



Possibilities

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MPLS-TE Troubleshooting on IOS-XR

Scenarios and Cases studies

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Agenda

- Most common mistakes observed while troubleshooting MPLS-TE.
- Case studies and scenarios
 - Case study# 1 – MPLS-TE down, due to RSVP signaling issue.
 - Case Study# 2 – A working MPLS-TE tunnel went down and failed to recover, after a fibre cut.
- Appendix
 - Demo – More case studies live in action.
 - Toolbox for troubleshooting MPLS-TE.

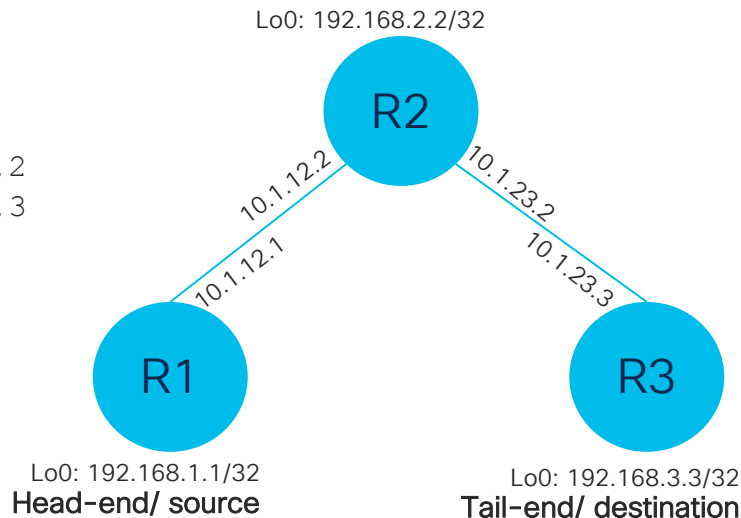
Common mistakes observed while troubleshooting MPLS-TE tunnels

Always ignoring the tail-end.

- MPLS-TE tunnels are unidirectional, hence majority of the people tend to focus too much on the head-end and ignore the tail-end router.
- Let's look at the sample configuration on an IOS-XR device:

Below is an example from the head-end:

```
explicit-path name tel
  index 1 next-address strict ipv4 unicast 10.1.12.2
  index 2 next-address strict ipv4 unicast 10.1.23.3
!
interface tunnel-te1
  ipv4 unnumbered Loopback0
  destination 192.168.3.3
  path-option 1 explicit name tel
  path-option 10 dynamic
!
```



Common mistakes observed while troubleshooting MPLS-TE tunnels

Always ignoring the tail-end.

- Let's check why the MPLS TE Tunnel is down:

```
RP/0/0/CPU0:R1#sh mpls traffic-eng tunnels 1
Sat May 16 04:23:10.716 UTC
```

```
Name: tunnel-te1 Destination: 192.168.3.3 Ifhandle:0x580
Signalled-Name: R1_t1
Status:
```

```
Admin: up Oper: down Path: not valid Signalling: Down
```

```
path option 1, type explicit tel
Last PCALC Error: Sat May 16 04:18:40 2020
```

```
Info: Can't find destination 0000.0000.0000.00
```

The destination is
being shown as
unknown

```
path option 10, type dynamic
Last PCALC Error: Sat May 16 04:18:40 2020
```

```
Info: Destination IP address, 192.168.3.3, not found in topology
G-PID: 0x0800 (derived from egress interface properties)
Bandwidth Requested: 0 kbps CT0
```

Common mistakes observed while troubleshooting MPLS-TE tunnels

Always ignoring the tail-end.

• Configuration on the head-end:

```
RP/0/0/CPU0:R1#show run router ospf
Sat May 16 04:20:01.999 UTC
router ospf 1
  router-id 192.168.1.1
  area 0
    mpls traffic-eng
    interface Loopback0
    !
    interface GigabitEthernet0/0/0/0
    !
    interface GigabitEthernet0/0/0/1
      cost 10
    !
  !
  mpls traffic-eng router-id Loopback0
  !
```

• Configuration on the tail-end:

```
RP/0/0/CPU0:R3#show run router ospf
router ospf 1
  router-id 192.168.3.3
  area 0
    mpls traffic-eng
    interface Loopback0
    !
    interface GigabitEthernet0/0/0/2
    !
    interface GigabitEthernet0/0/0/3
    !
    !
    mpls traffic-eng router-id Loopback1
  !
RP/0/0/CPU0:R3#sh ip int br | in Loop
Sat May 16 22:29:10.012 UTC
Loopback0                                192.168.3.3                Up
Up          default
Loopback1                                192.168.13.13             Up
Up          default
```

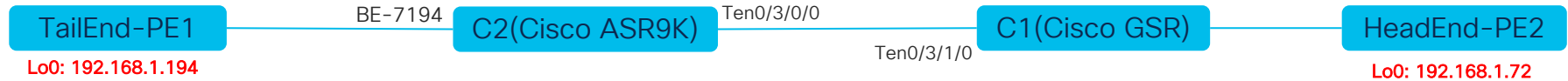
Loopback1 is not advertised in OSPF.

Case study # 1

Case studies and scenarios

Case study 1:

Topology:



PE1 and PE2 are both 3rd party vendor devices.

Problem:

RSVP-TE tunnel is not coming up and signaling is failing from PE2 to PE1. From the PE2 output, customer advised us there was a RSVP signaling failure observed on its "show mpls traffic-eng tunnels <tunnel-name>" equivalent command.

High level theory:

Basic logic of MPLS-TE is that, the headend sends a PATH message to the tail-end, and the tail-end responds with a RESV message back to the head-end. If this signaling is successfully completed, MPLS-TE tunnel comes UP.

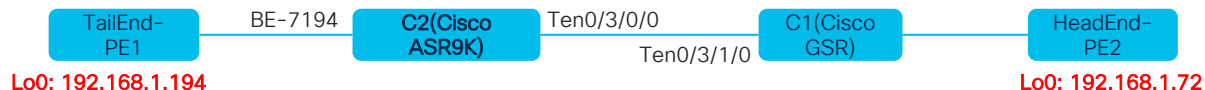
For detailed knowledge on the working of MPLS-TE, you can refer:

<https://www.ciscolive.com/c/dam/r/ciscolive/us/docs/2017/pdf/BRKMPL-2100.pdf>

Case studies and scenarios

Case study 1:

Troubleshooting:



We collected, show mpls traffic-eng trace and show rsvp traces from C2 and C1, as they were Cisco devices, to find clues, if these Cisco devices are dropping the signaling.

We focused only on traces, as they were the mid point of the TE tunnel.

One can use the below command to look at the status of the tunnel on the mid-points:

```
# show mpls traffic-eng tunnels all role all
```

Analysis:

MPLS traces which suggest that C2 is receiving a PATH message from the Head End:

```
Apr  4 14:16:11.688 mpls_te/sig 0/RP1/CPU0 t1  Type:p2p, mid, T:280, L:32786, S:192.168.1.72, E:192.168.1.72, D:192.168.1.194, Received event (PATH_CR) from RSVP
```

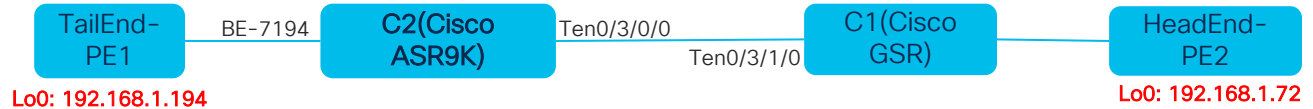
MPLS traces which suggest that C2 is sending a PATH message to the Tail End:

```
Apr  4 14:16:11.688 mpls_te/sig 0/RP1/CPU0 t1  Type:p2p, mid, T:280, L:32786, S:192.168.1.72, E:192.168.1.72, D:192.168.1.194, Sent event (PATH_CR)
```

C2(Cisco ASR9K)

Case studies and scenarios

Case study 1:



Analysis contd:

Below are the RSVP traces from show tech RSVP, that suggest, a PATH message was being sent to the Tail End, and destroyed 30 secs later:

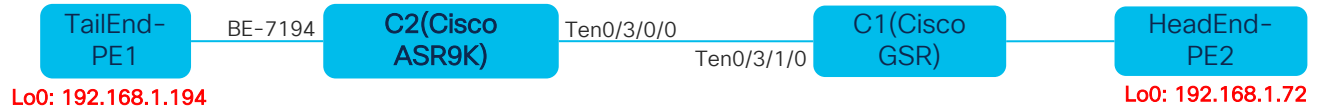
```
Apr  4 14:16:11.688 rsvp/sig 0/RP1/CPU0 t1  SIG:720: PATH Tunnel IPv4 created: dst
(192.168.1.194 :280), src (192.168.1.72:32786)
Apr  4 14:16:11.689 rsvp/sig 0/RP1/CPU0 t1  SIG:2880: PATH outgoing creating: flags:0xc0000018,
local_rid:192.168.1.32, nbor:192.168.1.194, nhop:10.1.12.2, next_ifh:Bundle-Ether7194 (ifh
0x20001a0), obj_len: 232
Apr  4 14:16:11.689 rsvp/sig 0/RP1/CPU0 t1  SIG:886: PATH Tunnel IPv4 outgoing: dst
(192.168.1.194 :280), src (192.168.1.72:32786)
Apr  4 14:16:41.267 rsvp/sig 0/RP1/CPU0 t1  SIG:3843: PATH destroy: dst (192.168.1.194:280),
src (192.168.1.72:32786) reason: (2): State deleted due to signaling
```

Now, below MPLS traces suggest that we are not receiving a RESV message back from the Tail End:

```
Apr  4 14:16:11.682 mpls_te/fsm 0/RP1/CPU0 t1  Type:p2p, mid, T:280, L:32786, S:192.168.1.72,
E:192.168.1.72, D:192.168.1.194, Event EV_RSVP_PATH_CREATE processed: state (ST_INIT ->
ST_WAIT_RESV)
```

Case studies and scenarios

Case study 1:



Analysis contd:

Now, 30 secs later, as the Head End doesn't get a RESV message from the Tail End, RSVP signaling is not getting completed. A PATH DEL message is sent to the Tail End by C2 (Cisco ASR9K):

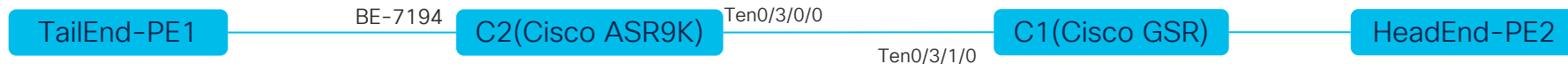
```
Apr 4 14:16:41.270 mpls_te/fsm 0/RP1/CPU0 t1 Type:p2p, mid, T:280, L:32786, S:192.168.1.72,
E:192.168.1.72, D:192.168.1.194, Cleaning-up s2l in state ST_WAIT_RESV (cause: Mid Cleanup
handling, subcause: Path delete request)
Apr 4 14:16:41.270 mpls_te/fsm 0/RP1/CPU0 t1 Type:p2p, mid, T:280, L:32786, S:192.168.1.72,
E:192.168.1.72, D:192.168.1.194, Event EV_RSVP_PATH_DEL processed: state (ST_WAIT_RESV ->
ST_NONE)
```

There can be 3 possibilities why the RESV wasn't received by the ASR9K from the Tail End:

- 1) C2 (ASR9K) sent the PATH message out of the LC towards the tail, but was dropped by some device in between.
- 2) The Tail End is receiving the PATH message, but wasn't processing at the time.
- 3) The Tail End receives the PATH message, processes it, and sends the RESV, but is dropped at the ASR9K. Upon comprehensive analysis, no drops observed on ASR9K's interface/ NP.

Case studies and scenarios

Case study 1:



Solution:

Customer found an issue at the 3rd party tail end device (PE1), which was not sending the RESV back.

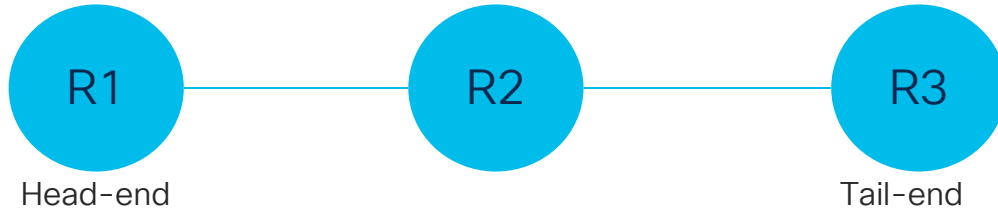
Upon rectifying the problem at the tail end, the issue was fixed, and the TE tunnel came UP.

Case study # 2

Case studies and scenarios

Case study 2:

Topology:



Problem:

RSVP-TE tunnel is not coming up between R1 (head-end) and R3 (tail-end)

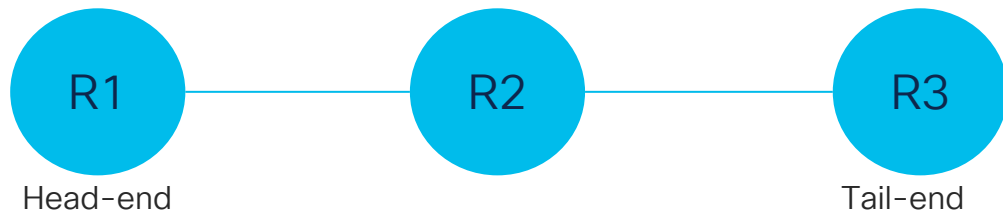
Trigger:

There was a fiber cut between R2 and R3, and then after a while, when the link restored, the tunnel wouldn't come up.

Case studies and scenarios

Case study 2:

Troubleshooting:



1) We checked the basics, show route, ping to the destination, and the show mpls traffic-eng tunnels:

```
RP/0/RP0/CPU0:R1#show mpls traffic-eng tunnels 13
```

```
Tue Mar 13 23:23:43.413 UTC
```

```
Name: tunnel-te13 Destination: 192.168.3.3 Ifhandle:0x4a020
```

```
Signalled-Name: tel
```

```
Status:
```

```
Admin: up Oper: down Path: not valid Signalling: Down
```

```
path option 50, type dynamic
```

```
Last PCALC Error: Tue Mar 13 20:15:30 2018
```

```
Info: No path to destination, 192.168.3.3 (unknown, Flags: 0)
```

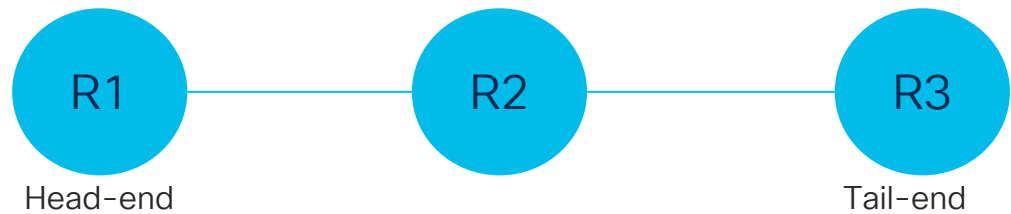
2) Per show log:

```
%ROUTING-BGP-3-ERR_ALM_ONE_LABEL : [7] : Unable to allocate label: 'MPLS_LSD' detected the 'warning'  
condition 'RW Creation aborted due to related Lbl Alloc failure
```

Case studies and scenarios

Case study 2:

Troubleshooting:



3) Per mpls traffic-engineering trace:

```
[0xC2D3801C, 'MPLS_LSD' detected the 'resource not available' condition 'Code(0)': No space left on device]
```

4) Then we checked what's bound to our destination:

```
RP/0/RP0/CPU0:R1#show mpls ldp bindings 192.168.3.3/32
Tue Mar 13 23:36:43.745 UTC
10.207.166.109/32, rev 0
```

```
No local binding (label OOR) <<<<
Remote bindings: (34 peers)
  Peer                Label
  -----
  -----
```

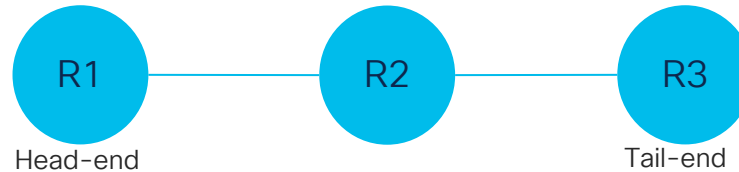
5) Let's check the label range on this device:

```
RP/0/RP0/CPU0:R1#show mpls label range
Wed Mar 14 00:11:29.224 UTC
Range for dynamic labels: Min/Max: 24000/289999
RP/0/RP0/CPU0:R1#
```


Case studies and scenarios

Case study 2:

Troubleshooting:



6) Let's check how many labels have been consumed:

```
RP/0/RP0/CPU0:R1#show mpls label table summary
```

```
Wed Mar 14 00:11:39.637 UTC
```

Application	Count
-----	-----
LSD (A)	4
TE-Control (A)	1784
BFD (A)	34
BFD (S)	34
L2VPN (A)	10813
BGP-VPNv4 (A) :bgp-default	247414
LDP (A)	5850
LDP (S)	5850
BGP-VPNv4 (S) :bgp-default	247409
-----	-----
TOTAL	265899

<<< $(289999 - 24000 = 265899)$. All available labels used.

Hence, we couldn't allocate any new labels to the TE tunnel.

Case studies and scenarios

Case study 2:

Solution:

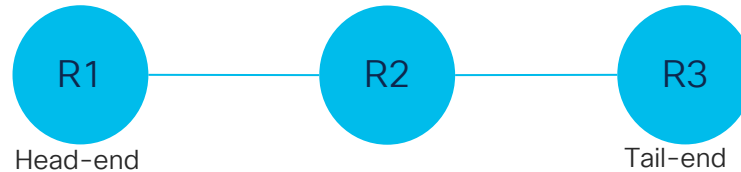
We simply increase the label pool, using the command:

```
# mpls label range 16000 1048575
```

Just for reference:

Label assignments:

0 - 15	Special labels
15 - 15,999	I2vpn labels
16000 - 23,999	SRGB labels
24,000 - 1,048,575	Dynamic range



- Demo – includes other common mistakes users make. Which are also true case studies

Thank you



Possibilities

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