



BASIC MPLS - MPLS Traffic Engineering Network

Traffic engineering is essential for service provider and Internet service provider (ISP) backbones. Such backbones must support a high use of transmission capacity, and the networks must be very resilient, so that they can withstand link or node failures.

MPLS traffic engineering provides an integrated approach to traffic engineering. With MPLS, traffic engineering capabilities are integrated into Layer 3, which optimizes the routing of IP traffic, given the constraints imposed by backbone capacity and topology.

MPLS traffic engineering routes traffic flows across a network based on the resources the traffic flow requires and the resources available in the network.

MPLS traffic engineering employs "constraint-based routing," in which the path for a traffic flow is the shortest path that meets the resource requirements (constraints) of the traffic flow. In MPLS traffic engineering, the flow has bandwidth requirements, media requirements, a priority versus other flows, and so on.

MPLS traffic engineering gracefully recovers to link or node failures that change the topology of the backbone by adapting to the new set of constraints.

Configuration

MPLS RSVP TE tunnels are a way to establish unidirectional label switching paths. In general RSVP TE serves similar purpose as label distribution using LDP protocol - establishing label switched path that ensures frame delivery from ingress to egress router, but with additional features:

- Possibility to establish label switching path using either full or partial explicit route;
- Constraint based LSP establishment - label switching path is established over links that fulfill requirements, such as bandwidth and link properties.

MPLS RSVP TE is based on RSVP protocol with extensions introduced by RFC 3209 that adds support for explicit route and label exchange.

MPLS Traffic Engineering - Preparing the Network

```
NetStepByStep-R2 (config-router) # mpls traffic-eng area X
```

- Turns on MPLS traffic engineering for OSPF area 0

```
NetStepByStep-R2 (config-router) # mpls traffic-eng router-id lo0
```

- Specifies that the traffic engineering router identifier for the node is the IP address associated with interface loopback0

```
NetStepByStep-R2 (config) # mpls traffic-eng tunnels
```

- Enables MPLS traffic engineering tunnels on a router.

```
NetStepByStep-R2 (config-if) # mpls traffic-eng tunnels
```

- Enables MPLS traffic engineering tunnels on an interface.

```
NetStepByStep-R2 (config-if) # ip rsvp bandwidth YYYY
```

- Enables RSVP for IP on an interface and specifies the amount of bandwidth that will be reserved.

Verification

```
show mpls traffic-eng topology brief
```

- Show the MPLS traffic engineering global topology as currently known at this node
- Provides a less detailed version of the topology

```
NetStepByStep-R2# show mpls traffic-eng topology brief
```

```
My_System_id: 2.2.2.2, Globl Link Generation 11
```

```
Signalling error holddown: 10 sec
```

```
IGP Id: 2.2.2.2, MPLS TE Id:2.2.2.2 Router Node
```

```
link[0 ]:DR Intf Address: 23.23.23.3, gen:10
```

```
frag_id 0, Intf Address:23.23.23.2
```

```
TE metric:10, IGP metric:10, attribute_flags:0x0
```

```
link[1 ]:DR Intf Address: 24.24.24.4, gen:11
```

```
frag_id 1, Intf Address:24.24.24.2
```

```
TE metric:10, IGP metric:10, attribute_flags:0x0
```

```

IGP Id: 3.3.3.3, MPLS TE Id:3.3.3.3 Router Node
  link[0 ]:DR Intf Address: 34.34.34.4, gen:6
    frag_id 0, Intf Address:34.34.34.3
    TE metric:10, IGP metric:10, attribute_flags:0x0

  link[1 ]:DR Intf Address: 23.23.23.3, gen:6
    frag_id 1, Intf Address:23.23.23.3
    TE metric:10, IGP metric:10, attribute_flags:0x0

IGP Id: 4.4.4.4, MPLS TE Id:4.4.4.4 Router Node
  link[0 ]:DR Intf Address: 34.34.34.4, gen:7
    frag_id 0, Intf Address:34.34.34.4
    TE metric:10, IGP metric:10, attribute_flags:0x0

  link[1 ]:DR Intf Address: 24.24.24.4, gen:7
    frag_id 1, Intf Address:24.24.24.4
    TE metric:10, IGP metric:10, attribute_flags:0x0

IGP Id: 23.23.23.3, Network Node
  link[0 ]:Nbr IGP Id: 3.3.3.3, gen:1

  link[1 ]:Nbr IGP Id: 2.2.2.2, gen:1

IGP Id: 24.24.24.4, Network Node
  link[0 ]:Nbr IGP Id: 4.4.4.4, gen:2

  link[1 ]:Nbr IGP Id: 2.2.2.2, gen:2

IGP Id: 34.34.34.4, Network Node
  link[0 ]:Nbr IGP Id: 4.4.4.4, gen:3

  link[1 ]:Nbr IGP Id: 3.3.3.3, gen:3

```

```
show mpls traffic-eng link-management summary
```

- Show a summary of link management information

```

NetStepByStep-R2# show mpls traffic-eng link-management summary
System Information::
  Links Count:          2
  Flooding System:     enabled
IGP Area ID:: ospf area 0
  Flooding Protocol:   OSPF
  Flooding Status:     data flooded
  Periodic Flooding:   enabled (every 180 seconds)
  Flooded Links:       2
  IGP System ID:       2.2.2.2
  MPLS TE Router ID:   2.2.2.2
  IGP Neighbors:       2
Link ID:: Et0/1 (23.23.23.2)

```

```
Link Status:
  Physical Bandwidth: 10000 kbits/sec
  Max Res Global BW: 5000 kbits/sec (reserved: 0% in, 0% out)
  Max Res Sub BW: 0 kbits/sec (reserved: 100% in, 100% out)
  MPLS TE Link State: MPLS TE on, RSVP on, admin-up, flooded
  Inbound Admission: reject-huge
  Outbound Admission: allow-if-room
  Admin. Weight: 10 (IGP)
  IGP Neighbor Count: 1
Link ID:: Et0/2 (24.24.24.2)
Link Status:
  Physical Bandwidth: 10000 kbits/sec
  Max Res Global BW: 5000 kbits/sec (reserved: 0% in, 0% out)
  Max Res Sub BW: 0 kbits/sec (reserved: 100% in, 100% out)
  MPLS TE Link State: MPLS TE on, RSVP on, admin-up, flooded
  Inbound Admission: reject-huge
  Outbound Admission: allow-if-room
  Admin. Weight: 10 (IGP)
  IGP Neighbor Count: 1
```

Troubleshoot

```
debug mpls traffic-eng areas
```

- Print information about traffic engineering area configuration change events
- Use in privileged EXEC mode.
- To disable debugging output, use the **no** form of this command.

```
debug mpls traffic-eng link-management events
```

- Print information about traffic engineering link management system events
- Use in privileged EXEC mode.
- To disable debugging output, use the **no** form of this command.

Video Cheat Sheet

R2

```
conf t
ip cef
!
router ospf 2
  mpls traffic-eng area 0
  mpls traffic-eng router-id lo0
!
  mpls traffic-eng tunnels
!
int e0/1
  mpls traffic-eng tunnels
  ip rsvp bandwidth 5000

int e0/2
  mpls traffic-eng tunnels
  ip rsvp bandwidth 5000
```