SR-TE On Demand LSP

Effective Cisco IOS XE Everest 16.6.1, SR TE On demand LSP feature provides the ability to connect Metro access rings via a static route to the destination. The static route is mapped to an explicit path that triggers an on demand LSP to the destination. The SR TE On demand LSP feature will be used to transport the VPN services between the Metro access rings.

Restrictions for SR-TE On Demand LSP

- Segment-Routing auto tunnel static route does not support ECMP.
- Metrics for IP explicit path and administrative distance change for auto tunnel SRTE static route is not supported.
- MPLS Traffic Engineering (TE) Nonstop Routing (NSR) must be configured on the active route processor (RP) for Stateful Switchover (SSO). This is because SR static auto tunnel fails to come up after SSO, unless the static route auto tunnel configuration is removed and reconfigured.
- IP unnumbered interfaces do not support dynamic path.
- When using IP unnumbered interfaces, you cannot specify next hop address as an explicit path index. It should be a node address or a label.

Information About SR-TE On Demand LSP

The SR TE On demand LSP feature provides the ability to connect Metro access rings via a static route to the destination.

SR-TE: Setup LSP as Static Route

Agile Carrier Ethernet (ACE) solution leverages Segment Routing-based transport for consolidated VPN services. In metro rings architecture, the access rings do not share their routing topologies with each other.

The SR TE On demand LSP feature provides the ability to connect Metro access rings via a static route to the destination. The static route is mapped to an explicit path and that will trigger an on demand LSP to the

destination. The SR TE On demand LSP feature is used to transport the VPN services between the Metro access rings.

Figure 1: Inter-Metro LSP in ACE Solution
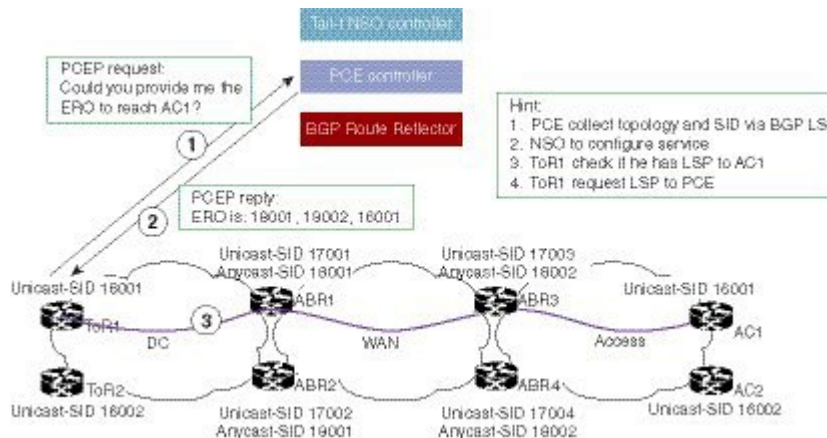
Inter-Metro LSPs have the following aspects:

- The source packet may not know the IP address of the destination device.

- Existing segment routing features are applicable for LSPs.

- The binding SID helps in steering the traffic in the SR-TE tunnel. In other words, ingress MPLS packet with the binding SID will be forwarded through the specific SR-TE tunnel.

Static SRTE over Unnumbered Interfaces

As explained in the previous section, you can set up LSP as static route to create an auto tunnel by specifying an IP explicit path.

The explicit path is a combination of IP addresses (or) IP address and labels. You can also configure the static SRTE tunnel over unnumbered interfaces. There are few restrictions for unnumbered interfaces against numbered interfaces.

- You must specify the node IP address, not the next hop interface address in the ip-explicit path option.
- You must not specify adjacency SID in the explicit path option. In short, the explicit path option should contain only the node IP address (/32 mask) and prefix SID labels.

How to Configure SR-TE On Demand LSP

Perform the following steps to configure SR-TE On Demand LSP.

Configuring LSP as Static Route

To avoid packet drop after RP switchover with SR TE, it is recommended to use the following command:

```
mpls traffic-eng nsr
```

If ISIS is configured, use the following command:

```
router isis
 nsf cisco
 nsf interval 0
```

Enabling Segment Routing Auto Tunnel Static Route

Perform this task to configure auto tunnel static route as follows:

- Configure IP explicit path
- Associate the auto tunnel with an IP explicit path with a static route
- Enable peer-to-peer (P2P) auto tunnel service

```
ip explicit-path name path1
 index 1 next-label 16002
 index 2 next-label 16006
 exit
mpls traffic-eng auto-tunnel p2p
mpls traffic-eng auto-tunnel p2p config unnumbered-interface loopback0
mpls traffic-eng auto-tunnel p2p tunnel-num min 10 max 100
ip route 172.16.0.1 255.240.0.0 segment-routing mpls path name path1
```

Verifying Segment Routing Auto-Tunnel Static Route

The command **show mpls traffic-eng service summary** displays all registered TE service clients and statistics that use TE auto tunnel.

```
Device# show mpls traffic-eng service summary
Service Clients Summary:
  Client: BGP TE
    Client ID               :0
    Total P2P tunnels       :1
    P2P add requests        :6
    P2P delete requests     :5
P2P add falis           :0
  P2P delete falis        :0
  P2P notify falis        :0
  P2P notify succs        :12
  P2P replays             :0
Client: ipv4static
  Client ID               :1
  Total P2P tunnels       :1
  P2P add requests        :6
  P2P delete requests     :5
  P2P add falis           :0
  P2P delete falis        :0
  P2P notify falis        :0
  P2P notify succs        :85
  P2P replays             :0
```

The command **show mpls traffic-eng auto-tunnel p2p** displays the peer-to-peer (P2P) auto tunnel configuration and operation status.

The command **show mpls traffic-eng tunnel summary** displays the status of P2P auto tunnel.

```
Device# show mpls traffic-eng auto-tunnel p2p
State: Enabled
  p2p auto-tunnels: 2 (up: 2, down: 0)
  Default Tunnel ID Range: 62336 - 64335
  Config:
unnumbered-interface: Loopback0 Tunnel ID range: 1000 - 2000
```

The command **show mpls traffic-eng tunnel summary** displays the status of P2P auto tunnel.

```
Device# show mpls traffic-eng tunnel summary
Signalling Summary:
    LSP Tunnels Process:
    Passive LSP Listener:
    RSVP Process:
    Forwarding:
    auto-tunnel:
running
running
running
enabled
p2p    Enabled  (1), id-range:1000-2000
Periodic reoptimization:
Periodic FRR Promotion:
Periodic auto-bw collection:
SR tunnel max label push:
P2P:
every 3600 seconds, next in 1265 seconds
Not Running
every 300 seconds, next in 66 seconds
13 labels
      Head: 11 interfaces,   5234 active signalling attempts, 1 established
            5440 activations,  206 deactivations
            1821 failed activations
            0 SSO recovery attempts, 0 SSO recovered
      Midpoints: 0, Tails: 0
    P2MP:
      Head: 0 interfaces,   0 active signalling attempts, 0 established
            0 sub-LSP activations,  0 sub-LSP deactivations
            0 LSP successful activations,  0 LSP deactivations
            0 SSO recovery attempts, LSP recovered: 0 full, 0 partial, 0 fail
      Midpoints: 0, Tails: 0
Bidirectional Tunnel Summary:
    Tunnel Head: 0 total, 0 connected, 0 associated, 0 co-routed
LSPs Head:
LSPs Mid:
LSPs Tail:
0 established, 0 proceeding, 0 associated, 0 standby
0 established, 0 proceeding, 0 associated, 0 standby
0 established, 0 proceeding, 0 associated, 0 standby
AutoTunnel P2P Summary:
    ipv4static:
        Tunnels: 1 created, 1 up, 0 down
    Total:
        Tunnels: 1 created, 1 up, 0 down
```

The command **show ip explicit-path** displays the configured IP explicit paths.

```
Device# show ip explicit-path
PATH path1 (strict source route, path complete, generation 5)
    1: next-label 16055
```

```
     2: next-label 16070
     3: next-label 16010
PATH path2 (strict source route, path complete, generation 9)
     1: next-label 16070
     2: next-label 16010
Device# show running-config | i ip route
ip route  10.10.10.10 255.255.255.255 segment-routing mpls path name path1 verbatim
ip route  11.11.11.1 255.255.255.255 segment-routing mpls path name path2 verbatim
ip route  11.11.11.2 255.255.255.255 segment-routing mpls path name path2 verbatim
```

The command **show mpls traffic-eng tunnel auto-tunnel detail** only displays TE service auto tunnel.

```
Device# show mpls traffic-eng tunnel auto-tunnel detail
P2P TUNNELS/LSPs:

Name: R1-RSP2_t4000                        (Tunnel4000) Destination: 0.0.0.0 Ifhandle: 0x23
 (auto-tunnel for ipv4static)
 Status:
   Admin: up        Oper: up     Path: valid       Signalling: connected
   path option 1, (SEGMENT-ROUTING) type explicit (verbatim) path1 (Basis for Setup)

 Config Parameters:
   Bandwidth: 0        kbps (Global)  Priority: 7  7   Affinity: 0x0/0xFFFF
   Metric Type: TE (default)
   Path Selection:
    Protection: any (default)
   Path-selection Tiebreaker:
     Global: not set   Tunnel Specific: not set   Effective: min-fill (default)
   Hop Limit: disabled [ignore: Verbatim Path Option]
   Cost Limit: disabled
   Path-invalidation timeout: 10000 msec (default), Action: Tear
   AutoRoute: disabled LockDown: disabled Loadshare: 0 [0] bw-based
   auto-bw: disabled
   Fault-OAM: disabled, Wrap-Protection: disabled, Wrap-Capable: No
 Active Path Option Parameters:
   State: explicit path option 1 is active
   BandwidthOverride: disabled  LockDown: disabled  Verbatim: enabled

 History:
   Tunnel:
     Time since created: 7 days, 22 hours, 48 minutes
     Time since path change: 7 days, 22 hours, 47 minutes
     Number of LSP IDs (Tun_Instances) used: 9
   Current LSP: [ID: 9]
     Uptime: 7 days, 22 hours, 47 minutes
 Tun_Instance: 9
 Segment-Routing Path Info (IGP information is not used)
   Segment0[First Hop]: 0.0.0.0, Label: 16055
   Segment1[ - ]: Label: 16070
   Segment2[ - ]: Label: 16010
```

The command **show mpls traffic-eng tunnel brief** displays auto tunnel information.

```
Device# show mpls traffic-eng tunnel brief
Signalling Summary:
   LSP Tunnels Process: running
   Passive LSP Listener: running
   RSVP Process:  running
   Forwarding:   enabled
   auto-tunnel:
 p2p    Enabled  (2), id-range:1000-2000
```

```
        Periodic reoptimization:  every 3600 seconds, next in 406 seconds
        Periodic FRR Promotion:  Not Running
        Periodic auto-bw collection: every 300 seconds, next in 107 seconds
        SR tunnel max label push:  13 labels
P2P TUNNELS/LSPs:
TUNNEL NAME    DESTINATION   UP IF   DOWN IF   STATE/PROT
R1_t1      66.66.66.66   -    -   up/down
R1_t2      66.66.66.66   -    -   up/down
R1_t3      66.66.66.66   -    -   up/down
R1_t10     66.66.66.66   -    -   up/down
SBFD tunnel    33.33.33.33   -    -    up/down
SBFD Session configured: 1  SBFD sessions UP: 1
```