

Dynamic Path Computation Client

Effective Cisco IOS XE Everest 16.6.1, the Stateful Path Computation Element Protocol (PCEP) enables a router to report and delegate Label Switched Paths (LSPs) that are established using Resource Reservation Protocol (RSVP) protocol to a stateful Path Computation Element (PCE). An LSP delegated to a PCE can be updated by the PCE and a stateful PCE can initiate an LSP on a Path Computation Client (PCC).

RSVP-TE LSPs require link-state routing protocols such as OSPF or IS-IS to distribute and learn traffic engineering topology. A stateful PCE can learn the traffic engineering topology through BGP Link-State (BGP-LS) protocol. The IGP instance running on a router feeds the traffic engineering topology information into BGP which passes that information to stateful PCE.

Note Dynamic PCC is available only on the Cisco RSP2 Module.

Note Path Computation Element is not supported on the Cisco RSP2 Module.

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Information About Dynamic PCC

PCEP functions

A PCEP session is a TCP session between a PCC and a PCE with protocol messages. The PCEP functions are verified based on the PCC functions. The configuration and verification show that the request is accepted and path computation is provided based on PCReq message from the client. The passive reporting enables a router to report a tunnel instead of delegating it to a PCE. The PCE is aware of the tunnel even though it cannot modify the tunnel.

PCEP functions are useful when a network has both router-controlled and PCE delegated tunnels. The PCE is aware of both the tunnels and can make an accurate decision on path computation.

Configure Dynamic PCC Globally

To configure dynamic PCC globally:

```
enable
configure terminal
segment-routing traffic-eng
pcc
pce address 12.12.12.12 source-address 196.196.196.196  ------ (12.12.12.12 is the PCE
server address)
end
```

Configure Dynamic PCE Delegated SR Policy

To configure dynamic PCE delegated SR policy:

```
on-demand color 100000
  authorize
  candidate-paths
   preference 100
    constraints
     segments
      dataplane mpls
     !
    !
    dynamic
     pcep   ---------------- PCE Delegated SR Policy
     metric
      type delay
     !
    !
   !
  !
```

Verify Dynamic PCC

Use the **show pce client peer detail** command to verify the PCE client peer details.

```
Router#show pce client peer detail
Load for five secs: 6%/1%; one minute: 6%; five minutes: 6%
Time source is NTP, 14:26:41.700 IST Thu Feb 10 2022

PCC's peer database:
--------------------

Peer address: 12.12.12.12 (best PCE)
  State up
  Capabilities: Stateful, Update, Segment-Routing, Instantiation
  PCEP has been up for: 01:41:50
  PCEP session ID: local 1, remote: 0
  Sending KA every 30 seconds
  Minimum acceptable KA interval: 20 seconds
  Peer timeout after 120 seconds
  Statistics:
    Keepalive messages: rx     198  |  tx     146
    Request messages:   rx       0  |  tx       0
```

```
    Reply messages:     rx       4  |  tx       0
    Error messages:     rx       0  |  tx       0
    Open messages:      rx       1  |  tx       1
    Report messages:    rx       0  |  tx      51
    Update messages:    rx      36  |  tx       0
    Reply time: avg = 0ms, min = 0ms, max = 0ms
```

Use the **show segment-routing traffic-eng policy name** command to verify the policy name.

```
Router#show segment-routing traffic-eng policy name
 *203.203.203.203|100000 detail
Load for five secs: 4%/1%; one minute: 5%; five minutes: 5%
Time source is NTP, 14:32:10.942 IST Thu Feb 10 2022


Name: *203.203.203.203|100000 (Color: 100000 End-point: 203.203.203.203)
  Owners : BGP
  Status:
    Admin: up, Operational: up for 00:00:25 (since 02-10 14:49:31.296)
  Candidate-paths:
    Preference 100 (BGP):
      Dynamic (pce 12.12.12.12) (active)
        Metric Type: DELAY, Path Accumulated Metric: 158
          35 [Adjacency-SID, 170.50.63.2 - 170.50.63.1]
  Attributes:
    Binding SID: 3095
      Allocation mode: dynamic
      State: Programmed
  IPv6 caps enabled
  Tunnel ID: 65543 (Interface Handle: 0x57)
  Per owner configs:
    BGP
      Binding SID: dynamic
  Stats:
    5 minute output rate 0 bits/sec, 0 packets/sec
    Packets: 10         Bytes: 744

  Event history:
    Timestamp                  Client                  Event type              Context:
Value
    ---------                  ------                  ----------              -------:
-----
    02-10 14:49:31.297         BGP                     Policy created          Name: BGP
    02-10 14:49:31.299         BGP                     Set colour              Colour:
100000
    02-10 14:49:31.299         BGP                     Set end point           End-point:
 203.203.203.203
    02-10 14:49:31.426         BGP                    Set dynamic             Path option:
 dynamic
    02-10 14:49:31.496         BGP                     BSID allocated          FWD: label
 3095
    02-10 14:49:31.510         BGP                    Set dynamic pce         Path option:
 dynamic pce
    02-10 14:49:32.152         FH Resolution           Policy state UP         Status:
PATH RESOLVED CP: 100
    02-10 14:49:32.450         FH Resolution           REOPT triggered         Status:
REOPTIMIZED CP: 100
```

Use the **show pce client lsp detail** command to verify PCC's tunnel database.

```
Router#show pce client lsp detail
Load for five secs: 5%/1%; one minute: 5%; five minutes: 5%
Time source is NTP, 14:36:15.835 IST Thu Feb 10 2022
```

```
PCC's tunnel database:
----------------------
Tunnel Name: bgp_color_100000_ep_203.203.203.203_discr_100
 LSPs:
  LSP[0]:
   source 206.206.206.206, destination 203.203.203.203, tunnel ID 1, LSP ID 0
   State: Admin up, Operation active
   Binding SID: 1906
   Setup type: SR
   Bandwidth: requested 0, used 0
   LSP object:
     PLSP-ID 0x80001, flags: D:0 S:0 R:0 A:1 O:2
   Metric type: Latency, Accumulated Metric 158
   ERO:
     SID[0]: Node, Label 16350, NAI: 203.203.203.203
 PLSP Event History (most recent first):
   Thu Feb 10 12:44:55.002: PCRpt update LSP-ID:0, SRP-ID:1, PST:1, METRIC_TYPE:12, REQ_BW:0,
 USED_BW:0
   Thu Feb 10 12:44:54.962: PCUpd SRP-ID:1, METRIC_TYPE:12, METRIC_VALUE:158
   Thu Feb 10 12:44:54.262: PCRpt update LSP-ID:0, SRP-ID:0, PST:1, METRIC_TYPE:12, REQ_BW:0,
 USED_BW:0
   Thu Feb 10 12:44:54.258: PCRpt create LSP-ID:0, SRP-ID:0, PST:1, METRIC_TYPE:12, REQ_BW:0,
 USED_BW:0
```

Use the **show pce lsp detail** command to verify that the tunnel is delegated.

```
Router#show pce lsp detail
Thu Feb 10 14:34:57.852 IST

PCE's tunnel database:
----------------------
PCC 196.196.196.196:

Tunnel Name: bgp_color_100000_ep_203.203.203.203_discr_100
Color: 100000
Interface Name: Tunnel65536
 LSPs:
  LSP[0]:
   source 206.206.206.206, destination 203.203.203.203, tunnel ID 1, LSP ID 0
   State: Admin up, Operation active
   Setup type: Segment Routing
   Binding SID: 1906
   Maximum SID Depth: 2
   Preference: 100
   Protection type: protected-preferred
   Invalidated traffic dropped: Yes
   PCEP information:
     PLSP-ID 0x80001, flags: D:1 S:0 R:0 A:1 O:2 C:0
   LSP Role: Single LSP
   State-sync PCE: None
   PCC: 196.196.196.196
   LSP is subdelegated to: None
   Reported path:
     Metric type: Latency, Accumulated Metric 158
      SID[0]: Node, Label 16350, Address 203.203.203.203
   Computed path: (Local PCE)
     Computed Time: Thu Feb 10 14:14:35 IST 2022 (00:20:22 ago)
     Metric type: Latency, Accumulated Metric 158
      SID[0]: Node, Label 16350, Address 203.203.203.203
   Recorded path:
     None
   Disjoint Group Information:
     None
```