Contents

MPLS TE commands

auto-tunnel backup

Use **auto-tunnel backup** to enable the automatic bypass tunnel setup feature (also called auto FRR) globally, and enter MPLS TE auto FRR view.

Use **undo auto-tunnel backup** to disable the auto FRR feature globally.

Syntax

auto-tunnel backup

undo auto-tunnel backup

Default

The auto FRR feature is disabled globally.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

This feature enables the device to automatically set up two bypass tunnels for each primary CRLSP: one for link protection and the other for node protection. For the tunnels to be set up, you must also use the **tunnel-number** command to specify a tunnel interface number range.

Execution of the **undo auto-tunnel backup** command deletes all existing bypass tunnels automatically created for MPLS TE auto FRR.

If the PLR is the penultimate node of a primary CRLSP, the PLR does not create a node-protection bypass tunnel for the primary CRLSP.

Examples

Enable the automatic bypass tunnel setup feature globally, and enter MPLS TE auto FRR view.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] auto-tunnel backup
[Sysname-te-auto-bk]
```

Related commands

mpls te auto-backup disable

nhop-only

timers removal unused

tunnel-number

disable (explicit path view)

Use **disable** to disable an explicit path.

Use **undo disable** to restore the default.

Syntax

```
disable

undo disable
```

Default

The explicit path is enabled.

Views

Explicit path view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

You can use the **disable** command to prevent an explicit path from being used by a tunnel during explicit path configuration.

Examples

\# Disable explicit path **path1**.

```
<Sysname> system-view
[Sysname] explicit-path path1
[Sysname-explicit-path-path1] disable
```

display explicit-path

Use **display explicit-path** to display explicit path information.

Syntax

```
display explicit-path [ path-name ]
```

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

path-name: Displays information about the explicit path specified by its name, a case-sensitive string of 1 to 31 characters. If you do not specify this argument, the command displays information about all explicit paths.

Examples

\# Display information about all explicit paths.

```
<Sysname> display explicit-path
Path Name: path1      Hop Count: 3     Path Status: Enabled
Index      IP Address               Hop Type      Hop Attribute
1          1.1.1.1                  Strict        Include
101        2.2.2.2                  Loose         Include
```

```
201        3.3.3.3              -          Exclude
```

Table 1 Command output

Field	Description
Path Name	Name of the explicit path.
Hop Count	Number of nodes specified in the explicit path.
Path Status	Explicit path status: • **Enabled**—The explicit path is available. • **Disabled**—The explicit path is not available.
Index	Index of a node on the explicit path.
IP Address	IP address of a node on the explicit path.
Hop Type	Node type: • **Strict**—The node must be connected directly to its previous hop. • **Loose**—The node can be connected indirectly to its previous hop.
Hop Attribute	Node attribute: • **Include**—The node must be included in the explicit path. • **Exclude**—The node must not be included in the explicit path.

display isis mpls te advertisement

Use **display isis mpls te advertisement** to display link and node information in an IS-IS TEDB.

Syntax

display isis mpls te advertisement [[**level-1** | **level-2**] | [**originate-system** *system-id* | **local**] | **verbose**] * [*process-id*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

level-1: Displays link and node information for Level-1 routers.

level-2: Displays link and node information for Level-2 routers.

originate-system *system-id*: Displays link and node information advertised by the system specified by its system ID, in the format of XXXX.XXXX.XXXX.

local: Displays link and node information advertised by the local device.

verbose: Displays detailed information. If you do not specify this keyword, the command displays brief information.

process-id: Specifies an IS-IS process by its ID in the range of 1 to 65535. If you do not specify an IS-IS process, this command displays link and node information for all IS-IS processes.

Usage guidelines

If you do not specify the **level-1** or **level-2** keyword, this command displays link and node information for both Level-1 and Level-2 routers.

If you do not specify the **originate-system** *system-id* option or the **local** keyword, this command displays link and node information advertised by all systems.

Examples

\# Display brief link and node information in the IS-IS TEDB for Level-1 routers.

```
<Sysname> display isis mpls te advertisement level-1
                      TE information for IS-IS(1)
                      --------------------------


Level-1 TE node and link information
----------------------------
Node total count   : 2
Node index         : 0
  System ID        : 0000.0000.0004
  MPLS LSR ID      : 4.4.4.4
  Node flags       : -/-/R/-
  Link total count : 1
  Link information :
    Neighbour         Frag ID   Link Type   Local Address    Remote Address
    0000.0000.0004.04  0x00      Broadcast   1.1.1.3

Node index         : 1
  System ID        : 0000.0000.0001
  MPLS LSR ID      : 1.1.1.1
  Node flags       : -/-/R/-
  Link total count : 1
  Link information :
    Neighbour         Frag ID   Link Type   Local Address    Remote Address
    0000.0000.0004.04  0x00      Broadcast   1.1.1.1          --
```

\# Display detailed link and node information in the IS-IS TEDB for Level-1 routers.

```
<Sysname> display isis mpls te advertisement level-1 local verbose
                      TE information for IS-IS(1)
                      --------------------------


Level-1 TE node and link information
----------------------------
Node total count   : 2
Node index         : 0
  System ID        : 0000.0000.0004
  MPLS LSR ID      : 4.4.4.4
  Node flags       : -/-/R/-
  Link total count : 1
  Link information :
```

```
    Link index   : 0
      Neighbor    : 0000.0000.0004.04      Frag ID     : 0x00
      Link type  : Broadcast              Admin group : 0x00000000
      IGP metric : 10                     TE metric   : 10
      Link flags : -/-/-
      Physical bandwidth: 12500000 bytes/sec
      Reservable bandwidth: 0 bytes/sec
      Unreserved bandwidth for each TE class:
        TE class  0: 0 bytes/sec          TE class  1: 0 bytes/sec
        TE class  2: 0 bytes/sec          TE class  3: 0 bytes/sec
        TE class  4: 0 bytes/sec          TE class  5: 0 bytes/sec
        TE class  6: 0 bytes/sec          TE class  7: 0 bytes/sec
        TE class  8: 0 bytes/sec          TE class  9: 0 bytes/sec
        TE class 10: 0 bytes/sec          TE class 11: 0 bytes/sec
        TE class 12: 0 bytes/sec          TE class 13: 0 bytes/sec
        TE class 14: 0 bytes/sec          TE class 15: 0 bytes/sec
      Bandwidth constraint model: Prestandard DS-TE RDM
      Bandwidth constraints:
        BC[00]: 0 bytes/sec                BC[01]: 0 bytes/sec
      Local address: 1.1.1.3

Node index        : 1
  System ID       : 0000.0000.0001
  MPLS LSR ID     : 1.1.1.1
  Node flags      : -/-/-/-
  Link total count : 1
  Link information :
    Link index   : 0
      Neighbor    : 0000.0000.0004.04      Frag ID     : 0x00
      Link type : Broadcast              Admin group : 0x00000000
      IGP metric: 10                     TE metric   : 10
      Link flags: -/-/-
      Physical bandwidth: 12500000 bytes/sec
      Reservable bandwidth: 0 bytes/sec
      Unreserved bandwidth for each TE class:
        TE class  0: 0 bytes/sec          TE class  1: 0 bytes/sec
        TE class  2: 0 bytes/sec          TE class  3: 0 bytes/sec
        TE class  4: 0 bytes/sec          TE class  5: 0 bytes/sec
        TE class  6: 0 bytes/sec          TE class  7: 0 bytes/sec
        TE class  8: 0 bytes/sec          TE class  9: 0 bytes/sec
        TE class 10: 0 bytes/sec          TE class 11: 0 bytes/sec
        TE class 12: 0 bytes/sec          TE class 13: 0 bytes/sec
        TE class 14: 0 bytes/sec          TE class 15: 0 bytes/sec
      Bandwidth constraint model: Prestandard DS-TE RDM
      Bandwidth constraints:
        BC[00]: 0 bytes/sec                BC[01]: 0 bytes/sec
      Local address: 1.1.1.1
```

Table 2 Command output

Field	Description
TE information for IS-IS(1)	TE information for IS-IS process 1.
Node total count	Total number of nodes that advertised TE information.
Node flags	Node information flags: • **A**—Already synchronized node information with CSPF. • **S**—Ready to synchronize node information with CSPF again after the previous synchronization failed. • **R**—The node is reachable. • **O**—The node is overloaded.
Link total count	Total number of links advertised by the node.
Link information	Link information advertised by the node.
Neighbor	System ID of the neighbor.
Frag ID	LSP fragment number.
Link type	Link type: **Broadcast** or **P2P**.
Admin group	Administrator group attribute of the link.
Link flags	Link information flags: • **A**—Already synchronized link information with CSPF. • **U**—Ready to update link information with CSPF again after the previous update failed. • **D**—Ready to delete link information from CSPF again after the previous deletion failed.
Bandwidth constraint model	This field is not supported in the current software version. Bandwidth constraint model: • Prestandard DS-TE RDM. • IETF DS-TE RDM. • IETF DS-TE MAM.
Bandwidth constraints	This field is not supported in the current software version.
Local address	Local IP address of the link.
Remote address	Remote IP address of the link.

display isis mpls te network

Use **display isis mpls te network** to display network information in an IS-IS TEDB.

Syntax

display isis mpls te network [[**level-1** | **level-2**] | **local** | **lsp-id** *lsp-id*] * [*process-id*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

`level-1`: Displays network information for Level-1 routers.

`level-2`: Displays network information for Level-2 routers.

`local`: Displays network information advertised by the local device.

`lsp-id` *lsp-id*: Displays network information for an LSP. The *lsp-id* argument is the LSP ID in the format of *SYSID.Pseudonode ID-fragment num*. *SYSID* represents the system ID of the node or pseudonode that generates the LSP. *Pseudonode ID* represents ID of the pseudonode. *fragment num* represents the fragment number of the LSP.

process-id: Specifies an IS-IS process by its ID in the range of 1 to 65535. If you do not specify an IS-IS process, this command displays network information for all IS-IS processes.

Usage guidelines

If you do not specify the `level-1` or `level-2` keyword, this command displays network information for both Level-1 and Level-2 routers.

If you do not specify the `local` keyword or the `lsp-id` *lsp-id* option, this command displays all TE network information.

Examples

Display network information in IS-IS TEDBs.

```
<Sysname> display isis mpls te network

     TE information for IS-IS(1)
     --------------------------


Level-1 network information
---------------------------
LAN ID             : 0000.0000.0004.04
Frag ID            : 0x00
Flags              : -/-/-
Attached routers   : 0000.0000.0001
                     0000.0000.0004


Level-2 Network Information
---------------------------
LAN ID             : 0000.0000.0004.04
Frag ID            : 0x00
Flags              : -/-/-
Attached routers   : 0000.0000.0001
                     0000.0000.0004
```

Table 3 Command output

Field	Description
TE information for IS-IS(1)	TE information for IS-IS process 1.
LAN ID	Broadcast network ID, in the format of *System-ID.Pseudonode-ID*.
Frag ID	LSP fragment number.

Field	Description
Flags	State flag for network information: • **A**—Already synchronizes network information with CSPF. • **U**—Ready to update network information with CSPF again after the previous update failed. • **D**—Ready to delete network information from CSPF again after the previous deletion failed.

display isis mpls te tunnel

Use **display isis mpls te tunnel** to display MPLS TE tunnel interface information for IS-IS.

Syntax

display isis mpls te tunnel [**level-1** | **level-2**] [*process-id*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

level-1: Displays tunnel interface information for Level-1 routers.

level-2: Displays tunnel interface information for Level-2 routers.

process-id: Specifies an IS-IS process by its ID in the range of 1 to 65535. If you do not specify an IS-IS process, this command displays tunnel information for all IS-IS processes.

Usage guidelines

If you do not specify the **level-1** or **level-2** keyword, this command displays IS-IS tunnel interface information for both IS-IS Level-1 and IS-IS Level-2 routers.

Examples

Display MPLS TE tunnel interface information for IS-IS.

```
<Sysname> display isis mpls te tunnel

                   MPLS-TE tunnel information for IS-IS(1)
                   --------------------------------------


                       Level-1 Tunnel Statistics
                       -------------------------


   Tunnel Name       Auto Route       Destination       Metric
   ------------------------------------------------------------------
   Tun0              Advertise        2.2.2.2           Relative 0


                       Level-2 Tunnel Statistics
```

```
                        -----------------------

   Tunnel Name        Auto Route       Destination      Metric
   ----------------------------------------------------------------------
   Tun0               Advertise        2.2.2.2          Relative 0
```

Table 4 Command output

Field	Description
MPLS-TE tunnel information for IS-IS(1)	MPLS TE tunnel interface information for IS-IS process 1.
Auto Route	Automatic route advertisement method on the tunnel interface: • **Advertise**—Forwarding adjacency. • **Shortcut**—IGP shortcut.
Destination	Tunnel destination address.
Metric	Metric type and value configured on the tunnel interface: • Relative. • Absolute.

display mpls te link-management bandwidth-allocation

Use **display mpls te link-management bandwidth-allocation** to display bandwidth information on MPLS TE-enabled interfaces.

Syntax

display mpls te link-management bandwidth-allocation [**interface** *interface-type interface-number*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

interface *interface-type interface-number*: Displays bandwidth information on the interface specified by its type and number. If you do not specify this option, the command displays bandwidth information on all MPLS TE-enabled interfaces.

Examples

Display bandwidth information on all MPLS TE-enabled interfaces.

```
<Sysname> display mpls te link-management bandwidth-allocation
Interface: Vlan-interface10
  Max Reservable Bandwidth of Prestandard RDM : 0 kbps
  Max Reservable Bandwidth of IETF RDM        : 0 kbps
  Max Reservable Bandwidth of IETF MAM        : 0 kbps
  Allocated Bandwidth-Item Count : 1
```

```
    Allocated Bandwidth          : 1000 kbps
    Physical Link Status         : Up
    BC   Prestandard RDM(kbps)   IETF RDM(kbps)        IETF MAM(kbps)
    0    0                       0                     0
    1    0                       0                     0
    2    0                       0                     0
    3    0                       0                     0
    TE Class    Class Type    Priority    BW Reserved(kbps)   BW Available(kbps)
       0            0            0            0                   0
       1            0            1            0                   0
       2            0            2            0                   0
       3            0            3            0                   0
       4            0            4            0                   0
       5            0            5            0                   0
       6            0            6            0                   0
       7            0            7            0                   0
       8            1            0            0                   0
       9            1            1            0                   0
      10            1            2            0                   0
      11            1            3            0                   0
      12            1            4            0                   0
      13            1            5            0                   0
      14            1            6            0                   0
      15            1            7            0                   0
```

Table 5 Command output

Field	Description
Interface	Interface enabled with MPLS TE.
Max Link Bandwidth	Maximum link bandwidth for MPLS TE traffic.
Max Reservable Bandwidth of Prestandard RDM	This field is not supported in the current software version.
Max Reservable Bandwidth of IETF MAM	This field is not supported in the current software version.
Allocated Bandwidth-Item Count	Number of CRLSPs that have successfully obtained bandwidth.
BC	This field is not supported in the current software version. Bandwidth constraint value.
Prestandard RDM	This field is not supported in the current software version.
IETF RDM	This field is not supported in the current software version.
IETF MAM	This field is not supported in the current software version.

Related commands

mpls te max-link-bandwidth

display mpls te pce discovery

Use **display mpls te pce discovery** to display information about discovered PCEs.

Syntax

display mpls te pce discovery [*ip-address*] [**verbose**]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

ip-address: Specifies a PCE by its IP address. If you do not specify this argument, the command displays information about all discovered PCEs.

verbose: Displays detailed information. If you do not specify this keyword, the command displays brief information.

Examples

Display brief information about PCE 100.100.100.150.

```
<Sysname> display mpls te pce discovery 100.100.100.150
Total number of PCEs: 1
Peer address          Discovery methods
100.100.100.150       Static, OSPF
```

Display brief information about all discovered PCEs.

```
<Sysname> display mpls te pce discovery
Total number of PCEs: 3
Peer address          Discovery methods
100.100.100.10        OSPF
100.100.100.150       Static, OSPF
100.100.100.160       Static
```

Table 6 Command output

Field	Description
Peer address	IP address of the PCE.
Discovery methods	PCE discovery methods: • **Static**—The PCE is specified by command. • **OSPF**—The PCE is discovered automatically by OSPF.

Display detailed information about PCE 2.2.2.9.

```
<Sysname> display mpls te pce discovery 2.2.2.9 verbose
PCE address: 2.2.2.9
  Discovery methods: OSPF
  Path scopes:
    Path scope                                          Preference
    Compute intra-area paths                            7
    Act as PCE for inter-area TE LSP computation        6
    Act as a default PCE for inter-area TE LSP computation  6
  Capabilities:
```

11

```
    Bidirectional path computation
    Support for request prioritization
    Support for multiple requests per message
  Domains:
    OSPF 1 area 0.0.0.0
    OSPF 1 area 0.0.0.1
```
Display detailed information about all discovered PCEs.
```
<Sysname> display mpls te pce discovery verbose
PCE address: 2.2.2.9
  Discovery methods: OSPF
  Path scopes:
    Path scope                                            Preference
    Compute intra-area paths                              7
    Act as PCE for inter-area TE LSP computation          6
    Act as a default PCE for inter-area TE LSP computation 6
  Capabilities:
    Bidirectional path computation
    Support for request prioritization
    Support for multiple requests per message
  Domains:
    OSPF 1 area 0.0.0.0
    OSPF 1 area 0.0.0.1

PCE address: 4.4.4.9
  Discovery methods: OSPF
  Path scopes:
    Path scope                                            Preference
    Compute intra-area paths                              7
    Act as PCE for inter-area TE LSP computation          6
  Capabilities:
    Bidirectional path computation
    Support for request prioritization
    Support for multiple requests per message
  Domains:
    OSPF 1 area 0.0.0.2
  Neighbor domains:
    OSPF 1 area 0.0.0.0
```
Table 7 Command output

Field	Description
Discovery methods	PCE discovery methods: • **Static**—The PCE is specified by command. • **OSPF**—The PCE is discovered automatically by OSPF.
Path scope	Scope of PCE path computation: • Compute intra-area paths. • Act as PCE for inter-area TE LSP computation. • Act as a default PCE for inter-area TE LSP computation. • Act as PCE for inter-AS TE LSP.

Field	Description
	• Act as a default PCE for inter-AS TE LSP. • Act as PCE for inter-layer TE LSP.
Preference	Preference of the PCE path scope, in the range of 0 to 7. A higher value represents a higher priority.
Capabilities	PCE capability: • Path computation with GMPLS link constraints. • Bidirectional path computation. • Diverse path computation. • Load-balanced path computation. • Synchronized path computation. • Support for multiple objective functions. • Support for additive path constraints. • Support for request prioritization. • Support for multiple requests per message.

display mpls te pce peer

Use **display mpls te pce peer** to display PCC and PCE peer information.

Syntax

display mpls te pce peer [*ip-address*] [**verbose**]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

ip-address: Specifies a peer by its IP address. If you do not specify this argument, the command displays information about all peers.

verbose: Displays detailed information. If you do not specify this keyword, the command displays brief information.

Usage guidelines

This command displays information about peers that are establishing or have established PCEP sessions to the local device.

Examples

Display brief information about all peers.

```
<Sysname> display mpls te pce peer
Total number of peers: 1
Peer address       Peer type   State     Mastership       Role
100.100.100.100    PCE         UP        Normal           Active
```

Table 8 Command output

Field	Description
Peer type	Peer type, PCC or PCE.
State	PCEP session state: • **Idle**—Initial state. • **TCPPending**—Waiting for the TCP connection to be set up. • **OpenWait**—Waiting for an Open message from the peer. • **KeepWait**—Waiting for a Keepalive message from the peer. • **UP**—The PCEP session is established.
Mastership	Peer role: • **Normal**—Normal PCC or PCE. • **Primary**—Primary PCE to which the CRLSP is delegated. This role is not supported in the current software version. • **Backup**—Backup PCE to which the CRLSP is delegated. This role is not supported in the current software version.
Role	Role of the local device in the PCEP session: • **Active**—Initiator of the PCEP session. • **Passive**—Responder of the PCEP session.

Display detailed information about all peers.

```
<Sysname> display mpls te pce peer verbose
Peer address: 100.100.100.20
  TCP Connection         : 100.100.100.20:5696 -> 100.100.100.10:4189
  Peer type              : PCC
  Session type           : Active stateful
  Session state          : UP
  Mastership             : Normal
  Role                   : active
  Session up time        : 0000 days 01 hours 03 minutes
  Session ID             : Local 1, Peer 1
  Keepalive interval     : Local 0 sec, Peer 0 sec
  Recommended DeadTimer   : Local 0 sec, Peer 0 sec
  Tolerance:
    Min keepalive interval: 10 sec
    Max unknown messages  : 10
  Request timeout        : 50 sec
  Delegation timeout     : 30 sec
```

Table 9 Command output

Field	Description
Peer type	Peer type: PCC or PCE.
Session type	PCEP session type: • Stateless. • Passive stateful. This type is not supported in the current software version. • Active stateful. This type is not supported in the current software version.
Session state	PCEP session state: • **Idle**—Initial state. • **TCPPending**—Waiting for the TCP connection to be set up.

Field	Description
	- **OpenWait**—Waiting for an Open message from the peer. - **KeepWait**—Waiting for a Keepalive message from the peer. - **UP**—The PCEP session is established.
Mastership	Peer role: - **Normal**—Normal PCC or PCE. - **Primary**—Primary PCE to which the CRLSP is delegated. This role is not supported in the current software version. - **Backup**—Backup PCE to which the CRLSP is delegated. This role is not supported in the current software version.
Role	Role of the local device in the PCEP session: - **Active**—Initiator of the PCEP session. - **Passive**—Responder of the PCEP session.
Min keepalive interval	Minimum acceptable keepalive interval in seconds.
Max unknown messages	Maximum number of unknown messages allowed in one minute.
Request timeout	Request timeout time in seconds.
Delegation timeout	This field is not supported in the current software version. Delegation timeout time in seconds.

display mpls te pce statistics

Use **display mpls te pce statistics** to display PCC and PCE statistics.

Syntax

display mpls te pce statistics [*ip-address*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

ip-address: Specifies a PCC or PCE by its IP address. If you do not specify this argument, the command displays statistics about all PCEs and PCCs.

Examples

Display statistics about all PCCs and PCEs.

```
<Sysname> display mpls te pce statistics
PCE address: 2.2.2.9
  Keepalive messages sent/received        : 70/75
  Open messages sent/received             : 1/1
  PCReq messages sent/received            : 0/0
  PCRep messages sent/received            : 0/0
```

```
     PCErr messages sent/received            : 0/0
     PCNtf messages sent/received            : 0/0
     Session setup failures                  : 0
     Unknown messages received               : 0
     Unknown requests received               : 0
     Unknown responses received              : 0
     Requests sent                           : 0
       Response is pending                   : 0
       Response with ERO received            : 0
       Response with NO-PATH received        : 0
       Canceled by peer sending a PCNtf      : 0
       Canceled by peer sending a PCErr      : 0
       Canceled by local speaker sending a PCNtf: 0
       Implicitly canceled (session down)    : 0
       Timeout                               : 0
     Requests received                       : 0
       Response is pending                   : 0
       Response with ERO sent                : 0
       Response with NO-PATH sent            : 0
       Canceled by local speaker sending a PCNtf: 0
       Canceled by local speaker sending a PCErr: 0
       Canceled by peer sending a PCNtf      : 0
       Implicitly canceled (session down)    : 0
```

Table 10 Command output

Field	Description
Unknown requests received	Number of unknown requests (the request ID carried in the RP object is 0) received.
Unknown responses received	Number of unknown responses (the request ID in the response does not match the one in the request) received.
Requests sent	Total number of sent requests.
Response is pending	Number of requests that are waiting for responses.
Response with ERO received	Number of requests that have received responses with ERO.
Response with NO-PATH received	Number of requests that have received responses with NO-PATH.
Cancelled by peer sending a PCNtf	Number of requests canceled byPCNtf messages sent by the peer.
Canceled by peer sending a PCErr	Number of requests canceled byPCErr messages sent by the peer.
Canceled by local speaker sending a PCNtf	Number of requests canceled by PCNtf messages sent by the local device.
Implicitly canceled(session down)	Number of requests that became invalid because the PCEP session was down.
Timeout	Number of requests that became invalid because of request timeout.
Requests received	Total number of received requests.
Response is pending	Number of requests whose responses are not sent yet.

Field	Description
Response with ERO sent	Number of responses sent with ERO.
Response with NO-PATH sent	Number of responses sent with NO-PATH.
Canceled by local speaker sending a PCNtf	Number of PCNtf messages for request cancellation sent by the local device.
Canceled by local speaker sending a PCErr	Number of PCErr messages for request cancellation sent by the local device.
Canceled by peer sending a PCNtf	Number of PCNtf messages for request cancellation sent by the peer.
Implicitly canceled(session down)	Number of requests that became invalid because the PCEP session was down.

display mpls te tedb

Use **display mpls te tedb** to display MPLS TE database (TEDB) information.

Syntax

display mpls te tedb { { **isis** { **level-1** | **level-2** } | **ospf area** *area-id* } | **link** *ip-address* | **network** | **node** [**local** | *mpls-lsr-id*] | **summary** }

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

isis: Displays TEDB information for IS-IS.

level-1: Displays TEDB information for Level-1 routers.

level-2: Displays TEDB information for Level-2 routers.

ospf area *area-id*: Displays TEDB information for an OSPF area. The value range for the OSPF area ID is 0 to 4294967295.

link *ip-address*: Displays TEDB information for a link. The *ip-address* argument represents the IP address of the local interface on the link.

network: Displays TEDB information for all broadcast and NBMA networks.

node: Displays TEDB information for the local or specified node. If you do not specify the **local** keyword or the *mpls-lsr-id* argument, this command displays TEDB information for all nodes.

local: Displays TEDB information for the local node.

mpls-lsr-id: Displays TEDB information for the node specified by its MPLS LSR ID.

summary: Displays summary TEDB information.

Examples

Display TEDB information for all broadcast and NBMA networks.

```
<Sysname> display mpls te tedb network
DR MPLS LSR-ID  DR-address     IGP    Process-ID Area/Level  Neighbors
8.1.1.2         3.0.0.2        OSPF   100        0           1.1.1.1
                                                             2.1.1.1
                                                             8.1.1.2
2.1.1.1         3.0.0.3        OSPF   100        0           2.1.1.1
                                                             3.1.1.1
                                                             2.1.1.2
3.1.1.2         3.0.0.4         OSPF  100        0           3.1.1.1
                                                             4.1.1.1
                                                             3.1.1.2
4.1.1.2         3.0.0.5        OSPF   100         0          4.1.1.1
                                                             5.1.1.1
                                                             4.1.1.2
5.1.1.2         3.0.0.6        OSPF   100        0           5.1.1.1
                                                             6.1.1.1
                                                             5.1.1.2
6.1.1.2         3.0.0.9        OSPF   100        0           6.1.1.1
                                                             7.1.1.1
                                                             6.1.1.2
7.1.1.1         12.0.0.7       OSPF   100        0           3.1.1.1
                                                             7.1.1.1
                                                             7.1.1.2
```

Table 11 Command output

Field	Description
DR MPLS LSR-ID	MPLS LSR ID of a designated router (DR), in dotted decimal notation.
DR-address	Interface address of the DR.
IGP	Internal gateway protocol: **OSPF** or **IS-IS**.
Process-ID	IGP process ID.
Area/Level	OSPF area or IS-IS level of the router.
Neighbors	Router IDs of the routers that have formed full adjacencies with the DR, and router ID of the DR itself.

Display summary TEDB information.
```
<Sysname> display mpls te tedb summary
MPLS LSR-ID     IGP    Process-ID  Area/Level   Links-Count
1.1.1.1         OSPF   100         1001         20
                                   1002         30
                                   1003         40
                                   1004         50
                                   1007         70
                                   1010         80
2.1.1.1         ISIS   100         Level-1      20
                                   Level-1      30

3.1.1.1         OSPF   100         0            4
```

Table 12 Command output

Field	Description
MPLS LSR-ID	MPLS LSR ID of a router, in dotted decimal notation.
IGP	Internal gateway protocol: **OSPF** or **IS-IS**.
Process-ID	IGP process ID.
Area/Level	OSPF area or IS-IS level of the router.
Links-Count	Number of links in an OSPF area or IS-IS level.

Display TEDB information for an OSPF area.

```
<Sysname> display mpls te tedb ospf area 1
Node information for OSPF area 1:
MPLS LSR-ID     IGP       Process-ID     Area          Links-Count
2.2.2.2         OSPF      100            1             1
3.3.3.3         OSPF      100            1             1


Network information for OSPF area 1:
DR MPLS LSR-ID  DR-address    IGP  Process-ID Area    Neighbors
3.3.3.3         20.1.1.2      OSPF 100        1       2.2.2.2
                                                      3.3.3.3
```

Table 13 Command output

Field	Description
MPLS LSR-ID	MPLS LSR ID of a router, in dotted decimal notation.
IGP	Internal gateway protocol: **OSPF** or **IS-IS**.
Process-ID	IGP process ID.
Area	OSPF area of the router.
Links-Count	Number of links in the OSPF area or IS-IS level.
DR MPLS LSR-ID	MPLS LSR ID of a DR.
DR-address	Interface address of the DR.
Neighbors	Router IDs of the routers that have formed full adjacencies with the DR, and router ID of the DR itself.

display mpls te tunnel-interface

Use **display mpls te tunnel-interface** to display information about MPLS TE tunnel interfaces.

Syntax

display mpls te tunnel-interface [**tunnel** *number*]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

tunnel *number*: Displays information about the tunnel interface specified by its number. The interface must have been created. If you do not specify this option, the command displays information about all MPLS TE tunnel interfaces.

Examples

Display information about all MPLS TE tunnel interfaces.

```
<Sysname> display mpls te tunnel-interface
Tunnel Name          : Tunnel 1
Tunnel State         : Up (Main CRLSP up)
Tunnel Attributes    :
  LSP ID             : 1                 Tunnel ID            : 1
  Admin State        : Normal
  Ingress LSR ID     : 1.1.1.1           Egress LSR ID        : 3.3.3.3
  Signaling          : Static            Static CRLSP Name    : static-cr-lsp-1
  Resv Style         : -
  Tunnel mode        : -
  Reverse-LSP name   : -
  Reverse-LSP LSR ID : -                 Reverse-LSP Tunnel ID: -
  Class Type         : -                 Tunnel Bandwidth     : -
  Reserved Bandwidth : -
  Setup Priority     : 0                 Holding Priority     : 0
  Affinity Attr/Mask : -/-
  Explicit Path      : -
  Backup Explicit Path : -
  Metric Type        : TE
  Record Route       : -                 Record Label         : -
  FRR Flag           : -                 Bandwidth Protection : Disabled
  Backup Bandwidth Flag: Disabled        Backup Bandwidth Type: -
  Backup Bandwidth   : -
  Bypass Tunnel      : No                Auto Created         : No
  Route Pinning      : -
  Retry Limit        : 10                Retry Interval       : 2 sec
  Reoptimization     : -                 Reoptimization Freq  : -
  Backup Type        : -                 Backup LSP ID        : -
  Auto Bandwidth     : Disabled          Auto Bandwidth Freq  : -
  Min Bandwidth      : -                 Max Bandwidth        : -
  Collected Bandwidth : -
```

Table 14 Command output

Field	Description
Tunnel Name	Name of the tunnel interface.
Tunnel State	Running state of the tunnel: **Down** or **Up**, followed by a brief description of the state in parentheses. The description information includes:

Field	Description
	• Main CRLSP down. • Main CRLSP up. • Main CRLSP being set up. • Shared-resource CRLSP down. • Shared-resource CRLSP up. • Shared-resource CRLSP being set up. • Shared-resource CRLSP being activated. • Shared-resource CRLSP switching to Main CRLSP. • Backup CRLSP down. • Backup CRLSP up. • Backup CRLSP being set up. • Reverse CRLSP down. • Reverse CRLSP up. • Reverse CRLSP being set up.
Admin State	Administrative state of the tunnel interface: • **Normal**—The interface is not shut down by the **shutdown** command. • **Shutdown**—The tunnel interface is shut down by the **shutdown** command.
Signaling	Signaling protocol used to set up the tunnel: **RSVP-TE** or **Static**.
Static CRLSP Name	Static CRLSP used by the tunnel.
Resv Style	Resource reservation style used by the tunnel. This field displays **FF** or **SE** for an MPLS TE tunnel that uses dynamic CRLSPs, and displays a hyphen (-) for an MPLS TE tunnel that uses static CRLSPs.
Tunnel Mode	Tunnel mode of the bidirectional tunnel: • **Co-routed, active**—The device is the active end of the co-routed bidirectional tunnel. • **Co-routed, passive**—The device is the passive end of the co-routed bidirectional tunnel. • **Associated**—The tunnel is an associated bidirectional tunnel.
Reverse-LSP Name	Name of the reverse LSP associated with the tunnel.
Reverse-LSP LSR ID	LSR ID of the ingress node on the reverse LSP. This field has a value for an associated bidirectional tunnel and for the passive end of a co-routed bidirectional tunnel. In other conditions, this field displays a hyphen (-).
Reverse-LSP Tunnel ID	Tunnel ID of the reverse LSP. This field has a value for an associated bidirectional tunnel and for the passive end of a co-routed bidirectional tunnel. In other conditions, this field displays a hyphen (-).
Class Type	CT of the tunnel: **CT0**, **CT1**, **CT2**, or **CT3**.
Tunnel Bandwidth	Bandwidth required by the tunnel, in kbps.
Reserved Bandwidth	Bandwidth reserved for the tunnel, in kbps.
Setup Priority	Tunnel setup priority.
Holding Priority	Tunnel holding priority.
Affinity Attr/Mask	Tunnel affinity attribute and mask.

Field	Description
Explicit Path Name	Name of the explicit path used by the tunnel. If the path used by the tunnel is not an explicit path, this field displays a hyphen (-).
Backup Explicit Path	Name of the explicit path used by the backup tunnel. If the path used by the backup tunnel is not an explicit path, this field displays a hyphen (-).
Metric Type	Link metric type used for tunnel path selection, **TE** or **IGP**.
Bandwidth Protection	Whether FRR needs bandwidth protection: **Enabled** or **Disabled**.
Backup Bandwidth Flag	Whether the bandwidth and the type of CRLSPs that the bypass tunnel can protect have been configured (by using the `mpls te backup bandwidth` command): • **Enabled**—Configured. • **Disabled**—Not configured.
Backup Bandwidth Type	Class type of the traffic on the primary tunnel that the bypass tunnel can protect.
Backup Bandwidth	Bandwidth that the bypass tunnel can protect, in kbps.
Bypass Tunnel	Whether it is a bypass tunnel: **Yes** or **No**.
Auto Created	Whether the bypass tunnel is automatically created: **Yes** or **No**.
Retry Limit	Maximum number of tunnel setup retries.
Retry Interval	Tunnel setup retry interval, in seconds.
Reoptimization Freq	Tunnel reoptimization frequency, in seconds.
Backup Type	CRLSP backup mode: • **None**—CRLSP backup is disabled. • **Hot Standby**. • **Ordinary**.
Backup LSP ID	LSP ID of the backup tunnel.
Auto Bandwidth	This field is not supported in the current software version. State of the automatic bandwidth adjustment feature.
Auto Bandwidth Freq	This field is not supported in the current software version. Automatic bandwidth adjustment interval, in seconds.
Min Bandwidth	This field is not supported in the current software version. Minimum bandwidth (in kbps) that can be applied to the tunnel by automatic bandwidth adjustment.
Max Bandwidth	This field is not supported in the current software version. Maximum bandwidth (in kbps) that can be applied to the tunnel by automatic bandwidth adjustment.
Collected Bandwidth	This field is not supported in the current software version. Current output rate, in kbps.

display ospf mpls te advertisement

Use `display ospf mpls te advertisement` to display link and node information in an OSPF TEDB.

Syntax

```
display ospf [ process-id ] [ area area-id ] mpls te advertisement
[ originate-router advertising-router-id | self-originate ]
```

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

process-id: Specifies an OSPF process ID in the range of 1 to 65535. If you do not specify this argument, the command displays information about all OSPF processes.

area *area-id*: Specifies an area by its ID, an IP address or a decimal integer. The integer is in the range of 0 to 4294967295. If you specify an integer, the system will translate the integer into the IP address format. If you do not specify this option, the command displays information about all areas.

originate-router *advertising-router-id*: Displays information originated from a router specified by its router ID.

self-originate: Displays information generated by the local router.

Examples

Display link and node information for all processes in all areas.

```
<Sysname> display ospf mpls te advertisement

        OSPF Process 1 with Router ID 2.2.2.2
            Traffic Engineering Database


                 Area: 0.0.0.1

   Adv Router ID           : 1.1.1.1
   MPLS LSR ID             : 1.1.1.1
   Flags                   : A/S/R
   Router Address Count    : 1
     Router Address Index  : 0
     Instance ID           : 0.0.0.0
     MPLS LSR ID           : 1.1.1.1
   Link Count              : 1
     Link Index            : 0
     Link Type             : Broadcast
     Instance ID           : 0.0.0.1
     Link Flags            : -/U/-
     Link ID               : 197.168.1.1
     TE Metric             : 1000
     IGP Metric            : 1000
     Maximum Bandwidth     : 12500000 bytes/sec
     Maximum Reservable BW : 0 bytes/sec
```

```
    Administrative Group     : 0x0
    Unreserved Bandwidth for each TE Class:
      TE class  0 = 0 bytes/sec
      TE class  1 = 0 bytes/sec
      TE class  2 = 0 bytes/sec
      TE class  3 = 0 bytes/sec
      TE class  4 = 0 bytes/sec
      TE class  5 = 0 bytes/sec
      TE class  6 = 0 bytes/sec
      TE class  7 = 0 bytes/sec
      TE class  8 = 0 bytes/sec
      TE class  9 = 0 bytes/sec
      TE class 10 = 0 bytes/sec
      TE class 11 = 0 bytes/sec
      TE class 12 = 0 bytes/sec
      TE class 13 = 0 bytes/sec
      TE class 14 = 0 bytes/sec
      TE class 15 = 0 bytes/sec
    Bandwidth Constraint Model: Prestandard DS-TE RDM
    Bandwidth Constraints:
      BC [ 0] = 0 bytes/sec
      BC [ 1] = 0 bytes/sec
    Local Interface Address  : 197.168.1.1
    Remote Interface Address : 197.168.1.11
```

Table 15 Command output

Field	Description
Adv Router ID	ID of the router that advertised TE information.
MPLS LSR ID	MPLS LSR ID of the router that advertised TE information.
Flags	TE information flags: • **A**—Already synchronized information with CSPF. • **S**—Ready to synchronize information with CSPF. • **R**—The router that advertised information is reachable.
Router Address Count	Number of Router TLV messages in TEDB.
Router Address Index	Index of the current Router TLV message.
Instance ID	LSA instance ID.
Link Count	Number of Link TLV messages in TEDB.
Link Index	Index of the current Link TLV message.
Link Type	Link types: • Point to Point. • Point to Multi Point. • Broadcast. • NBMA.
Link Flags	Link information flags: • **A**—Already synchronized information with CSPF. • **U**—Ready to update information with CSPF again after the previous update failed.

Field	Description
	• **D**—Ready to delete information from CSPF again after the previous deletion failed.
Link ID	Link state ID.
IGP Metric	OSPF protocol metric.
Administrative Group	Link attributes.
Bandwidth Constraint Model	This field is not supported in the current software version. Bandwidth constraint model: Prestandard DS-TE RDM, IETF DS-TE RDM, or IETF DS-TE MAM.
Bandwidth Constraints	This field is not supported in the current software version. This field takes effect only on DS-TEs.
BC	This field is not supported in the current software version. Bandwidth constraint value. The Prestandard mode supports two BCs, and the IETF mode supports four BCs.

display ospf mpls te network

Use **display ospf mpls te network** to display network information in an OSPF TEDB.

Syntax

display ospf [*process-id*] [**area** *area-id*] **mpls te network** [**originate-router** *advertising-router-id* | **self-originate**]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

process-id: Specifies an OSPF process ID in the range of 1 to 65535. If you do not specify this argument, the command displays information about all OSPF processes.

area *area-id*: Specifies an area by its ID, an IP address or a decimal integer, in the range of 0 to 4294967295. If you specify an integer, the system will translate the integer into the IP address format. If you do not specify this option, the command displays information about all areas.

originate-router *advertising-router-id*: Displays information originated from a router specified by its router ID.

self-originate: Displays information generated by the local router.

Examples

Display network information for all processes in all areas.

```
<Sysname> display ospf mpls te network

         OSPF Process 1 with Router ID 12.1.1.1
```

```
                    Traffic Engineering Network

                          Area: 0.0.0.0

       Adv Router ID            :  1.1.1.1
       Designated Router        :  197.168.1.1
       Flags                    :  -/U/-
        Attached Router    2.2.2.2
        Attached Router    1.1.1.1
```

Table 16 Command output

Field	Description
Adv Router ID	ID of the router that advertised the TE network information.
Designated Router	IP address of the designated router.
Flag	Network information flags: • **A**—Already synchronized information with CSPF. • **U**—Ready to update information with CSPF again after the previous update failed. • **D**—Ready to delete information from CSPF again after the previous deletion failed.
Attached Router	ID of the attached router.

display ospf mpls te pce

Use **display ospf mpls te pce** to display information about PCEs discovered by OSPF.

Syntax

display ospf [*process-id*] [**area** *area-id*] **mpls te pce** [**originate-router** *advertising-router-id* | **self-originate**]

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

process-id: Specifies an OSPF process ID in the range of 1 to 65535. If you do not specify this argument, the command displays information about all OSPF processes.

area *area-id*: Specifies an area by its ID, an IP address or a decimal integer. The integer is in the range of 0 to 4294967295. If you specify an integer, the system will translate the integer into the IP address format. If you do not specify this option, the command displays information about all areas.

originate-router *advertising-router-id*: Displays information originated from a router specified by its router ID.

self-originate: Displays information generated by the local router.

Examples

Display PCE information for all processes in all areas.

```
<Sysname> display ospf mpls te pce


          OSPF Process 1 with Router ID 2.1.1.1
                Path Computation Element


                       Area: 0.0.0.1


    Adv Router ID              : 2.1.1.1
    PCE Address                : 5.6.7.8
    Flags                      : A/-/R/E
    PCE Path Scopes:
        Path Scope                 Preference
        L (PCE for intra-area)     7
        R (PCE for inter-area)     6
    PCE Capabilities:
        Bidirectional path computation
        Support for request prioritization
        Support for multiple requests per message
    PCE Domain List:
        Area 0.0.0.1
        Area 0.0.0.3
    PCE Neighbor Domain List:
        Area 0.0.0.2
```

Table 17 Command output

Field	Description
Adv Router ID	ID of the router that advertised the information.
Flags	PCE information flag: • **A**—Already synchronized information with PCEP. • **U**—Ready to update information with PCEP again after the previous update failed. • **D**—Ready to delete information from PCEP again after the previous deletion failed. • **R**—The router that advertised information is reachable. • **E**—PCE information is valid.
Path Scope	PCE path scope: • L (PCE for intra-area). • R (PCE for inter-area). • Rd (Default PCE for inter-area). • S (PCE for inter-AS). • Sd (Default PCE for inter-AS). • Y (PCE for inter-layer).
Preference	Preference of the PCE path scope, in the range of 0 to 7. A higher value represents a higher priority.
PCE Capabilities	PCE capability: • Path computation with GMPLS link constraints.

Field	Description
	• Bidirectional path computation. • Diverse path computation. • Load-balanced path computation. • Synchronized path computation. • Support for multiple objective functions. • Support for additive path constraints. • Support for request prioritization. • Support for multiple requests per message.
PCE Domain List	List of local domains that support TE on the PCE.
PCE Neighbor Domain List	List of neighbor domains that support TE on the PCE.
Area	Area that supports TE.
AS	AS that supports TE.

display ospf mpls te tunnel

Use **display ospf mpls te tunnel** to display MPLS TE tunnel interface information for OSPF.

Syntax

display ospf [*process-id*] [**area** *area-id*] **mpls te tunnel**

Views

Any view

Predefined user roles

network-admin

network-operator

mdc-admin

mdc-operator

Parameters

process-id: Specifies an OSPF process ID in the range of 1 to 65535. If you do not specify this argument, the command displays information about all OSPF processes.

area *area-id*: Specifies an area by its ID, an IP address or a decimal integer. The integer is in the range of 0 to 4294967295. If you specify an integer, the system will translate the integer into the IP address format. If you do not specify this option, the command displays information about all areas.

Examples

Display MPLS TE tunnel interface information for all OSPF processes in all areas.

```
<Sysname> display ospf mpls te tunnel

        OSPF Process 1 with Router ID 2.2.2.2
                Traffic Engineering Tunnel


                    Area: 0.0.0.1
Interface: Tunnel1 (12.1.1.2)
    State: Inactive
    Neighbor ID: 0.0.0.0        Cost: 0
```

```
        Destination: 125.1.1.1
        Auto Route: IGP Shortcut
        Metric: Relative  10
```

Table 18 Command output

Field	Description
Interface	Name and IP address of a tunnel interface.
State	Tunnel interface states: • **Inactive**—The tunnel interface is not used to forward packets, because the tunnel route is not the optimal route. • **Active**—The tunnel interface is used to forward packets, because the tunnel route is the optimal route.
Neighbor ID	Router ID for the tunnel destination.
Cost	Route cost of the tunnel interface.
Destination	LSR ID for the tunnel destination.
Auto Route	Automatic route advertisement method: **IGP Shortcut** or **IGP Advertise**.
Metric	Absolute or relative metric of the MPLS TE tunnel.

explicit-path

Use **explicit-path** to create an explicit path and enter its view, or enter the view of an existing explicit path.

Use **undo explicit-path** to remove an explicit path.

Syntax

explicit-path *path-name*

undo explicit-path *path-name*

Default

No explicit paths exist.

Views

System view

Predefined user roles

network-admin

mdc-admin

Parameters

path-name: Specifies a name for the explicit path, a case-sensitive string of 1 to 31 characters.

Usage guidelines

In explicit path view, you can use the **nexthop** command to explicitly specify a node or link that a tunnel must or must not traverse.

Examples

Create explicit path **path1** and enter its view.

```
<Sysname> system-view
```

```
[Sysname] explicit-path path1
[Sysname-explicit-path-path1]
```

Related commands

display explicit-path

mpls te backup-path

mpls te path

nexthop

fast-reroute timer

Use **fast-reroute timer** to set the interval for selecting an optimal bypass tunnel.

Use **undo fast-reroute timer** to restore the default.

Syntax

fast-reroute timer *interval*

undo fast-reroute timer

Default

The optimal bypass tunnel selection interval is 300 seconds.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

interval: Specifies the interval for selecting an optimal bypass tunnel, in the range of 0 to 604800 seconds. If you set the interval to 0 seconds, RSVP does not periodically select an optimal bypass tunnel.

Usage guidelines

If you have specified multiple bypass tunnels for a primary CRLSP, MPLS TE selects an optimal bypass tunnel to protect the primary CRLSP. Sometimes, a bypass tunnel might become better than the current optimal bypass tunnel because, for example, the reservable bandwidth changes. Therefore, MPLS TE must poll the bypass tunnels periodically to update the optimal bypass tunnel.

> **NOTE:**
>
> After traffic is switched from the primary CRLSP to a bypass tunnel, MPLS TE no longer periodically selects optimal bypass tunnels for the primary CRLSP.

Examples

Set the optimal bypass tunnel selection interval to 120 seconds.
```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] fast-reroute timer 120
```

link-management periodic-flooding timer

Use **link-management periodic-flooding timer** to set the interval at which IGP floods TE information.

Use **undo link-management periodic-flooding timer** to restore the default.

Syntax

link-management periodic-flooding timer *interval*

undo link-management periodic-flooding timer

Default

The IGP floods TE information every 180 seconds.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

interval: Specifies the interval at which IGP floods TE information, in the range of 0 to 3600 seconds.

Usage guidelines

When the reservable bandwidth of a link changes, IGP floods the link TE information to notify network devices of the change. You can use the **mpls te bandwidth change thresholds** command to configure IGP to flood only significant bandwidth changes of a link to prevent excessive IGP flooding. The bandwidth changes that cannot trigger immediate flooding are flooded at the interval configured by the **link-management periodic-flooding timer** command.

If you set the interval to 0, the periodical flooding feature is disabled. If you set the interval to a value less than 30 seconds (1 to 29 seconds), the device automatically sets the interval to 30 seconds.

After you execute this command, the configured interval takes effect immediately.

Examples

Configure IGP to flood TE information every 100 seconds.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] link-management periodic-flooding timer 100
```

Related commands

mpls te bandwidth change thresholds

mpls te

Use **mpls te** to enable MPLS TE for the local node and enter MPLS TE view.

Use **undo mpls te** to disable MPLS TE for the local node.

Syntax

mpls te

undo mpls te

Default

MPLS TE is disabled.

Views

System view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

Disabling MPLS TE also deletes all CRLSPs on the device and MPLS TE configurations on all interfaces.

Examples

Enable MPLS TE for the local node and enter MPLS TE view.

```
<Sysname> system-view
[Sysname] mpls lsr-id 1.1.1.9
[Sysname] mpls te
[Sysname-te]
```

Related commands

mpls te enable

mpls te affinity-attribute

Use **mpls te affinity-attribute** to set an affinity for a tunnel.

Use **undo mpls te affinity-attribute** to restore the default.

Syntax

mpls te affinity-attribute *attribute-value* [**mask** *mask-value*]

undo mpls te affinity-attribute

Default

The affinity is 0x00000000, and the mask is 0x00000000. That is, a tunnel can use any link.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

attribute-value: Specifies the affinity value, a hexadecimal number in the range of 0 to ffffffff. An affinity is a 32-bit binary number. Each bit of the affinity represents an attribute, which takes a value of 0 or 1.

mask *mask-value*: Specifies the mask of the affinity bits, a hexadecimal number in the range of 0 to ffffffff. A mask is a 32-bit binary number. Each bit of the mask determines whether to check the corresponding bit of the link attribute. If the mask bit is 1, the corresponding link attribute bit must be checked with the affinity bit. The link can be used by the tunnel only when the link attribute bit meets certain requirements. If the mask bit is 0, the corresponding link attribute bit is not checked.

Usage guidelines

Affinity determines which links a tunnel can use. The affinity attribute and its mask, and the link attribute are all 32-bit long. A link is available for a tunnel if the link attribute meets the following requirements:

- The link attribute bits corresponding to the affinity attribute's 1 bits whose mask bits are 1 must have a minimum of one bit set to 1.
- The link attribute bits corresponding to the affinity attribute's 0 bits whose mask bits are 1 must have no bit set to 1.

The link attribute bits corresponding to the 0 bits in the affinity mask are not checked.

For example, if the affinity is 0xfffffff0 and the mask is 0x0000ffff, a link is available for the tunnel when its attribute bits meet the following requirements:

- The highest 16 bits each can be 0 or 1 (no requirements).
- The 17th through 28th bits must have a minimum of one bit whose value is 1.
- The lowest four bits must be 0.

Examples

Set the tunnel affinity to 0x101 and mask to 0x303. Then, a link is available for the tunnel only when the link attribute bits (from left to right) meet the following requirements:

- The 23rd bit is 0.
- The 31st bit is 0.
- A minimum of one bit from the 24th to 32nd bits must be 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te affinity-attribute 101 mask 303
```

Related commands

display mpls te tunnel-interface

mpls te link-attribute

mpls te auto-tunnel backup disable

Use **mpls te auto-tunnel backup disable** to disable the auto FRR feature on an RSVP-enabled interface.

Use **undo mpls te auto-tunnel backup disable** to enable the auto FRR feature on an RSVP-enabled interface.

Syntax

mpls te auto-tunnel backup disable

undo mpls te auto-tunnel backup disable

Default

The auto FRR feature is enabled on all RSVP-enabled interfaces after it is enabled globally.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

The auto FRR feature allows an interface to automatically set up a node-protection bypass tunnel and a link-protection bypass tunnel for each of its primary CRLSPs. The output interface of the primary CRLSPs is the interface itself.

Bypass tunnels are set up before the primary CRLSP fails. Therefore, they use extra bandwidth. To save network bandwidth, configure auto FRR only for key interfaces. On other interfaces, use the **mpls te auto-tunnel backup disable** command to disable the interfaces from automatically setting up bypass tunnels.

Execution of the **mpls te auto-tunnel backup disable** command deletes all existing bypass tunnels automatically created on the interface.

Examples

Disable auto FRR on VLAN-interface 10.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
[Sysname-Vlan-interface10] mpls te auto-tunnel backup disable
```

Related commands

auto-tunnel backup

mpls te backup

Use **mpls te backup** to enable tunnel backup and specify the backup mode for a tunnel.

Use **undo mpls te backup** to disable tunnel backup.

Syntax

mpls te backup { **hot-standby** | **ordinary** }

undo mpls te backup

Default

Tunnel backup is disabled.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

hot-standby: Enables hot backup for the tunnel. In this mode, a backup CRLSP is established immediately after the primary CRLSP is established. When the primary CRLSP fails, MPLS TE immediately switches traffic to the backup CRLSP.

ordinary: Enables ordinary backup for the tunnel. In this mode, a backup CRLSP is established after the primary CRLSP fails.

Usage guidelines

After you execute this command for a tunnel, the record route flag is automatically set for the tunnel, regardless of whether the **mpls te record-route** command is configured.

In the same tunnel interface view, the **mpls te backup** command is mutually exclusive with the **mpls te reoptimization** command.

If both the **mpls te backup** and **mpls te bidirectional** commands are configured, only the **mpls te bidirectional** command takes effect.

Examples

Enable hot backup for Tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te backup hot-standby
```

Related commands

mpls te backup-path

mpls te backup bandwidth

Use **mpls te backup bandwidth** to configure the bandwidth and the CT that the bypass tunnel can protect.

Use **undo mpls te backup bandwidth** to restore the default.

Syntax

mpls te backup bandwidth [**ct0** | **ct1** | **ct2** | **ct3**] { *bandwidth* | **un-limited** }

undo mpls te backup bandwidth

Default

The bandwidth and the CT that the bypass tunnel can protect are not specified.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

ct0: Specifies the bypass tunnel to protect only CRLSPs of CT 0.

ct1: Specifies the bypass tunnel to protect only CRLSPs of CT 1.

ct2: Specifies the bypass tunnel to protect only CRLSPs of CT 2.

ct3: Specifies the bypass tunnel to protect only CRLSPs of CT 3.

bandwidth: Specifies the total bandwidth that the bypass tunnel can protect, in the range of 1 to 4294967295, in kbps.

un-limited: Puts no limit on total protected bandwidth. This keyword means the bypass tunnel does not provide bandwidth protection.

Usage guidelines

If no CT is specified, CRLSPs of all CTs can use the bypass tunnel.

If you specify the **un-limited** keyword, the bypass tunnel does not provide bandwidth protection. FRR does not guarantee the bandwidth of the protected tunnels. If the sum of traffic of the protected tunnels exceeds the actual bandwidth of the bypass tunnel, traffic of protected tunnels might be lost. The primary CRLSP that does not need bandwidth protection prefers this type of bypass tunnels over other types of bypass tunnels.

If you specify the *bandwidth* argument, the bypass tunnel provides bandwidth protection. The primary CRLSP that needs bandwidth protection prefers this type of bypass tunnels over other types of bypass tunnels. If you set the value for the *bandwidth* argument to 0, the bypass tunnel performs best-effort forwarding for the traffic of primary CRLSP, and the occupied bandwidth is not fixed. Therefore, this type of bypass tunnel cannot protect a primary CRLSP with the bandwidth 0 or a primary CRLSP whose bandwidth exceeds the protected bandwidth.

The specified bandwidth value must be less than the actual bandwidth of the bypass tunnel. Otherwise, the bypass tunnel will be overwhelmed after FRR, and the protected tunnel might be torn down.

After an FRR, the primary CRLSP will be down if you modify the bandwidth that the bypass tunnel can protect and your modification results in one of the following:

- The CT type changes.
- The bypass tunnel cannot protect adequate bandwidth as configured.
- FRR protection type (whether or not to provide bandwidth protection for the primary CRLSP) changes.

The bandwidth value specified is used only for calculating and determining the bandwidth protection relationship between a primary CRLSP and a bypass tunnel. The bandwidth is not reserved on the bypass tunnel.

After you execute this command for a tunnel, the record route flag is automatically set for the tunnel, regardless of whether the **mpls te record-route** command is configured.

Examples

Configure Tunnel 1 to provide protection for CRLSPs of CT 0 without constraining the protected bandwidth. Configure Tunnel 2 to provide protection for CRLSPs of CT 1 and protect a maximum of 1000 kbps bandwidth.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te backup bandwidth ct0 un-limited
[Sysname-Tunnel1] quit
[Sysname] interface tunnel 2 mpls-te
[Sysname-Tunnel2] mpls te backup bandwidth ct1 1000
```

Related commands

display mpls te tunnel-interface

mpls te fast-reroute

mpls te backup-path

Use **mpls te backup-path** to specify a path for the backup CRLSP and set the preference of the path.

Use **undo mpls te backup-path** to delete the specified path for the backup CRLSP.

Syntax

mpls te backup-path preference *value* { **dynamic** [**pce** [*ip-address*]&<0-8>] | **explicit-path** *path-name* } [**no-cspf**]

undo mpls te backup-path preference *value*

Default

MPLS TE uses the dynamically calculated path to establish the backup CRLSP.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

preference *value*: Specifies a preference value for a path, in the range of 1 to 10. A smaller value represents a higher preference.

dynamic: Uses the path dynamically calculated by CSPF to establish the backup CRLSP.

pce: Uses the path calculated by PCEs to establish the CRLSP. If you do not specify this keyword, the local LSR uses the path dynamically calculated by CSPF.

[*ip-address*]&<0-8>: Specifies a space-separated list of a maximum of eight PCE addresses. If you do not specify a PCE address, the system automatically selects a PCE from the discovered PCEs. If you specify more than one PCE address, a BRPC calculation will be performed on the specified PCEs in configuration order.

explicit-path *path-name*: Uses the specified explicit path to establish the backup CRLSP. The *path-name* argument specifies the name of an explicit path, a case-sensitive string of 1 to 31 characters.

no-cspf: Calculates the path by searching the routing table instead of using the CSPF algorithm.

Usage guidelines

You can specify a maximum of 10 backup paths for a tunnel interface. The backup paths must have different preferences.

When establishing a backup CRLSP, MPLS TE performs CSPF calculations using the specified paths in the descending order of preference until the backup CRLSP is established successfully. If the CSPF calculations for all paths are failed, the backup CRLSP cannot be established.

This command takes effect only when backup has been enabled for the tunnel by using the **mpls te backup** command.

If you specify PCE addresses in this command or in the **mpls te path** command, the local device establishes PCEP sessions to the specified PCEs. If you do not specify a PCE address, the local device establishes PCEP sessions to all discovered PCEs.

Examples

Configure Tunnel 1 to use explicit path **path1** and the path calculated by PCEs to establish a backup CRLSP. Set a higher preference for the path calculated by PCEs.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te backup-path preference 2 explicit-path path1
[Sysname-Tunnel1] mpls te backup-path preference 1 dynamic pce 1.1.1.9 2.2.2.9
```

Related commands

display mpls te tunnel-interface

mpls te backup

mpls te path

mpls te bandwidth

Use **mpls te bandwidth** to assign bandwidth to the MPLS TE tunnel and specify a class type (CT) for the tunnel.

Use **undo mpls te bandwidth** to restore the default.

Syntax

mpls te bandwidth [**ct0** | **ct1** | **ct2** | **ct3**] *bandwidth*

undo mpls te bandwidth

Default

No bandwidth (0 bps) is assigned to an MPLS TE tunnel and the tunnel is available for CT 0.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

ct0: Specifies CT 0 for the tunnel.

ct1: Specifies CT 1 for the tunnel.

ct2: Specifies CT 2 for the tunnel.

ct3: Specifies CT 3 for the tunnel.

bandwidth: Specifies the bandwidth required by the MPLS TE tunnel, in the range of 1 to 4294967295, in kbps.

Usage guidelines

If you do not specify a CT for the tunnel, the tunnel is available for CT 0.

If the bandwidth required by the MPLS TE tunnel is more than 1024 kbps, set the bandwidth to a multiple of 1024 kbps.

This command applies only to the MPLS TE tunnels established by RSVP-TE. The bandwidth and CT of an MPLS TE tunnel established by using a static CRLSP are determined by the **static-cr-lsp ingress** command.

Examples

Assign 1000 kbps bandwidth to MPLS TE Tunnel 1 and specify the CT of the tunnel as CT 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te bandwidth ct1 1000
```

Related commands

display mpls te tunnel-interface

mpls te max-link-bandwidth

mpls te bandwidth change thresholds

Use **mpls te bandwidth change thresholds** to set the bandwidth up/down threshold for the IGP to flood TE information.

Use **undo mpls te bandwidth change thresholds** to restore the default.

Syntax

mpls te bandwidth change thresholds { **down** | **up** } *percent*

undo mpls te bandwidth change thresholds { **down** | **up** }

Default

The IGP floods the TE information when the bandwidth increases or decreases by 10% of the link reservable bandwidth.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Parameters

down: Specifies the bandwidth decrease percentage threshold that triggers the IGP to flood TE information. When the percentage of the link reservable-bandwidth decrease to the maximum link reservable bandwidth reaches or exceeds the threshold, the IGP floods the TE information and updates the TEDB.

up: Specifies the bandwidth increase percentage threshold that triggers the IGP to flood TE information. When the percentage of the link reservable-bandwidth increase to the maximum link reservable bandwidth reaches or exceeds the threshold, the IGP floods the TE information and updates the TEDB.

percent: Specifies the IGP flooding threshold in the range of 0% to 100%.

Usage guidelines

When the reservable bandwidth of a link changes, the IGP floods the link TE information to notify network devices of the change. To avoid frequent TE information flooding from affecting network performance, you can use this command to configure the IGP to flood only significant bandwidth changes of a link.

Examples

On VLAN-interface 10, configure the IGP to flood TE information when the link available bandwidth decreases by 100%.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
[Sysname-Vlan-interface10] mpls te bandwidth change thresholds down 100
```

Related commands

link-management periodic-flooding timer

mpls te bidirectional

Use **mpls te bidirectional** to enable the bidirectional tunnel feature on an MPLS TE tunnel interface.

Use **undo mpls te bidirectional** to disable the bidirectional tunnel feature on an MPLS TE tunnel interface.

Syntax

mpls te bidirectional { **associated reverse-lsp** { **lsp-name** *lsp-name* | **lsr-id**
ingress-lsr-id **tunnel-id** *tunnel-id* } | **co-routed** { **active** | **passive**
reverse-lsp lsr-id *ingress-lsr-id* **tunnel-id** *tunnel-id* } }

undo mpls te bidirectional

Default

The bidirectional tunnel feature is disabled on an MPLS TE tunnel interface. A tunnel established on an MPLS TE tunnel interface is a unidirectional MPLS TE tunnel.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

associated reverse-lsp lsp-name *lsp-name*: Configures an associated bidirectional MPLS TE tunnel, and specifies the associated reverse CRLSP. The *lsp-name* argument specifies the name of a static CRLSP (the reverse CRLSP), a case-sensitive string of 1 to 15 characters.

associated reverse-lsp lsr-id *ingress-lsr-id* **tunnel-id** *tunnel-id*: Configures an associated bidirectional MPLS TE tunnel, and specifies the associated reverse CRLSP. The *ingress-lsr-id* argument specifies the LSR ID of the ingress node on the reverse CRLSP and the *tunnel-id* argument specifies the tunnel ID of the reverse CRLSP. The value range for the *tunnel-id* argument is 0 to 65535.

co-routed: Configures a co-routed bidirectional MPLS TE tunnel.

active: Specifies the local end as the active end of the co-routed bidirectional MPLS TE tunnel.

passive reverse-lsp lsr-id *ingress-lsr-id* **tunnel-id** *tunnel-id*: Specifies the local end as the passive end of the co-routed bidirectional MPLS TE tunnel, and specifies the associated reverse CRLSP. The *ingress-lsr-id* argument specifies the LSR ID of the ingress node on the reverse CRLSP and the *tunnel-id* argument specifies the tunnel ID of the reverse CRLSP. The value range for the *tunnel-id* argument is 0 to 65535. You must specify a reverse CRLSP on the passive end, so that the CRLSP and the reverse CRLSP are associated to form a bidirectional MPLS TE tunnel.

Usage guidelines

A bidirectional MPLS TE tunnel can be established in co-routed mode or associated mode.

* Co-routed mode uses the extended RSVP-TE protocol to establish a bidirectional MPLS TE tunnel. To establish a co-routed bidirectional MPLS TE tunnel, you must perform the following tasks:
  o Specify the signaling protocol as RSVP-TE.
  o Configure one end of the tunnel as the active end and the other as the passive end.
* In associated mode, you establish a bidirectional MPLS TE tunnel by binding two unidirectional CRLSPs in opposite directions. The two CRLSPs can be established in different modes and use different paths. For example, one CRLSP is established statically and the other CRLSP is established dynamically by RSVP-TE.

To create a bidirectional MPLS TE tunnel, you must disable the PHP feature on both ends of the tunnel to assign non-null labels to the penultimate hop.

If the **mpls te bidirectional** command is configured together with one of the following commands, only the **mpls te bidirectional** command takes effect:

- **`mpls te backup`**
- **`mpls te reoptimization`**
- **`mpls te fast-reroute`**

Examples

- Configure an MPLS TE bidirectional tunnel between Device A and Device B in co-routed mode:

  # Configure Device A as follows:

  o Enable the MPLS TE bidirectional tunnel feature on tunnel interface Tunnel 1.

  o Configure Device A as the active end of the co-routed bidirectional tunnel.

  ```
  <DeviceA> system-view
  [DeviceA] interface tunnel 1 mode mpls-te
  [DeviceA-Tunnel1] destination 10.0.0.2
  [DeviceA-Tunnel1] mpls te bidirectional co-routed active
  ```

  # Configure Device B as follows:

  o Enable the MPLS TE bidirectional tunnel feature on tunnel interface Tunnel 1.

  o Configure Device B as the passive end of the co-routed bidirectional tunnel.

  o Specify the ingress node's LSR ID of the reverse CRLSP as 10.0.0.1—the LSR ID of Sysname1.

  o Specify the tunnel ID of the reverse CRLSP as 2—the tunnel ID configured on Device A.

  ```
  <DeviceB> system-view
  [DeviceB] interface tunnel 1 mode mpls-te
  [DeviceB-Tunnel1] destination 10.0.0.1
  [DeviceB-Tunnel1] mpls te bidirectional co-routed passive reverse-lsp lsr-id 10.0.0.1
  tunnel-id 2
  ```

- Configure an MPLS TE bidirectional tunnel between Device A and Device B in associated mode:

  # Configure Device A as follows:

  o Enable the MPLS TE bidirectional tunnel feature on tunnel interface Tunnel 1.

  o Configure the tunnel establishment mode as **associated**.

  o Specify the ingress node's LSR ID of the reverse CRLSP as 10.0.0.2—the LSR ID of Device B.

  o Specify the tunnel ID of the reverse CRLSP as 2—the tunnel ID configured on Device B.

  ```
  <DeviceA> system-view
  [DeviceA] interface tunnel 1 mode mpls-te
  [DeviceA-Tunnel1] destination 10.0.0.2
  [DeviceA-Tunnel1] mpls te bidirectional associated reverse-lsp lsr-id 10.0.0.2
  tunnel-id 2
  ```

  # Configure Device B as follows:

  o Enable the MPLS TE bidirectional tunnel feature on tunnel interface Tunnel 1.

  o Configure the tunnel establishment mode as **associated**.

  o Specify the ingress node's LSR ID of the reverse CRLSP as 10.0.0.1—the LSR ID of Device A.

  o Specify the tunnel ID of the reverse CRLSP as 3—the tunnel ID configured on Device A.

  ```
  <DeviceB> system-view
  [DeviceB] interface tunnel 1 mode mpls-te
  [DeviceB-Tunnel1] destination 10.0.0.1
  ```

```
[DeviceB-Tunnel1] mpls te bidirectional associated reverse-lsp lsr-id 10.0.0.1
tunnel-id 3
```

Related commands

display mpls te tunnel-interface

mpls te enable (interface view)

Use **mpls te enable** to enable MPLS TE on an interface.

Use **undo mpls te enable** to disable MPLS TE on an interface.

Syntax

mpls te enable

undo mpls te enable

Default

MPLS TE is disabled on an interface.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

After you enable MPLS TE on an interface by using the **mpls te enable** command, the interface can act as part of an MPLS TE tunnel.

After you execute the **undo mpls te enable** command on an interface, MPLS TE is disabled on the interface and all CRLSPs on the interface are deleted.

Examples

Enable MPLS TE on VLAN-interface 10.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
[Sysname-Vlan-interface10] mpls te enable
```

Related commands

display mpls te link-management bandwidth-allocation

mpls te

mpls te enable (IS-IS view)

Use **mpls te enable** to enable MPLS TE for an IS-IS process.

Use **undo mpls te enable** to disable MPLS TE for an IS-IS process.

Syntax

mpls te enable [**level-1** | **level-2**]

undo mpls te enable [**level-1** | **level-2**]

Default

MPLS TE is disabled for an IS-IS process.

Views

IS-IS view

Predefined user roles

network-admin

mdc-admin

Parameters

`level-1`: Enables MPLS TE for IS-IS at Level-1.

`level-2`: Enables MPLS TE for IS-IS at Level-2.

Usage guidelines

If you do not specify an IS-IS level, this command enables MPLS TE for IS-IS at both Level-1 and Level-2.

IS-IS TE uses a sub-TLV of the extended IS reachability TLV (type 22) to carry TE attributes. Because the extended IS reachability TLV carries wide metrics, specify a wide metric-compatible metric style for the IS-IS process before enabling IS-IS TE. Available metric styles for IS-IS TE include wide, compatible, or wide-compatible. For more information about IS-IS, see *Layer 3—IP Routing Configuration Guide*.

If you execute this command multiple times, the most recent configuration takes effect. For example, if you execute the `mpls te enable` command and then the `mpls te enable level-1` command, MPLS TE is enabled for Level-1 and disabled for Level-2.

After you enable MPLS TE for both Level-1 and Level-2, executing the `undo mpls te enable level-1` command disables MPLS TE for Level-1. MPLS TE is still enabled for Level-2. Similarly, the `undo mpls te enable level-2` command only disables MPLS TE for Level-2.

IS-IS messages cannot be fragmented at the IP layer. For IS-IS TE to operate correctly, make sure the following requirements are met:

- The Link State PDU size is large enough so that the Link State PDUs can carry TE information. To set the maximum size of Level-1 and Level-2 Link State PDUs, use the `lsp-length originate` command.
- The MTU of an IS-IS enabled interface is greater than or equal to the size of IS-IS Link State PDUs with TE information. To set the interface MTU, use the `mtu` command.

Examples

Enable MPLS TE for IS-IS process 1 at Level-2.

```
<Sysname> system-view
[Sysname] isis 1
[Sysname-isis-1] cost-style compatible
[Sysname-isis-1] mpls te enable level-2
```

Related commands

`cost-style` (*Layer 3—IP Routing Command Reference*)

mpls te enable (OSPF area view)

Use `mpls te enable` to enable MPLS TE for an OSPF area.

Use `undo mpls te enable` to disable MPLS TE for an OSPF area.

Syntax

```
mpls te enable

undo mpls te enable
```

Default

MPLS TE is disabled for an OSPF area.

Views

OSPF area view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

OSPF TE uses Type-10 opaque LSAs to carry the TE attributes for a link. Before you configure OSPF TE, you must enable opaque LSA advertisement and reception by using the `opaque-capability enable` command. For more information about opaque LSA advertisement and reception, see *Layer 3—IP Routing Configuration Guide*.

Examples

Enable MPLS TE for OSPF process 1 in OSPF area 1.

```
<Sysname> system-view
[Sysname] ospf 1
[Sysname-ospf-1] area 1
[Sysname-ospf-1-area-0.0.0.1] mpls te enable
```

Related commands

`opaque-capability enable` (*Layer 3—IP Routing Command Reference*)

mpls te fast-reroute

Use `mpls te fast-reroute` to enable fast reroute (FRR).

Use `undo mpls te fast-reroute` to disable FRR.

Syntax

```
mpls te fast-reroute [ bandwidth ]

undo mpls te fast-reroute
```

Default

FRR is disabled.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

`bandwidth`: Provides bandwidth protection for the primary CRLSP. If you do not specify this keyword, bandwidth protection is not provided for the primary CRLSP.

Usage guidelines

FRR provides a quick link or node protection on a CRLSP. FRR traffic switching can happen in as fast as 50 milliseconds, minimizing data loss.

After FRR is enabled for an MPLS TE tunnel, once a link or node fails on the primary CRLSP, the following events occur:

- FRR reroutes the traffic to a bypass tunnel.
- The ingress node attempts to set up a new CRLSP.

After the new CRLSP is set up successfully, traffic is forwarded on the new CRLSP.

When a primary CRLSP does not need bandwidth protection, it prefers to use a bypass tunnel that does not provide bandwidth protection. No bandwidth guarantee is required after FRR.

When a primary CRLSP needs bandwidth protection, it prefers to use the bypass tunnel that can protect bandwidth as much as possible to provide bandwidth guarantee after FRR.

Regardless of whether a primary CRLSP requires bandwidth protection, the following will occur when the primary CRLSP is bound to a bypass tunnel that provides bandwidth protection:

- The bypass tunnel will reserve the protected bandwidth for the primary CRLSP.
- The RRO message of the PLR will carry the bandwidth protection flag.

After FRR is enabled for a tunnel, the label recording feature is automatically enabled for the tunnel, regardless of whether the **mpls te record-route label** command is configured.

If both the **mpls te fast-reroute** and **mpls te bidirectional** commands are configured, only the **mpls te bidirectional** command takes effect.

Examples

Enable FRR for Tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te fast-reroute
```

Related commands

display mpls te tunnel-interface

mpls te backup bandwidth

mpls te fast-reroute bypass-tunnel

Use **mpls te fast-reroute bypass-tunnel** to specify a bypass tunnel for an interface.

Use **undo mpls te fast-reroute bypass-tunnel** to delete a bypass tunnel from an interface.

Syntax

mpls te fast-reroute bypass-tunnel tunnel *tunnel-number*

undo mpls te fast-reroute bypass-tunnel tunnel *tunnel-number*

Default

No bypass tunnel is specified for an interface.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Parameters

tunnel *tunnel-number*: Specifies a bypass tunnel by the tunnel interface number. The value range for the *tunnel-number* argument is 1 to 4095.The specified bypass tunnel must be established by RSVP, and the protected interface must not be the outgoing interface of a bypass tunnel.

Usage guidelines

The protected interface (where the command is executed) is the outgoing interface of a primary CRLSP. When the outgoing interface is down or a neighbor failure is detected through the BFD or hello mechanism, traffic of the primary CRLSP is switched to the bypass tunnel.

When you use this command, follow these restrictions and guidelines:

- You can specify a maximum of three bypass tunnels for an interface.
- A bypass tunnel can protect a maximum of three interfaces.

Examples

Configure tunnel interface Tunnel 1 as the bypass tunnel for VLAN-interface 10.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
[Sysname-Vlan-interface10] mpls te fast-reroute bypass-tunnel tunnel 1
```

Related commands

fast-reroute timer

mpls te igp advertise

Use **mpls te igp advertise** to enable forwarding adjacency for an MPLS TE tunnel, so IGP advertises the tunnel as a link in the IGP network.

Use **undo mpls te igp advertise** to disable forwarding adjacency.

Syntax

mpls te igp advertise [**hold-time** *value*]

undo mpls te igp advertise

Default

Forwarding adjacency is disabled for an MPLS TE tunnel, and IGP does not advertise the tunnel as a link in the IGP network.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

hold-time *value*: Specifies the period of time that IGP waits to advertise an MPLS TE tunnel up/down state change. The value range is 0 to 4294967295 milliseconds. The default value is 0, which means when the MPLS TE tunnel state changes, IGP immediately advertises the state change.

Usage guidelines

To make forwarding adjacency take effect, you must establish two MPLS TE tunnels in opposite directions between two nodes, and enable forwarding adjacency on both nodes.

On an interface, if you configure both the **mpls te igp advertise** command and the **mpls te igp shortcut** command, the most recent configuration takes effect.

Examples

Enable forwarding adjacency for MPLS TE Tunnel 1, and set the wait time before advertising a tunnel state change to 10000 milliseconds.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te igp advertise hold-time 10000
```

Related commands

mpls te igp metric

mpls te igp shortcut

mpls te igp metric

Use **mpls te igp metric** to assign a metric to an MPLS TE tunnel.

Use **undo mpls te igp metric** to restore the default.

Syntax

mpls te igp metric { **absolute** *value* | **relative** *value* }

undo mpls te igp metric

Default

The metric of an MPLS TE tunnel equals its IGP metric.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

absolute *value*: Specifies an absolute metric, an integer in the range of 1 to 65535.

relative *value*: Specifies a relative metric, an integer in the range of −10 to +10. A relative metric is the assigned metric value plus the IGP metric.

Usage guidelines

When IGP shortcut is enabled for an MPLS TE tunnel, the MPLS TE tunnel is included in the IGP route calculation as a link. You can use this command to configure the metric of this link used for IGP route calculation.

Examples

Assign MPLS TE tunnel interface Tunnel 1 a relative metric of −1 for route calculation in IGP shortcut mechanism.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te igp metric relative -1
```

mpls te igp shortcut

Use `mpls te igp shortcut` to enable IGP shortcut for an MPLS TE tunnel. The tunnel ingress node includes the tunnel in the IGP route calculation as a link.

Use `undo mpls te igp shortcut` to disable IGP shortcut.

Syntax

`mpls te igp shortcut` [`isis` | `ospf`]

`undo mpls te igp shortcut`

Default

IGP shortcut is disabled for an MPLS TE tunnel. The ingress node does not include the tunnel in the IGP route calculation as a link.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

`isis`: Includes the MPLS TE tunnel in IS-IS route calculation.

`ospf`: Includes the MPLS TE tunnel in OSPF route calculation.

Usage guidelines

If you do not specify the IGP in this command, both OSPF and IS-IS will include the MPLS TE tunnel in route calculation.

On an interface, if you configure both the `mpls te igp advertise` command and the `mpls te igp shortcut` command, the most recent configuration takes effect.

Examples

Enable IGP shortcut for MPLS TE Tunnel 1, so the tunnel ingress node considers the tunnel as a link in the OSPF and IS-IS route calculation.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te igp shortcut
```

Related commands

`mpls te igp advertise`

`mpls te igp metric`

mpls te link-attribute

Use `mpls te link-attribute` to set the link attribute.

Use `undo mpls te link-attribute` to restore the default.

Syntax

> **mpls te link-attribute** *attribute-value*
>
> **undo mpls te link-attribute**

Default

> The link attribute value is 0x00000000.

Views

> Interface view

Predefined user roles

> network-admin
>
> mdc-admin

Parameters

> *attribute-value*: Specifies the link attribute value, a hexadecimal number in the range of 0 to ffffffff. A link attribute value is a 32-bit binary number. Each bit represents an attribute with a value of 0 or 1.

Usage guidelines

> The TE information for a link advertised by the IGP includes the link attribute configured by this command. After receiving the link TE information, the ingress node of an MPLS TE tunnel determines whether the link can be used for MPLS TE tunnel establishment according to the following settings:
>
> - The configured tunnel affinity attribute.
> - The affinity mask.
> - The link attribute.
>
> A link is available for a tunnel if the following requirements are met:
>
> - The link attribute bits corresponding to the affinity attribute's 1 bits whose mask bits are 1 must have a minimum of one bit set to 1.
> - The link attribute bits corresponding to the affinity attribute's 0 bits whose mask bits are 1 must have no bit set to 1.
>
> The link attribute bits corresponding to the 0 bits in the affinity mask are not checked.
>
> For example, if the affinity is 0xfffffff0 and the mask is 0x0000ffff, a link is available for the tunnel when its link attribute bits meet the following requirements:
>
> - The highest 16 bits each can be 0 or 1 (no requirements).
> - The 17th through 28th bits must have a minimum of one bit whose value is 1.
> - The lowest four bits must be 0.

Examples

> # On VLAN-interface 10, set the link attribute to 0x00000101.
>
> ```
> <Sysname> system-view
> [Sysname] interface vlan-interface 10
> [Sysname-Vlan-interface10] mpls te link-attribute 101
> ```

Related commands

> **mpls te affinity-attribute**

mpls te loop-detection

Use **mpls te loop-detection** to enable loop detection during establishment of an MPLS TE tunnel.

Use **undo mpls te loop-detection** to disable loop detection for the MPLS TE tunnel.

Syntax

mpls te loop-detection

undo mpls te loop-detection

Default

Loop detection is disabled for an MPLS TE tunnel.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

When loop detection is enabled on the ingress node of an MPLS TE tunnel, the route recording feature is automatically enabled for the tunnel, regardless of whether the **mpls te record-route** command is configured. When establishing the MPLS TE tunnel, each node of the tunnel detects whether a loop has occurred according to the recorded route information.

Examples

Enable loop detection for establishing MPLS TE Tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te loop-detection
```

mpls te max-link-bandwidth

Use **mpls te max-link-bandwidth** to set the maximum bandwidth for MPLS TE traffic on an interface.

Use **undo mpls te max-link-bandwidth** to restore the default.

Syntax

mpls te max-link-bandwidth { *bandwidth-value* | **percent** *percent-bandwidth* }

undo mpls te max-link-bandwidth

Default

The maximum link bandwidth for MPLS TE traffic is 0 kbps.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Parameters

bandwidth-value: Specifies the maximum link bandwidth in the range of 1 to 4294967295 kbps.

percent *percent-bandwidth*: Specifies the percentage of the maximum link bandwidth out of the total bandwidth of the interface. The value range is 1 to 100.

Usage guidelines

The device carries the maximum link bandwidth in advertised IGP routes. The tunnel ingress node can obtain the information and use the information in CSPF calculation to select a path that meets the tunnel bandwidth requirements.

Examples

On VLAN-interface 10, set the maximum link bandwidth for MPLS TE traffic to 1158 kbps.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
[Sysname-Vlan-interface10] mpls te max-link-bandwidth 1158
```

Related commands

display mpls te link-management bandwidth-allocation

mpls te bandwidth

mpls te metric

Use **mpls te metric** to assign a TE metric to the link.

Use **undo mpls te metric** to restore the default.

Syntax

mpls te metric *value*

undo mpls te metric

Default

A link uses its IGP metric as its TE metric.

Views

Interface view

Predefined user roles

network-admin

mdc-admin

Parameters

value: Specifies a TE metric for the link, in the range of 1 to 4294967295.

Usage guidelines

The device carries two types of metrics (IGP metric and TE metric) of a link in the advertised IGP routes. You can use this command to configure the TE metric. When the tunnel ingress receives the link metrics, it uses the IGP or TE metric for path selection according to the configuration of the **mpls te path-metric-type** or **path-metric-type** command.

Examples

Assign a TE metric of 20 to the link on VLAN-interface 10.

```
<Sysname> system-view
[Sysname] interface vlan-interface 10
```

```
[Sysname-Vlan-interface10] mpls te metric 20
```

Related commands

> **mpls te path metric-type**
>
> **path metric-type**

mpls te path

Use **mpls te path** to specify a path for the tunnel and set the preference of the path.

Use **undo mpls te path** to delete the specified path for the tunnel.

Syntax

> **mpls te path preference** *value* { **dynamic** [**pce** [*ip-address*]&<0-8>] | **explicit-path** *path-name* } [**no-cspf**]
>
> **undo mpls te path preference** *value*

Default

MPLS TE uses the dynamically calculated path to establish a CRLSP.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

preference *value*: Specifies a preference value for a path, in the range of 1 to 10. A smaller value represents a higher preference.

dynamic: Uses the path dynamically calculated by CSPF to establish the CRLSP.

pce: Uses the path calculated by PCEs to establish the CRLSP. If you do not specify this keyword, the local LSR uses the path dynamically calculated by CSPF.

[*ip-address*]&<0-8>: Specifies a space-separated list of a maximum of eight PCE addresses. If you do not specify a PCE address, the system automatically selects a PCE from discovered PCEs. If you specify more than one PCE address, a BRPC calculation will be performed on the specified PCEs in configuration order.

explicit-path *path-name*: Uses the specified explicit path to establish the CRLSP. The *path-name* argument specifies the name of an explicit path, a case-sensitive string of 1 to 31 characters.

no-cspf: Calculates the path by searching the routing table instead of using the CSPF algorithm.

Usage guidelines

You can specify a maximum of 10 paths for a tunnel interface. The paths must have different preferences.

When establishing a CRLSP, MPLS TE performs CSPF calculations according to the specified paths in a descending order of preference until the CRLSP is established successfully. If the CSPF calculations for all paths are failed, the CRLSP cannot be established.

If you specify PCE addresses in this command or in the **mpls te backup-path** command, the local device establishes PCEP sessions to the specified PCEs. If you do not specify a PCE address, the local device establishes PCEP sessions to all discovered PCEs.

Examples

Configure Tunnel 1 to use explicit path **path1** and the path calculated by PCEs for CRLSP establishment. Set a higher preference for the path calculated by PCEs.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te path preference 2 explicit-path path1
[Sysname-Tunnel1] mpls te path preference 1 dynamic pce 1.1.1.9 2.2.2.9
```

Related commands

display mpls te tunnel-interface

mpls te backup-path

mpls te path-metric-type

Use **mpls te path-metric-type** to specify the link metric type for path selection of a tunnel.

Use **undo mpls te path-metric-type** to restore the default.

Syntax

mpls te path-metric-type { **igp** | **te** }

undo mpls te path-metric-type

Default

No link metric type is specified for path selection of a tunnel.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

igp: Uses the IGP metric.

te: Uses the TE metric.

Usage guidelines

Each MPLS TE link has two metrics: IGP metric and TE metric. By using the two metrics, you can select different tunnels for different classes of traffic. For example, use the IGP metric to represent a link delay (a smaller IGP metric value indicates a lower link delay). Use the TE metric to represent a link bandwidth value (a smaller TE metric value indicates a bigger link bandwidth value).

You can establish two MPLS TE tunnels: Tunnel1 for voice traffic and Tunnel2 for video traffic. Configure Tunnel1 to use IGP metrics for path selection, and configure Tunnel2 to use TE metrics for path selection. As a result, the video traffic travels through the path that has larger bandwidth and the voice service travels through the path that has lower delay.

If you specify a metric type for a tunnel by using this command, the tunnel uses the specified metric type for path selection. If you do not specify a metric type, the tunnel uses the metric type specified by the **path-metric-type** command in MPLS TE view for path selection.

Examples

Configure Tunnel 1 to use the IGP metric for path selection.

```
<Sysname> system-view
```

```
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te path-metric-type igp
```

Related commands

display mpls te tunnel-interface

mpls te metric

path-metric-type

mpls te priority

Use **mpls te priority** to set a setup priority and a holding priority for an MPLS TE tunnel.

Use **undo mpls te priority** to restore the default.

Syntax

mpls te priority *setup-priority* [*hold-priority*]

undo mpls te priority

Default

The setup priority and the holding priority of an MPLS TE tunnel are both 7.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

setup-priority: Specifies the setup priority in the range of 0 to 7. A smaller number represents a higher priority.

hold-priority: Specifies the holding priority in the range of 0 to 7. A smaller number represents a higher priority. If you do not specify this argument, the holding priority is the same as the setup priority.

Usage guidelines

The setup priority and holding priority of an MPLS TE tunnel determines the importance of the tunnel. A tunnel that has a higher setup priority than the holding priority of another tunnel can preempt the resources of the second.

The setup priority and holding priority can be applied to the following scenarios:

- Multiple MPLS TE tunnels use the same path but the path does not have enough bandwidth for all the tunnels. You can configure different setup and holding priorities for different tunnels to make sure important tunnels can be established first.
- Before an important tunnel is established, multiple less-important MPLS TE tunnels have existed on the network, occupying the bandwidth resources and the optimal path. You can assign a higher setup priority to the import tunnel, so the tunnel can preempt the resources of the existing tunnels and use the optimal path.

The setup priority of a tunnel must not be higher than its holding priority. Configure the setup priority value to be equal to or greater than the holding priority value.

Examples

Set both the setup priority and holding priority of Tunnel 1 to 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te priority 1 1
```

Related commands

display mpls te tunnel-interface

mpls te record-route

Use **mpls te record-route** to enable route recording and label recording for a tunnel.

Use **undo mpls te record-route** to disable route recording and label recording for a tunnel.

Syntax

mpls te record-route [**label**]

undo mpls te record-route

Default

Route recording or label recording is disabled for a tunnel.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

label: Enables both route recording and label recording. If you do not specify this keyword, the command enables only route recording.

Usage guidelines

Route recording records the nodes that an MPLS TE tunnel traverses. Label recording records the label assigned by each node. The recorded information helps you know about the path used by the MPLS TE tunnel and the label distribution information. When the tunnel fails, the recorded information helps you locate the fault.

Examples

Enable route recording for MPLS TE tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te record-route
```

Related commands

display mpls te tunnel-interface

mpls te reoptimization (tunnel interface view)

Use **mpls te reoptimization** to enable tunnel reoptimization.

Use **undo mpls te reoptimization** to disable tunnel reoptimization.

Syntax

mpls te reoptimization [**frequency** *seconds*]

```
undo mpls te reoptimization
```

Default

Tunnel reoptimization is disabled.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

frequency *seconds*: Specifies the tunnel reoptimization frequency in the range of 1 to 604800 seconds. The default is 3600 seconds.

Usage guidelines

MPLS TE uses the tunnel reoptimization feature to implement dynamic CRLSP optimization. For example, if a link on the optimal path does not have enough reservable bandwidth during tunnel setup, MPLS TE sets up the tunnel on another path. When the link has enough bandwidth, tunnel optimization can automatically switch the tunnel to the optimal path.

You can configure the ingress to perform tunnel reoptimization periodically. Or, you can use the **mpls te reoptimization** command in user view to trigger the ingress to perform a tunnel reoptimization at any time.

On the same tunnel interface, the **mpls te reoptimization** command is mutually exclusive with the following commands:

- **mpls te route-pinning.**
- **mpls te backup**.

If both the **mpls te reoptimization** and **mpls te bidirectional** commands are configured, only the **mpls te bidirectional** command takes effect.

Examples

Enable reoptimization for tunnel 1, and set the reoptimization frequency to 43200 seconds (12 hours).

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te reoptimization frequency 43200
```

Related commands

display mpls te tunnel-interface

mpls te reoptimization (user view)

mpls te reoptimization (user view)

Use **mpls te reoptimization** to reoptimize all reoptimization-enabled MPLS TE tunnels.

Syntax

mpls te reoptimization

Views

User view

Predefined user roles

network-admin

mdc-admin

Usage guidelines

After this command is executed in tunnel interface view, you can execute it in user view to trigger the ingress node to immediately reselect an optimal path for a tunnel.

Examples

Reoptimize all reoptimization-enabled MPLS TE tunnels.

```
<Sysname> mpls te reoptimization
```

Related commands

mpls te reoptimization (tunnel interface view)

mpls te resv-style

Use **mpls te resv-style** to configure the resource reservation style for the MPLS TE tunnel.

Use **undo mpls te resv-style** to restore the default.

Syntax

mpls te resv-style { **ff** | **se** }

undo mpls te resv-style

Default

The resource reservation style is SE.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

ff: Specifies the resource reservation style as fixed filter (FF). In FF style, resources are reserved for individual senders and cannot be shared among senders on the same session.

se: Specifies the resource reservation style as shared explicit (SE). In SE style, resources are reserved for senders on the same session and shared among them.

Usage guidelines

This command applies only to MPLS TE tunnels established by RSVP-TE.

Examples

Use the FF reservation style to establish MPLS TE tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te resv-style ff
```

Related commands

display mpls te tunnel-interface

mpls te signaling

mpls te retry

Use **mpls te retry** to set the maximum number of tunnel setup attempts.

Use **undo mpls te retry** to restore the default.

Syntax

mpls te retry *retries*

undo mpls te retry

Default

The maximum number of tunnel setup attempts is 3.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

retries: Specifies the number of tunnel setup attempts, in the range of 1 to 4294967295.

Usage guidelines

After failing to establish an MPLS TE tunnel, the tunnel ingress node waits for the tunnel setup retry interval (configured by the **mpls te timer retry** command). Then it tries to set up the tunnel until the tunnel is established successfully. If the tunnel cannot be established when the number of attempts reaches the maximum, the ingress waits for a longer period and then repeats the previous process.

Examples

Set the maximum number of tunnel setup attempts to 20.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te retry 20
```

Related commands

display mpls te tunnel-interface

mpls te timer retry

mpls te route-pinning

Use **mpls te route-pinning** to enable route pinning.

Use **undo mpls te route-pinning** to restore the default.

Syntax

mpls te route-pinning

undo mpls te route-pinning

Default

Route pinning is disabled.

Views

> Tunnel interface view

Predefined user roles

> network-admin
>
> mdc-admin

Usage guidelines

> When route pinning is enabled, an established CRLSP does not re-select an optimal path even if the optimal route has changed.
>
> Use this feature to avoid CRLSPs from changing frequently on an unstable network. This feature ensures that the established CRLSPs are not re-established as long as they are available.
>
> In the same tunnel interface view, the **mpls te route-pinning** command cannot be used together with the **mpls te reoptimization** command.

Examples

> \# Enable route pinning for Tunnel 1.
> ```
> <Sysname> system-view
> [Sysname] interface tunnel 1 mode mpls-te
> [Sysname-Tunnel1] mpls te route-pinning
> ```

Related commands

> **display mpls te tunnel-interface**

mpls te signaling

> Use **mpls te signaling** to configure the signaling protocol for an MPLS TE tunnel interface.
>
> Use **undo mpls te signaling** to restore the default.

Syntax

> **mpls te signaling** { **rsvp-te** | **static** }
>
> **undo mpls te signaling**

Default

> MPLS TE uses RSVP-TE to establish tunnels.

Views

> Tunnel interface view

Predefined user roles

> network-admin
>
> mdc-admin

Parameters

> **rsvp-te**: Uses the RSVP-TE signaling protocol to establish a tunnel.
>
> **static**: Uses a static CRLSP to establish a tunnel.

Usage guidelines

> To use RSVP-TE to establish an MPLS TE tunnel, you must enable MPLS TE and RSVP on each node and interface that the MPLS TE tunnel traverses.

To establish an MPLS TE tunnel over a static CRLSP, you must configure the tunnel to use the static CRLSP by using the **mpls te static-cr-lsp** command.

Examples

Use RSVP-TE to establish MPLS TE tunnel 1.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te signaling rsvp-te
```

Related commands

display mpls te tunnel-interface

mpls te static-cr-lsp

mpls te static-cr-lsp

Use **mpls te static-cr-lsp** to specify a static CRLSP for a tunnel.

Use **undo mpls te static-cr-lsp** to remove the configuration.

Syntax

mpls te static-cr-lsp *lsp-name*

undo mpls te static-cr-lsp *lsp-name*

Default

A tunnel does not use any static CRLSP.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

lsp-name: Specifies a static CRLSP by its name, a case-sensitive string of 1 to 15 characters.

Usage guidelines

This command takes effect only when the **mpls te signaling static** command has been configured in tunnel interface view.

Execute this command on the ingress node. The static CRLSP specified must have been created by using the **static-cr-lsp ingress** command.

Examples

Configure tunnel 1 to use static CRLSP **static-te-3**.

```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te static-cr-lsp static-te-3
```

Related commands

display mpls te tunnel-interface

mpls te signaling

static-cr-lsp egress

```
static-cr-lsp ingress
static-cr-lsp transit
```

mpls te timer retry

Use **mpls te timer retry** to set the tunnel setup retry interval.

Use **undo mpls te timer retry** to restore the default.

Syntax

mpls te timer retry *seconds*

undo mpls te timer retry

Default

The retry interval is 2 seconds.

Views

Tunnel interface view

Predefined user roles

network-admin

mdc-admin

Parameters

seconds: Specifies the interval at which MPLS TE tries to re-establish the tunnel, in the range of 1 to 604800 seconds.

Usage guidelines

After failing to establish an MPLS TE tunnel, the tunnel ingress node waits for the tunnel setup retry interval. Then, it tries to set up the tunnel until the tunnel is established successfully. If the tunnel cannot be established when the number of attempts reaches the maximum (configured by the **mpls te retry** command), the ingress waits for a longer period. Then, it repeats the previous process.

Examples

Set the setup retry interval to 20 seconds for tunnel 1.
```
<Sysname> system-view
[Sysname] interface tunnel 1 mode mpls-te
[Sysname-Tunnel1] mpls te timer retry 20
```

Related commands

display mpls te tunnel-interface

mpls te retry

nexthop

Use **nexthop** to add or modify a node in an explicit path, and configure the attributes of the node.

Use **undo nexthop** to delete a node in an explicit path.

Syntax

nexthop [**index** *index-number*] *ip-address* [**exclude** | **include** [**loose** | **strict**]]

undo nexthop index *index-number*

Default

An explicit path does not include any nodes.

Views

Explicit path view

Predefined user roles

network-admin

mdc-admin

Parameters

index *index-number*: Specifies an index for the node in the explicit path, in the range of 1 to 65535. If you do not specify an index, MPLS TE automatically calculates an index for the node, the value of which is the current maximum index value plus 100.

ip-address: Specifies a node by its IP address in dotted decimal notation.

exclude: Excludes the specified node from the explicit path.

include: Includes the specified node on the explicit path.

loose: Specifies the node as a loose node, which means the specified node and its previous hop can be indirectly connected.

strict: Specifies the node as a strict node, which means the node and its previous hop must be directly connected.

Usage guidelines

The IP address specified in this command can be one of the following:

- **Link IP address**—IP address of an interface on the device, identifying a link.
- **Device LSR ID**—Identifies the device.

The address of a strict node must be a link IP address. The address of a loose node can be a link IP address or the device LSR ID.

CSPF excludes the links or devices specified by **exclude** from path calculation, and uses the links specified by **include** in ascending order of indexes to establish a CRLSP.

When you execute the **nexthop** command, follow these guidelines:

- If you specify an existing index, the command modifies the IP address or attribute of the node identified by that index.
- If you specify neither **include** nor **exclude**, the **include** keyword is used by default.
- If you specify neither **loose** nor **strict**, the **strict** keyword is used by default.

Examples

Exclude IP address 10.0.0.125 from MPLS TE explicit path **path1**.

```
<Sysname> system-view
[Sysname] explicit-path path1
[Sysname-explicit-path-path1] nexthop 10.0.0.125 exclude
```

Related commands

display explicit-path

nhop-only

Use **nhop-only** to configure the PLR to create only link-protection bypass tunnels.

Use **undo nhop-only** to restore the default.

Syntax

    nhop-only

    undo nhop-only

Default

    The PLR automatically creates both link-protection and node-protection bypass tunnels.

Views

    MPLS TE auto FRR view

Predefined user roles

    network-admin

    mdc-admin

Usage guidelines

    Execution of the **nhop-only** command deletes all existing node-protection bypass tunnels automatically created for MPLS TE auto FRR.

Examples

    # Configure the device to automatically create only link-protection bypass tunnels.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] auto-tunnel backup
[Sysname-te-auto-bk] nhop-only
```

Related commands

    auto-tunnel backup

    tunnel-number

path-metric-type

Use **path-metric-type** to specify the link metric type to be used for path selection when a metric type is not explicitly specified for a tunnel.

Use **undo path-metric-type** to restore the default.

Syntax

    path-metric-type { **igp** | **te** }

    undo path-metric-type

Default

    A tunnel uses TE metrics of links for path selection when no metric type is specified for the tunnel.

Views

    MPLS TE view

Predefined user roles

    network-admin

    mdc-admin

Parameters

igp: Uses the IGP metric.

te: Uses the TE metric.

Usage guidelines

Each MPLS TE link has two metrics: IGP metric and TE metric. By correctly planning the two metrics, you can select different tunnels for different classes of traffic. For example, use the IGP metric to represent a link delay (a smaller IGP metric value indicates a lower link delay). Use the TE metric to represent a link bandwidth value (a smaller TE metric value indicates a bigger link bandwidth value).

You can establish two MPLS TE tunnels: Tunnel1 for voice traffic and Tunnel2 for video traffic. Configure Tunnel1 to use IGP metrics for path selection, and configure Tunnel2 to use TE metrics for path selection. As a result, the video traffic travels through the path that has larger bandwidth and the voice traffic travels through the path that has lower delay.

If you specify a metric type for a tunnel by using the **mpls te path-metric-type** command, the tunnel uses the specified metric type for path selection. If you do not specify a metric type, the tunnel uses the metric type specified by the **path-metric-type** command for path selection.

Examples

Configure MPLS TE tunnels that are not explicitly specified with a metric type to use the IGP metric for path selection.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] path-metric-type igp
```

Related commands

mpls te metric

mpls te path-metric-type

pce address

Use **pce address** to configure an IP address for a PCE.

Use **undo pce address** to restore the default.

Syntax

pce address *ip-address*

undo pce address

Default

No PCE IP address is configured.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

ip-address: Specifies the PCE IP address.

Usage guidelines

For the device to act as a PCE, use this command to specify a PCE IP address for the device.

As a best practice, configure the loopback interface address as the PCE address. For a PCE to be discovered, enable OSPF TE on the loopback interface to advertise the PCE address or manually specify the PCE on PCCs.

If no PCE address is configured, the local device can only act as a PCC and use the MPLS LSR ID to communicate with the PCE. A PCC sends a PCEP connection request to a PCE, but it does not accept a request from a PCE.

Examples

Specify the local device as a PCE and configure the IP address for the PCE as 10.10.10.10.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce address 10.10.10.10
```

pce deadtimer

Use **pce deadtimer** to set the PCEP session deadtimer.

Use **undo pce deadtimer** to restore the default.

Syntax

pce deadtimer *value*

undo pce deadtimer

Default

The PCEP session deadtimer is 120 seconds.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

value: Specifies the PCEP session deadtimer in the range of 0 to 255 seconds. Value 0 indicates that the PCEP session will never time out.

Usage guidelines

The local device sends the deadtimer setting to its peer. If the local device does not receive a PCEP message from its peer before the deadtimer expires, it tears down the PCEP session. Then, the local device tries to establish a new PCEP session to its peer.

The deadtimer must be greater than the keepalive interval.

Examples

Set the PCEP session deadtimer to 180 seconds.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce deadtimer 180
```

Related commands

display mpls te pce peer

pce keepalive

pce keepalive

Use **pce keepalive** to set the keepalive interval for PCEP sessions.

Use **undo pce keepalive** to restore the default.

Syntax

pce keepalive *interval*

undo pce keepalive

Default

The keepalive interval is 30 seconds.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

interval: Specifies the keepalive interval in the range of 0 to 255 seconds. Value 0 indicates that no keepalive messages will be sent once the PCEP session is established.

Usage guidelines

If the keepalive interval for the local device is less than the **min-keepalive** setting on the peer device, the local device uses the peer's **min-keepalive** setting as the keepalive interval.

If the keepalive interval is set to 0 on the local device, configure the **min-keepalive** value as 0 on the peer device to avoid session establishment failure.

For more information about the **min-keepalive** setting, see the **pce tolerance** command.

Examples

Set the keepalive interval to 60 seconds.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce keepalive 60
```

Related commands

display mpls te pce peer

pce deadtimer

pce tolerance

pce request-timeout

Use **pce request-timeout** to set the path calculation request timeout time.

Use **undo pce request-timeout** to restore the default.

Syntax

pce request-timeout *value*

undo pce request-timeout

Default

The request timeout time is 10 seconds.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

value: Specifies the request timeout time in the range of 5 to 100 seconds.

Usage guidelines

In EPC calculation, if a PCC does not receive a calculation reply within the configured timeout time, it resends calculation requests to the PCE until it receives a reply.

In BRPC calculation, if a PCC does not receive a calculation reply from the PCE within the configured timeout time, the PCC does not resend a request. If a PCE does not receive a calculation reply from its downstream PCE within the timeout time, it sends the local calculation result to its upstream device as a reply. The PCE does not wait for a reply from its downstream PCE.

Examples

Set the request timeout time to 20 seconds.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce request-timeout 20
```

Related commands

display mpls te pce peer

pce static

Use **pce static** to specify a PCE as a peer on a PCC or PCE.

Use **undo pce static** to delete the specified PCE peer.

Syntax

pce static *ip-address*

undo pce static *ip-address*

Default

No PCE peers exist.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

ip-address: Specifies the IP address of a PCE peer.

Examples

Specify the PCE 10.10.10.10 as a peer.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce static 10.10.10.10
```

Related commands

display mpls te pce discovery

pce tolerance

Use **pce tolerance** to set the minimum acceptable keepalive interval and the maximum number of allowed unknown messages received from the peer.

Use **undo pce tolerance** to restore the default.

Syntax

pce tolerance { **min-keepalive** *value* | **max-unknown-messages** *value* }

undo pce tolerance { **min-keepalive** | **max-unknown-messages** }

Default

The minimum acceptable keepalive interval is 10 seconds, and the maximum number of allowed unknown messages in a minute is 5.

Views

MPLS TE view

Predefined user roles

network-admin

mdc-admin

Parameters

min-keepalive *value*: Specifies the minimum acceptable keepalive interval in the range of 0 to 255 seconds. Value 0 indicates that any keepalive interval is acceptable.

max-unknown-messages *value*: Limits the maximum number of allowed unknown messages in a minute, in the range of 0 to 16384. Value 0 indicates that no limit is enforced.

Usage guidelines

If the keepalive interval set on the peer device is less than the **min-keepalive** setting on the local device, the peer device uses the **min-keepalive** setting as the keepalive interval.

If the number of unknown messages received from the peer in a minute exceeds the **max-unknown-messages** setting on the local device, the local device tears down the PCEP session.

Examples

Set the minimum acceptable keepalive interval to 20 seconds and the maximum number of allowed unknown messages to 10.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] pce tolerance min-keepalive 20
[Sysname-te] pce tolerance max-unknown-messages 10
```

Related commands

> **display mpls te pce peer**
>
> **pce keepalive**

reset mpls te pce statistics

Use **reset mpls te pce statistics** to clear PCC and PCE statistics.

Syntax

> **reset mpls te pce statistics** [*ip-address*]

Views

> User view

Predefined user roles

> network-admin
>
> mdc-admin

Parameters

> *ip-address*: Specifies a PCC or PCE by its IP address. If you do not specify this argument, the command clears statistics about all PCEs and PCCs.

Examples

> # Clear statistics about PCE 10.10.10.10.
>
> ```
> <Sysname> reset mpls te pce statistics 10.10.10.10
> ```

Related commands

> **display mpls te pce statistics**

snmp-agent trap enable te

Use **snmp-agent trap enable te** to enable SNMP notifications for MPLS TE.

Use **undo snmp-agent trap enable te** to disable SNMP notifications for MPLS TE.

Syntax

> **snmp-agent trap enable te**
>
> **undo snmp-agent trap enable te**

Default

> SNMP notifications for MPLS TE are disabled.

Views

> System view

Predefined user roles

> network-admin
>
> mdc-admin

Usage guidelines

> This command enables generating SNMP notifications for MPLS TE upon MPLS TE tunnel status changes, as defined in RFC 3812. For MPLS TE event notifications to be sent correctly, you must

also configure SNMP on the device. For more information about SNMP configuration, see the network management and monitoring configuration guide for the device.

Examples

Enable SNMP notifications for MPLS TE.

```
<Sysname> system-view
[Sysname] snmp-agent trap enable te
```

timers removal unused

Use **timers removal unused** to set a removal timer for unused bypass tunnels.

Use **undo timers removal unused** to restore the default.

Syntax

timers removal unused *seconds*

undo timers removal unused

Default

A bypass tunnel is removed after it is unused for 3600 seconds.

Views

MPLS TE auto FRR view

Predefined user roles

network-admin

mdc-admin

Parameters

seconds: Specifies the period of time after which an unused bypass tunnel is removed, in the range of 300 to 604800 seconds. You can also set this argument to 0, which means not to remove unused bypass tunnels.

Usage guidelines

An automatically created bypass tunnel can protect multiple primary CRLSPs. A bypass tunnel is unused when the bypass tunnel is not bound to any primary CRLSP. When a bypass tunnel is unused for the period of time configured by this command, MPLS TE removes the bypass tunnel to release the occupied bandwidth and tunnel interface number.

Configure a removal timer according to your network conditions, with the following considerations:

- **Save resources**—If the timer value is too big, unused bypass tunnels occupy bandwidth and interface numbers for a long time.
- **Keep network stability**—If the timer value is too small, bypass tunnels might be set up and removed frequently.

Examples

Set the removal timer to 60000 seconds (100 minutes) for unused bypass tunnels.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] auto-tunnel backup
[Sysname-te-auto-bk] timers removal unused 60000
```

Related commands

auto-tunnel backup

tunnel-number

Use **tunnel-number** to specify an interface number range for automatically created bypass tunnels.

Use **undo tunnel-number** to restore the default.

Syntax

tunnel-number min *min-number* **max** *max-number*

undo tunnel-number

Default

No interface number range is specified, and the PLR cannot set up a bypass tunnel automatically.

Views

MPLS TE auto FRR view

Predefined user roles

network-admin

mdc-admin

Parameters

min *min-number* **max** *max-number*: Specifies a range of interface numbers for automatically created bypass tunnels. The value range for both the *min-number* and *max-number* arguments is 1 to 4095.The *min-number* must be smaller than or equal to the *max-number*, and the specified interface number range must include no more than 1000 interface numbers.

Usage guidelines

To enable the PLR to automatically create bypass tunnels, you must perform the following tasks:

1. Enable auto FRR globally by using the **auto-tunnel backup** command.
2. Specify the interface number range for bypass tunnels by using the **tunnel-number** command.

The PLR uses the interface numbers in the specified range in ascending order for the bypass tunnels.

When you use the **tunnel-number** command, follow these restrictions and guidelines:

- If you execute this command multiple times, the most recent configuration takes effect.
- If bypass tunnels are already created automatically, make sure the *min-number* is not greater than the minimum interface number used by the existing bypass tunnels. The *max-number* is not smaller than the maximum interface number used by the existing bypass tunnels.
- The interface number range specified by this command can include the interface numbers used by the tunnel interfaces created by the **interface tunnel** command. However, those interface numbers cannot be used for bypass tunnels, unless they are released by the **undo interface tunnel** command.

Examples

Specify interface numbers 100 to 120 for automatically created bypass tunnels.

```
<Sysname> system-view
[Sysname] mpls te
[Sysname-te] auto-tunnel backup
[Sysname-te-auto-bk] tunnel-number min 100 max 120
```

Related commands

       `auto-tunnel backup`

`auto-tunnel backup`