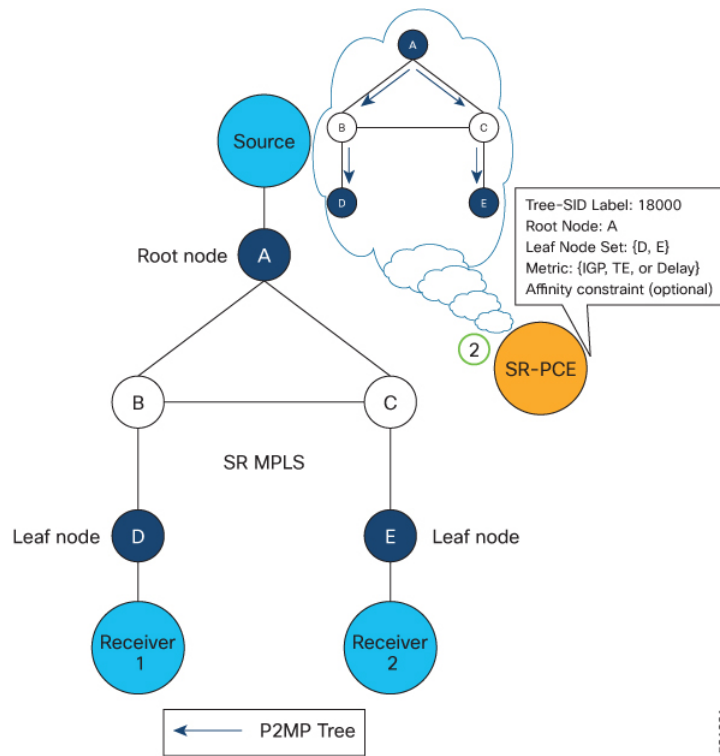
## Tree SID Workflow Overview

This sections shows a basic workflow using a Tree SID policy:

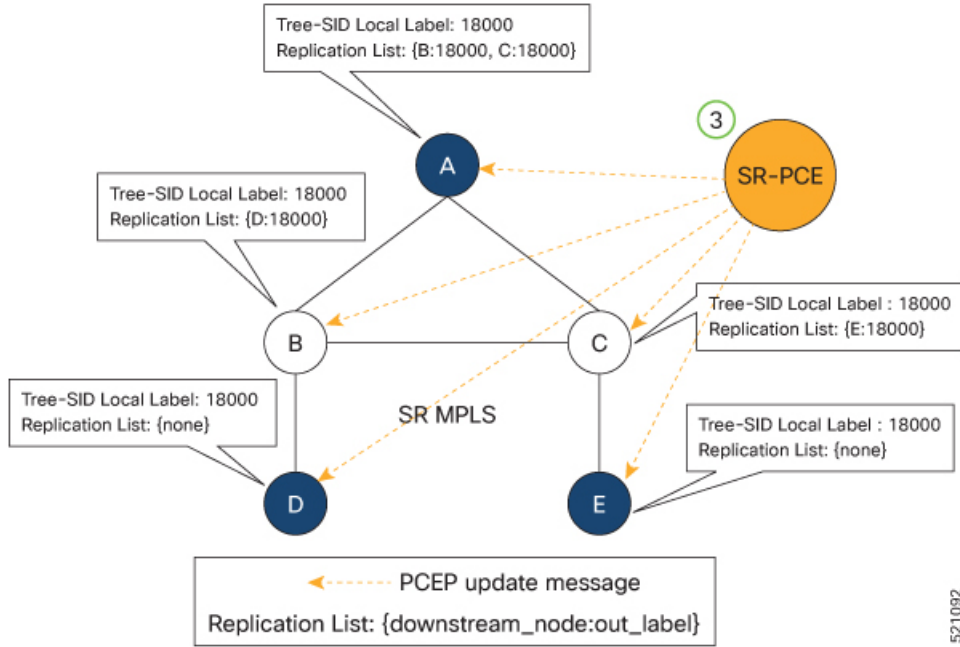
1. User creates a Tree-SID policy.



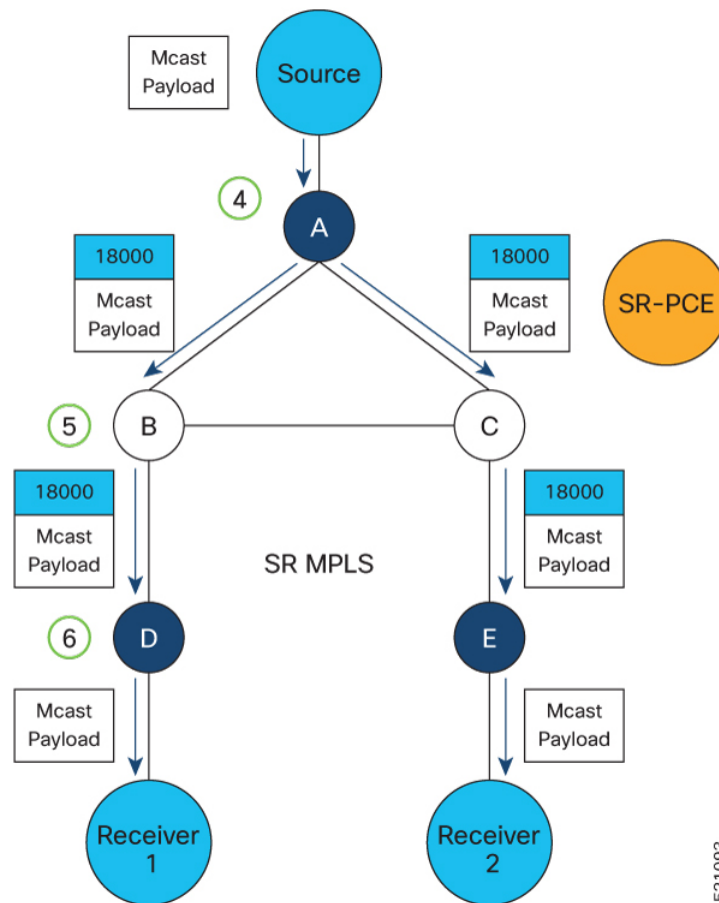
2. SR-PCE computes the P2MP Tree.



- SR-PCE instantiates the Tree-SID state at each node in the tree.



- The Root node encapsulates the multicast traffic, replicates it, and forwards it to the Transit nodes.
- The Transit nodes replicate the multicast traffic and forward it to the Leaf nodes.
- The Leaf nodes decapsulate the multicast traffic and forward it to the multicast receivers.



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## Behaviors and Limitations

PCE redundancy is not supported for Tree-SID. Tree-SID can only be controlled by a single PCE. Configure only one PCE on each PCC in the Tree-SID path.

## Configure Segment Routing Tree-SID

To configure Segment Routing Tree-SID for Point-to-Multipoint (P2MP) SR policies, complete the following configurations:

1. Configure Path Computation Element Protocol (PCEP) Path Computation Client (PCC) on all nodes involved in the Tree-SID path (root, mid-point, leaf)
2. Configure Affinity Maps on the SR-PCE
3. Configure P2MP SR Policy on SR-PCE

#### 4. Configure Multicast on the Root and Leaf Nodes

##### Configure PCEP PCC on All Nodes in Tree-SID Path

Configure all nodes involved in the Tree-SID path (root, mid-point, leaf) as PCEP PCC. For detailed PCEP PCC configuration information, see [Configure the Head-End Router as PCEP PCC](#).

##### Configure Affinity Maps on the SR-PCE

Use the **affinity bit-map** *COLOR bit-position* command in PCE SR-TE sub-mode to define affinity maps. The bit-position range is from 0 to 255.

```
Router# configure
Router(config)# pce
Router(config-pce)# segment-routing traffic-eng
Router(config-pce-sr-te)# affinity bit-map RED 23
Router(config-pce-sr-te)# affinity bit-map BLUE 24
Router(config-pce-sr-te)# affinity bit-map CROSS 25
Router(config-pce-sr-te)#
```

##### Configure P2MP SR Policy on SR-PCE

Configure the end-point name and addresses, Tree-SID label, and constraints for the P2MP policy.

Use the **endpoint-set** *NAME* command in SR-PCE P2MP sub-mode to enter the name of the end-point set and to define the set of end-point addresses.

```
Router(config-pce-sr-te)# p2mp
Router(config-pce-sr-te-p2mp)# endpoint-set BAR
Router(config-pce-p2mp-ep-set)# ipv4 10.1.1.2
Router(config-pce-p2mp-ep-set)# ipv4 10.1.1.3
Router(config-pce-p2mp-ep-set)# ipv4 10.1.1.4
Router(config-pce-p2mp-ep-set)# exit
Router(config-pce-sr-te-p2mp)#
```

Use the **policy** *policy* command to configure the P2MP policy name and enter P2MP Policy sub-mode. Configure the source address, endpoint-set color, Tree-SID label, affinity constraints, and metric type.

```
Router(config-pce-sr-te-p2mp)# policy FOO
Router(config-pce-p2mp-policy)# source ipv4 10.1.1.6
Router(config-pce-p2mp-policy)# color 10 endpoint-set BAR
Router(config-pce-p2mp-policy)# tresid mpls 15200
Router(config-pce-p2mp-policy)# candidate-paths
Router(config-pce-p2mp-policy-path)# constraints
Router(config-pce-p2mp-policy-path-const)# affinity
Router(config-pce-p2mp-policy-path-const-affinity)# exclude BLUE
Router(config-pce-p2mp-policy-path-const-affinity)# exit
Router(config-pce-p2mp-policy-path-const)# exit
Router(config-pce-p2mp-policy-path-const-preference)# preference 100
Router(config-pce-p2mp-policy-path-const-preference)# dynamic
Router(config-pce-p2mp-policy-path-const-preference-info)# metric type te
Router(config-pce-p2mp-policy-path-const-preference-info)# root
Router(config-pce-p2mp-policy-path-const-preference-info)# root
Router(config)#
```

##### Configure Multicast on the Root and Leaf Nodes

On the root node of the SR P2MP segment, use the **router pim** command to enter Protocol Independent Multicast (PIM) configuration mode to statically steer multicast flows into an SR P2MP policy.



**Note** Enter this configuration only on an SR P2MP segment. Multicast traffic cannot be steered into a P2P policy.

```
Router(config)# router pim
Router(config-pim)# vrf name
Router(config-pim-name)# address-family ipv4
Router(config-pim-name-ipv4)# sr-p2mp-policy FOO
Router(config-pim-name-ipv4-srp2mp)# static-group 235.1.1.5 10.1.1.6
Router(config-pim-name-ipv4-srp2mp)# root
Router(config)#
```

On the root and leaf nodes of the SR P2MP tree, use the **mdt static segment-routing** command to configure the multicast distribution tree (MDT) core as Tree-SID from the multicast VRF configuration submode.

```
Router(config)# multicast-routing
Router(config-mcast)# vrf TEST
Router(config-mcast-TEST)# address-family ipv4
Router(config-mcast-TEST-ipv4)# mdt static segment-routing
```

On the leaf nodes of an SR P2MP segment, use the **static sr-policy p2mp-policy** command to configure the static SR P2MP Policy from the multicast VRF configuration submode to statically decapsulate multicast flows.

```
Router(config)# multicast-routing
Router(config-mcast)# vrf TEST
Router(config-mcast-TEST)# address-family ipv4
Router(config-mcast-TEST-ipv4)# static sr-policy FOO
```

## Running Config

The following example shows how to configure the end point addresses and P2MP SR policy with affinity constraints on SR-PCE.

```
pce
segment-routing
traffic-eng
affinity bit-map
RED 23
BLUE 24
CROSS 25
!
p2mp
endpoint-set BAR
ipv4 10.1.1.2
ipv4 10.1.1.3
ipv4 10.1.1.4
!
policy FOO
source ipv4 10.1.1.6
color 10 endpoint-set BAR
treesid mpls 15200
candidate-paths
preference 100
dynamic
metric
type te
```

```

    !
    !
    !
    constraints
    affinity
    exclude
    BLUE
    !
    !
    !
    !
    !
    !
    !
    !
    !
    !

```

The following example shows how to statically decapsulate multicast flows on the leaf nodes.

```

multicast-routing
vrf TEST
  address-family ipv4
    static sr-policy FOO
  !
  !
  !

```

The following example shows to configure the multicast distribution tree (MDT) core as Tree-SID on the root and leaf nodes.

```

multicast-routing
vrf TEST
  address-family ipv4
    mdt static segment-routing
  !
  !
  !

```

The following example shows how to steer traffic to the SR P2MP policy on the root node.

```

router pim
vrf TEST
  address-family ipv4
    sr-p2mp-policy FOO
    static-group 232.1.1.5 10.1.1.6
  !
  !
  !
  !

```

