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
- TE optimization criteria (for example, TE or IGP metric) and constraints

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A P2MP SR policy request contains the following:

- Policy name
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.

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.
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.

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.

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.

Running Config

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

```
Router(config-pce-sr-te-p2mp) policy FOO
Router(config-pce-p2mp-policy) source ipv4 1.1.1.6
Router(config-pce-p2mp-policy) color 10 endpoint-set BAR
Router(config-pce-p2mp-policy) treesid mpls 15200
Router(config-pce-p2mp-policy) candidate-paths
Router(config-pce-p2mp-path-const) affinity
Router(config-pce-p2mp-path-affinity) exclude BLUE
Router(config-pce-p2mp-path-affinity) exit
Router(config-pce-p2mp-policy-path) exit
Router(config-pce-p2mp-policy-path) preference 100
Router(config-pce-p2mp-policy-path-const) dynamic
Router(config-pce-p2mp-policy-path-info) metric type te
Router(config-pce-p2mp-policy-path-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 1.1.1.6
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-PE.

```
pce
segment-routing
```
traffic-eng
  affinity bit-map
    RED 23
    BLUE 24
    CROSS 25
  !
p2mp
  endpoint-set BAR
    ipv4 1.1.1.2
    ipv4 1.1.1.3
    ipv4 1.1.1.4
  !
policy FOO
  source ipv4 1.1.1.6
  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 1.1.1.6
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Running Config

!