MPLS Command Reference

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affinity

To specify affinity and affinity mask values for an LSP in an LSP attribute list, use the **affinity** command in LSP attributes configuration mode. To remove the specified attribute flags, use the **no** form of this command.

affinity *value* [**mask** *value*]

no affinity

Syntax Description

value	Attribute flag value required for links that make up an LSP. The attribute flag value can be either 0 or 1.
mask *value*	(Optional) Indicates which attribute values should be checked. If a bit in the mask is 0, an attribute value of the link or that bit is irrelevant. If a bit in the mask is 1, the attribute value of that link and the required affinity of the tunnel for that bit must match.

Command Default

Attribute flag values are not specified.

Command Modes

LSP attributes configuration (config-lsp-attr)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The affinity value determines the attribute flags for links that make up the LSP, either 0 or 1. The attribute mask determines which attribute value the router should check. If a bit in the mask is 0, an attribute value of a link or that bit is irrelevant. If a bit in the mask is 1, the attribute value of a link and the required affinity of the LSP for that bit must match.

An LSP can use a link if the link affinity equals the attribute flag value and the affinity mask value.

Any value set to 1 in the affinity should also be set to 1 in the mask.

To associate the LSP affinity attribute and the LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where *string* is the identifier of the specific LSP attribute list.

Examples

The following example shows how to specify the affinity value and affinity mask values for links comprising an LSP.

```
Router(config-lsp-attr)# affinity 0 mask 0
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show mpls traffic-eng lsp attributes	Displays global LSP attribute lists.

auto-bw

To specify an automatic bandwidth configuration for a LSP in an LSP attribute list, use the **auto-bw** command in LSP attributes configuration mode. To remove automatic bandwidth configuration, use the **no** form of this command.

auto-bw [**frequency** *secs*] [**max-bw** *kbps*] [**min-bw** *kbps*] [**collect-bw**]

no auto-bw

Syntax Description

frequency *secs*	(Optional) Specifies the interval between bandwidth adjustments. The specified interval ranges from 300 to 604800 seconds.
max-bw *kbps*	(Optional) Specifies the maximum automatic bandwidth for the path option. The value ranges from 0 to 4294967295 kbps.
min-bw *kbps*	(Optional) Specifies the minimum automatic bandwidth for the path option. The value ranges from 0 to 4294967295 kbps.
collect-bw	(Optional) Collects bandwidth output rate information for the path option, but does not adjust its bandwidth.

Command Default

The automatic bandwidth for the LSP is not enabled.

Command Modes

LSP attributes configuration (config-lsp-attr)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to set an automatic bandwidth configuration for a LSP in an LSP attributes list.

To sample the bandwidth used by an LSP without automatically adjusting it, specify the **collect-bw** keyword in the **auto-bw** command in an LSP attribute list.

If you enter the **auto-bw** command without the **collect-bw** keyword, the bandwidth of the LSP is adjusted to the largest average output rate sampled for the LSP since the last bandwidth adjustment for the LSP was made.

To constrain the automatic bandwidth adjustment that can be made to an LSP in an LSP attribute list, use the **max-bw** or **min-bw** keyword and specify the permitted maximum allowable bandwidth or minimum allowable bandwidth, respectively.

The **no** form of the **auto-bw** command disables the automatic bandwidth adjustment for the tunnel and restores the configured bandwidth for the LSP where configured bandwidth is determined as follows:

- If the LSP bandwidth was explicitly configured with the **mpls traffic-eng lsp attributes lsp-id bandwidth** command after the running configuration was written to the startup configuration, the configured bandwidth is the bandwidth specified by that command.
- Otherwise, the configured bandwidth is the bandwidth specified for the tunnel in the startup configuration.

To associate the LSP automatic bandwidth adjustment attribute and the LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where *string* is the identifier of the specific LSP attribute list.

Examples

The following example sets the automatic bandwidth configuration for an LSP in an LSP attribute list.

```
Router(config-lsp-attr)# auto-bw
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show mpls traffic-eng lsp attributes	Displays global LSP attribute lists.

bandwidth

To configure LSP bandwidth in an LSP attribute list, use the **bandwidth** command in LSP attributes configuration mode. To remove the configured bandwidth from the LSP attribute list, use the **no** form of this command.

bandwidth global *kbps*

no bandwidth

Syntax Description

global *kbps*	Indicates a global pool path option. *kbps*—Number of kilobits per second set aside for the path option. The range is from 1 to 4294967295 kbps.

Command Default

The LSP bandwidth is not configured in the LSP attribute list.

Command Modes

LSP attributes configuration (config-lsp-attr)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to configure the LSP bandwidth in the LSP attribute list. The bandwidth configured can be associated with both dynamic and explicit path options.

To associate the LSP bandwidth and the LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where *string* is the identifier of the specific LSP attribute list.

The bandwidth configured in the LSP attribute list will override the bandwidth configured on the tunnel.

Examples

The following example shows how to specify an LSP bandwidth in the LSP attribute list.

```
Router(config-lsp-attr)# bandwidth global 1000
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show mpls traffic-eng lsp attributes	Displays global LSP attribute lists.

index

To insert or modify a path entry at a specific index, use the **index** command in IP explicit path configuration mode. To remove the path entry at the specified index, use the **no** form of this command.

index *index command*

no index *index*

Syntax Description

index	Index number at which the path entry will be inserted or modified. The valid values range from 0 to 65534.
command	An IP explicit path configuration command that creates or modifies a path entry.

Command Default

A path entry is not inserted for a specific index.

Command Modes

IP explicit path configuration (cfg-ip-expl-path)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following example shows how to insert a path entry at index 6.

```
Router(cfg-ip-expl-path)# index 6 next-address 209.165.200.225

Explicit Path identifier 6:
    6: next-address 209.165.200.225
```

Related Commands

Command	Description
ip explicit-path	Enters the command mode for IP explicit paths and creates or modifies the specified path.
next-address	Specifies the next IP address in the explicit path.
show ip explicit-paths	Displays the configured IP explicit paths.

ip explicit-path

To enter the command mode for IP explicit paths and create or modify the specified path, use the **ip explicit-path** command in global configuration mode. To disable this configuration, use the **no** form of this command.

ip explicit-path {**name** *word* | **identifier** *number*} [**enable** | **disable**]

no ip explicit-path {**name** *word* | **identifier** *number*}

Syntax Description

name *word*	Specifies the name of the explicit path.
identifier *number*	Specifies the number of the explicit path. The range is from 1 to 65535.
enable	(Optional) Enables the path.
disable	(Optional) Prevents the path from being used for routing while it is being configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

An IP explicit path is a list of IP addresses, each representing a node or link in the explicit path.

Examples

The following example shows how to enter the explicit path command mode for IP explicit paths.

```
Router(config)# ip explicit-path identifier 500
Router(config-ip-expl-path)#
```

Related Commands

Command	Description
index	Inserts or modifies a path entry at a specific index.
next-address	Specifies the next IP address in the explicit path.
show ip explicit-paths	Displays the configured IP explicit paths.

ip route

To establish a static route through a next hop IP address, physical interface, MPLS–TP tunnel, or MPLS–TE tunnel to the destination, use the **ip route** command in global configuration mode. To remove static routes, use the **no** form of this command.

ip route *destination mask* [*next-hop-address*] [**interface** *type number*] [*tunnel-id*] [*cost*]

no ip route *destination mask* [*next-hop-address*] [**interface** *type number*] [*tunnel-id*] [**cost**]

Syntax Description

destination	Destination IP address.
mask	Prefix mask for the destination.
next-hop-address	IP address of the next hop that can be used to reach the destination.
interface *type number*	Specifies the network interface type and interface number.
tunnel-id	ID of MPLS–TP tunnel or MPLS–TE tunnel.
cost	Cost to reach the destination.

Command Default

No static routes are established.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The establishment of a static route is appropriate when the CPT software cannot dynamically build a route to the destination.

Examples

The following example shows how to create a static route through a MPLS–TP tunnel using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# ip route 192.0.2.1 255.255.255.255 tunnel-tp1 2
Router(config)# ip route 192.0.2.1 255.255.255.255 tunnel-tp2 3
Router(config)# exit
```

The following example shows how to create a static route through a physical interface using Cisco IOS commands:

```
Router> enable
Router# configure terminal
Router(config)# ip route 192.0.2.1 255.255.255.255 TenGigabitEthernet4/1 5
Router(config)# exit
```

ip rsvp bandwidth

To enable Resource Reservation Protocol (RSVP) for IP on an interface, use the **ip rsvp bandwidth** command in interface configuration mode. To disable RSVP, use the **no** form of this command.

ip rsvp bandwidth [*interface-kbps* [*single-flow-kbps*]]
no ip rsvp bandwidth [*interface-kbps* [*single-flow-kbps*]]

Syntax Description

interface-kbps	(Optional) Maximum amount of bandwidth, in kbps, that may be allocated by RSVP flows. The range is from 1 to 10,000,000.
single-flow-kbps	(Optional) Maximum amount of bandwidth, in kbps, that may be allocated to a single flow. The range is from 1 to 10,000,000.

Command Default

RSVP is disabled by default. If the **ip rsvp bandwidth** command is entered without bandwidth values, a default bandwidth value is assumed for both the *interface-kbps* and *single-flow-kbps* arguments.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If you configure non-zero bandwidth for the MPLS–TP tunnel or at a midpoint LSP, ensure that the interface to which the output link is attached has enough available bandwidth. For example, if three tunnel LSPs run over link 1 and each LSP was assigned 1000 with the **tp bandwidth** command, the interface associated with link 1 needs bandwidth of 3000 with the **ip rsvp bandwidth** command.

Examples

The following example shows how to enable RSVP for IP on an interface by specifying the bandwidth using Cisco IOS commands.

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# ip rsvp bandwidth 100
```

Related Commands

Command	Description
show ip rsvp sender	Displays RSVP PATH-related sender information currently in the database for a specified interface.
mpls traffic-eng tunnels	Enables MPLS traffic engineering tunnel signaling on an interface.

Command	Description
tunnel mpls traffic-eng bandwidth	Configures the bandwidth required for a MPLS-TE tunnel.
tp bandwidth	Configures the bandwidth for the MPLS–TP tunnel.

ip rsvp signalling hello graceful-restart neighbor

To enable Resource Reservation Protocol (RSVP) traffic engineering (TE) graceful restart capability on a neighboring router, use the **ip rsvp signalling hello graceful-restart neighbor** command in interface configuration mode. To disable RSVP-TE graceful restart capability, use the **no** form of this command.

ip rsvp signalling hello graceful-restart neighbor *ip-address*

no ip rsvp signalling hello graceful-restart neighbor *ip-address*

Syntax Description

ip-address	IP address of a neighbor on a given interface.

Command Default

No neighboring routers have RSVP-TE graceful restart capability enabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to enable support for graceful restart on routers helping their neighbors recover TE tunnels following stateful switchover (SSO).

Note You must issue this command on each interface of the neighboring router that you want to restart.

Examples

The following example shows how to configure RSVP-TE graceful restart on an interface of a neighboring router with the IP address 192.0.2.1.

```
Router# configure terminal
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# ip rsvp signalling hello graceful-restart neighbor 192.0.2.1
```

mpls ip (global configuration)

To configure MPLS hop-by-hop forwarding globally, use the **mpls ip** command in global configuration mode. To disable MPLS hop-by-hop forwarding, use the **no** form of this command.

mpls ip

no mpls ip

Syntax Description

This command has no arguments or keywords.

Command Default

The **mpls ip** command is enabled by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Globally enabling MPLS forwarding does not enable it on the interfaces. You must enable MPLS forwarding on the interfaces separately.

MPLS forwarding of packets along normally routed paths (also called dynamic label switching) is enabled by this command. For a given interface to perform dynamic label switching, this switching function must be enabled.

The **no** form of this command stops dynamic label switching for all the interfaces regardless of the interface configuration; it also stops distribution of labels for dynamic label switching. However, the **no** form of this command does not affect the sending of labeled packets through the LSP tunnels.

Examples

The following example shows how to globally configure MPLS hop-by-hop forwarding.

```
Router> enable
Router# configure terminal
Router(config)# mpls ip
```

Related Commands

Command	Description
mpls ip (interface configuration)	Enables MPLS forwarding of IPv4 packets along normally routed paths for the associated interface.

mpls ip (interface configuration)

To configure MPLS hop-by-hop forwarding on a specific interface, use the **mpls ip** command in interface configuration mode. To disable MPLS hop-by-hop forwarding on a specific interface, use the **no** form of this command.

mpls ip

no mpls ip

Syntax Description

This command has no arguments or keywords.

Command Default

The **mpls ip** command is enabled by default.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

MPLS forwarding of IPv4 packets along normally routed paths is also called dynamic label switching. If dynamic label switching has been enabled when this command is issued on an interface, label distribution for the interface begins with the periodic transmission of neighbor discovery Hello messages on the interface. When the outgoing label for a destination routed through the interface is known, packets for the destination are labeled with that outgoing label and forwarded through the interface.

The **no** form of this command causes packets routed out through the interface to be sent unlabeled; this form of the command also terminates label distribution for the interface. However, the **no** form of the command does not affect the sending of labeled packets through any LSP tunnels that might use the interface.

Examples

The following example shows how to configure MPLS hop-by-hop forwarding on the interface.

```
Router> enable
Router# configure terminal
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# mpls ip
```

Related Commands

Command	Description
show mpls interfaces	Displays information about one or more interfaces that have been configured for label switching.

mpls label protocol ldp (global configuration)

To specify the MPLS Label Distribution Protocol (LDP) on all the interfaces, use the **mpls label protocol ldp** command in global configuration mode. To remove the label distribution protocol on all the interfaces, use the **no** form of this command.

mpls label protocol ldp

no mpls label protocol ldp

Syntax Description

This command has no arguments or keywords.

Command Default

LDP is the default label distribution protocol.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following command shows how to establish LDP as the label distribution protocol on all the interfaces.

```
Router(config)# mpls label protocol ldp
```

Related Commands

Command	Description
mpls label protocol ldp (interface configuration)	Specifies LDP for an interface.
show mpls interfaces	Displays information about one or more or all interfaces that are configured for label switching.

mpls label protocol ldp (interface configuration)

To specify the MPLS Label Distribution Protocol (LDP) for an interface, use the **mpls label protocol ldp** command in interface configuration mode. To remove the label distribution protocol from the interface, use the **no** form of this command.

mpls label protocol ldp

no mpls label protocol ldp

Syntax Description

This command has no arguments or keywords.

Command Default

If no protocol is explicitly configured for an interface, the label distribution protocol that was globally configured is used. To set the global label distribution protocol, use the global **mpls label protocol** command.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

To successfully establish a session for label distribution for a link connecting two label switch routers (LSRs), the link interfaces on the LSRs must be configured to use the same label distribution protocol. If there are multiple links connecting two LSRs, all of the link interfaces connecting the two LSRs must be configured to use the same protocol.

Examples

The following example shows how to establish LDP as the label distribution protocol for an interface.

```
Router(config-if)# mpls label protocol ldp
```

Related Commands

Command	Description
mpls label protocol ldp (global configuration)	Specifies the LDP on all the interfaces.
show mpls interfaces	Displays information about one or more or all interfaces that are configured for label switching.

mpls ldp autoconfig

To enable MPLS Label Distribution Protocol (LDP) on interfaces for which an OSPF instance has been defined, use the **mpls ldp autoconfig** command in router configuration mode. To disable this configuration, use the **no** form of this command.

mpls ldp autoconfig [**area** *area-id*]

no mpls ldp autoconfig [**area** *area-id*]

Syntax Description

area *area-id*	(Optional) Enables LDP on the interfaces belonging to the specified OSPF area.

Command Default

LDP is not enabled on the interfaces.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

- You can specify this command multiple times to enable LDP on different routing areas with interfaces running OSPF.
- If LDP is disabled globally, the **mpls ldp autoconfig** command fails. LDP must be enabled globally by means of the global **mpls ip** command first.
- If the **mpls ldp autoconfig** command is configured, you cannot issue the global **no mpls ip** command. If you want to disable LDP, you must issue the **no mpls ldp autoconfig** command first.
- The **mpls ldp autoconfig** command is supported only with OSPF interior gateway protocols (IGPs).
- If an OSPF area is not specified, LDP is enabled on all the interfaces belonging to the OSPF process.

Examples

The following example shows how to autoconfigure MPLS LDP for OSPF area 5.

```
Router(config-router)# mpls ldp autoconfig area 5
```

Related Commands

Command	Description
mpls ip (global configuration)	Enables LDP globally.

Command	Description
show mpls interfaces	Displays information about the interfaces configured for LDP.
show mpls ldp discovery	Displays the status of the LDP discovery process.

mpls ldp backoff

To configure parameters for the MPLS label distribution protocol (LDP) backoff mechanism, use the **mpls ldp backoff** command in global configuration mode. To disable this configuration, use the **no** form of this command.

mpls ldp backoff *initial-backoff maximum-backoff*

no mpls ldp backoff *initial-backoff maximum-backoff*

Syntax Description

initial-backoff	Number ranging from 5 to 2147483, inclusive, that defines the initial backoff value in seconds. The default is 15 seconds.
maximum-backoff	Number ranging from 5 to 2147483, inclusive, that defines the maximum backoff value in seconds. The default value is 120 seconds.

Command Default

The LDP backoff mechanism parameters are not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The LDP backoff mechanism prevents two incompatibly configured label switch routers (LSRs) from engaging in an unthrottled sequence of session setup failures.

If a session setup attempt fails due to an incompatibility, each LSR delays its next attempt (that is, backs off), increasing the delay exponentially with each successive failure until the maximum backoff delay is reached. The default settings correspond to the lowest settings for initial and maximum backoff values defined by the LDP protocol specification. You should change the settings from the default values only if such settings result in undesirable behavior.

Examples

The following example shows how to set the initial backoff delay to 30 seconds and the maximum backoff delay to 240 seconds.

```
Router(config)# mpls ldp backoff 30 240
```

Related Commands

Command	Description
show mpls ldp backoff	Displays information about the configured session setup backoff parameters and any potential LDP peers with which session setup attempts are being throttled.

mpls ldp explicit-null

To enable the router to advertise an MPLS LDP Explicit Null label in situations where it would normally advertise an Implicit Null label, use the **mpls ldp explicit-null** command in global configuration mode. To disable this configuration, use the **no** form of this command.

mpls ldp explicit-null [**for** *prefix-acl* | **to** *peer-acl*]

no mpls ldp explicit-null

Syntax Description

for *prefix-acl*	(Optional) Specifies prefixes for which Explicit Null must be advertised in place of Implicit Null.
to *peer-acl*	(Optional) Specifies LDP peers to which Explicit Null must be advertised in place of Implicit Null.

Command Default

Explicit Null labels are not advertised.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Normally, LDP advertises an Implicit Null label for directly connected routes. The Implicit Null label causes the previous hop (penultimate) router to do penultimate hop popping. In certain cases, it is desirable to prevent the penultimate router from performing penultimate hop popping and to force it to replace the incoming label with the Explicit Null label.

When you issue the **mpls ldp explicit-null** command, Explicit Null is advertised in place of Implicit Null for directly connected prefixes permitted by the *prefix-acl* argument to peers permitted by the *peer-acl* argument.

If you do not specify the *prefix-acl* argument in the command, Explicit Null is advertised in place of Implicit Null for all directly connected prefixes.

If you do not specify the *peer-acl* argument in the command, Explicit Null is advertised in place of Implicit Null to all the peers.

Examples

The following command shows how to enable the Explicit Null label for all directly connected routes to all the LDP peers.

```
Router(config)# mpls ldp explicit-null
```

mpls ldp graceful-restart

To enable MPLS LDP graceful restart, use the **mpls ldp graceful-restart** command in global configuration mode. To disable LDP graceful restart, use the **no** form of this command.

mpls ldp graceful-restart

no mpls ldp graceful-restart

Syntax Description

This command has no arguments or keywords.

Command Default

MPLS LDP graceful restart is not enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

MPLS LDP graceful restart must be enabled before an LDP session is established. Use the **no** form of the command to disable the graceful restart on all the LDP sessions.

Examples

The following example shows how to enable LDP graceful restart.

```
Router(config)# mpls ldp graceful-restart
```

Related Commands

Command	Description
mpls ldp graceful-restart timers forwarding-holding	Specifies the amount of time the MPLS LDP forwarding state must be preserved after the control plane restarts.
mpls ldp graceful-restart timers max-recovery	Specifies the amount of time a router should hold stale label-FEC bindings after an MPLS LDP session has been reestablished.
mpls ldp graceful-restart timers neighbor-liveness	Specifies the amount of time a router should wait for an MPLS LDP session to be reestablished.

mpls ldp graceful-restart timers forwarding-holding

To specify the amount of time the MPLS forwarding state must be preserved after the control plane restarts, use the **mpls ldp graceful-restart timers forwarding-holding** command in global configuration mode. To revert to the default timer value, use the **no** form of this command.

mpls ldp graceful-restart timers forwarding-holding *secs*

no mpls ldp graceful-restart timers forwarding-holding

Syntax Description

secs	Amount of time (in seconds) that the MPLS forwarding state must be preserved after the control plane restarts. The default value is 600 seconds. The acceptable range of values is 30 to 600 seconds.

Command Default

The MPLS forwarding state is preserved for 600 seconds.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If the timer expires, all the entries that are marked stale are deleted.

Examples

The following example shows how to specify the MPLS forwarding state to be preserved for 300 seconds.

```
Router(config)# mpls ldp graceful-restart timers forwarding-holding 300
```

Related Commands

Command	Description
mpls ldp graceful-restart	Enables MPLS LDP graceful restart.
mpls ldp graceful-restart timers max-recovery	Specifies the amount of time a router must hold stale label-FEC bindings after an MPLS LDP session has been reestablished.
mpls ldp graceful-restart timers neighbor-liveness	Specifies the amount of time a router must wait for an MPLS LDP session to be reestablished.

mpls ldp graceful-restart timers max-recovery

To specify the amount of time a router should hold stale label-Forwarding Equivalence Class (FEC) bindings after an MPLS LDP session has been reestablished, use the **mpls ldp graceful-restart timers max-recovery** command in global configuration mode. To revert to the default timer value, use the **no** form of this command.

mpls ldp graceful-restart timers max-recovery *secs*

no mpls ldp graceful-restart timers max-recovery *secs*

Syntax Description

secs	Amount of time (in seconds) that the router should hold stale label-FEC bindings after an LDP session has been reestablished. The default value is 120 seconds. The acceptable range of values is 15 to 600 seconds.

Command Default

Stale label-FEC bindings are held for 120 seconds after an LDP session has been reestablished.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

After the timer expires, all stale label-FEC bindings learned from the associated LDP session are removed, which results in the removal of any forwarding table entries that are based on those bindings.

Examples

The following example shows how to specify that the router must hold stale label-FEC bindings after an LDP session has been reestablished for 180 seconds.

```
Router(config)# mpls ldp graceful-restart timers max-recovery 180
```

Related Commands

Command	Description
mpls ldp graceful-restart	Enables MPLS LDP graceful restart.
mpls ldp graceful-restart timers forwarding-holding	Specifies the amount of time the MPLS LDP forwarding state should be preserved.
mpls ldp graceful-restart timers neighbor-liveness	Specifies the amount of time a router should wait for an MPLS LDP session to be reestablished.

mpls ldp graceful-restart timers neighbor-liveness

To specify the upper bound on the amount of time a router must wait for an MPLS LDP session to be reestablished, use the **mpls ldp graceful-restart timers neighbor-liveness** command in global configuration mode. To revert to the default timer value, use the **no** form of this command.

mpls ldp graceful-restart timers neighbor-liveness *secs*

no mpls ldp graceful-restart timers neighbor-liveness

Syntax Description

secs	Amount of time (in seconds) that the router must wait for an LDP session to be reestablished. The default value is 120 seconds. The range is from 5 to 300 seconds.

Command Default

The default value is 120 seconds.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The amount of time a router waits for an LDP session to be reestablished is the lesser of the following values:

- The value of the fault tolerant (FT) type length value (TLV) reconnect timeout of the peer.
- The value of the neighbor liveness timer.

If the router cannot reestablish an MPLS LDP session with the neighbor in the allotted time, the router deletes the stale label-FEC bindings received from that neighbor.

Examples

The following example shows how to set the amount of time that the router must wait for an MPLS LDP session to be reestablished to 30 seconds.

```
Router(config)# mpls ldp graceful-restart timers neighbor-liveness 30
```

Related Commands

Command	Description
mpls ldp graceful-restart	Enables MPLS LDP graceful restart.

Command	Description
mpls ldp graceful-restart timers forwarding-holding	Specifies the amount of time the MPLS LDP forwarding state must be preserved after the control plane restarts.
mpls ldp graceful-restart timers max-recovery	Specifies the amount of time a router must hold stale label-FEC bindings after an MPLS LDP session has been reestablished.

mpls ldp igp sync

To enable MPLS LDP-Interior Gateway Protocol (IGP) synchronization on an interface that belongs to an OSPF process, use the **mpls ldp igp sync** command in interface configuration mode. To disable MPLS LDP-IGP synchronization, use the **no** form of the command.

mpls ldp igp sync [**delay** *seconds*]

no mpls ldp igp sync [**delay**]

Syntax Description

delay *seconds*	(Optional) Sets a delay timer for MPLS LDP-IGP synchronization. The range is from 5 to 60 seconds.

Command Default

MPLS LDP-IGP synchronization is enabled by default on all the interfaces configured for the process. A delay timer is not set.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command works with the **mpls ldp sync** command, which enables MPLS LDP-IGP synchronization on all the interfaces that belong to an OSPF process. To disable MPLS LDP-IGP synchronization on a selected interface, use the **no mpls ldp igp sync** command in the configuration for that interface.

Use the **mpls ldp igp sync delay** *seconds* command to configure a delay time for MPLS LDP and IGP synchronization on an interface-by-interface basis. To remove the delay timer from a specified interface, use the **no mpls ldp igp sync delay** command. This command sets the delay time to 0 seconds, but leaves MPLS LDP-IGP synchronization enabled.

When LDP is fully established and synchronized, LDP checks the delay timer:

- If you configured a delay time, LDP starts the timer. When the timer expires, LDP checks that synchronization is still valid and notifies the OSPF process.
- If the delay time is not configured, synchronization is disabled or down, or an interface is removed from an IGP process, LDP stops the timer and immediately notifies the OSPF process.

Examples

The following example shows how to set a delay timer of 45 seconds for MPLS LDP-IGP synchronization on an interface.

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# mpls ldp igp sync delay 45
```

Related Commands

Command	Description
mpls ldp sync	Enables MPLS LDP-IGP synchronization on interfaces for an OSPF process.
show mpls ldp igp sync	Displays the status of the MPLS LDP-IGP synchronization process.

mpls ldp igp sync holddown

To specify how long an Interior Gateway Protocol (IGP) must wait for an MPLS LDP synchronization to be achieved, use the **mpls ldp igp sync holddown** command in global configuration mode. To disable the hold-down timer, use the **no** form of this command.

mpls ldp igp sync holddown *milliseconds*

no mpls ldp igp sync holddown

Syntax Description

milliseconds	Number of milliseconds an IGP must wait for an LDP session to be established. The valid range of values is from 1 to 2147483647 milliseconds.

Command Default

An IGP will wait indefinitely for LDP synchronization to be achieved.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command enables you to limit the amount of time an IGP waits for LDP synchronization to be achieved.

Examples

The following example shows how to configure the IGP to wait 10,000 milliseconds (10 seconds) for LDP synchronization.

```
Router(config)# mpls ldp igp sync holddown 10000
```

Related Commands

Command	Description
mpls ldp sync	Enables MPLS LDP-IGP synchronization on interfaces for an OSPF process.
show mpls ldp igp sync	Displays the status of the MPLS LDP-IGP synchronization process.

mpls ldp neighbor targeted

To set up a targeted session with a specified MPLS LDP neighbor, use the **mpls ldp neighbor targeted** command in global configuration mode. To disable a targeted session, use the **no** form of this command.

mpls ldp neighbor *ip-addr* **targeted ldp**

no mpls ldp neighbor *ip-addr* **targeted ldp**

Syntax Description

ip-addr	Router ID (IP address) that identifies a neighbor.
targeted ldp	Specifies Label Distribution Protocol (LDP) as the label protocol for the targeted session.

Command Default

A targeted session with a specified neighbor is not set up.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use the **mpls ldp neighbor targeted** command when you need to set up a targeted session and other means of establishing targeted sessions do not apply, such as configuring **mpls ip** on a traffic engineering (TE) tunnel. For example, you would use this command to set up a targeted session between directly connected MPLS label switch routers (LSRs) when MPLS label forwarding convergence time is an issue.

The **mpls ldp neighbor targeted** command can improve label convergence time for directly connected neighbor LSRs when the links directly connecting them are down. When the links between the neighbor LSRs are up, both the link and targeted Hellos maintain the LDP session. If the links between the neighbor LSRs go down, the targeted Hellos maintain the session, allowing the LSRs to retain labels learned from each other. When a link directly connecting the LSRs comes back up, the LSRs can immediately reinstall labels for forwarding use without having to reestablish their LDP session and exchange labels.

For the **no** form of the command, if the **targeted** keyword is not specified, all the configuration information for the specified neighbor reverts to the defaults and the neighbor record is deleted.

Examples

The following example shows how to set a targeted session with the neighbor 192.0.2.1.

```
Router(config)# mpls ldp neighbor 192.0.2.1 targeted ldp
```

Related Commands

Command	Description
show mpls ldp neighbor	Displays the status of Label Distribution Protocol (LDP) sessions.

mpls ldp router-id

To specify a preferred interface for the Label Distribution Protocol (LDP) router ID, use the **mpls ldp router-id** command in global configuration mode. To disable the interface from being used as the LDP router ID, use the **no** form of this command.

mpls ldp router-id *interface* **[force]**

no mpls ldp router-id *interface* **[force]**

Syntax Description

interface	Interface specified to be used as the MPLS LDP router ID, provided that the interface is operational.
force	(Optional) Alters the behavior of the **mpls ldp router-id** command, as described in the "Usage Guidelines" section.

Command Default

If the **mpls ldp router-id** command is not used, the router examines the IP addresses of all the operational interfaces. If these IP addresses include loopback interface addresses, the router selects the largest loopback address as the LDP router ID. Otherwise, the router selects the largest IP address pertaining to an operational interface as the LDP router ID.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The loopback IP address does not become the router ID of the local LDP ID under the following circumstances:

- If the loopback interface has been explicitly shut down.
- If the **mpls ldp router-id** command specifies that a different interface should be used as the LDP router ID.

If you use a loopback interface, ensure that the IP address for the loopback interface is configured with a /32 network mask. In addition, ensure that the routing protocol in use is configured to advertise the corresponding /32 network.

Examples

The following example shows how to assign interface TenGigabitEthernet4/1 as the LDP router ID:

```
Router> enable
Router# configure terminal
Router(config)# mpls ip
```

```
Router(config)# mpls label protocol ldp
Router(config)# mpls ldp router-id TenGigabitEthernet4/1
```

Related Commands

Command	Description
show mpls ldp discovery	Displays the status of the LDP discovery process.

mpls ldp session protection

To enable MPLS LDP autoconfiguration for existing or new LDP sessions, use the **mpls ldp session protection** command in global configuration mode. To disable this configuration, use the **no** form of this command.

mpls ldp session protection [**for** *acl*] [**duration** {**infinite** | *seconds*}]

no mpls ldp session protection [**for** *acl*] [**duration** {**infinite** | *seconds*}]

Syntax Description

for *acl*	(Optional) Specifies a standard IP access control list that contains the prefixes that are to be protected.
duration	(Optional) Specifies the time that the LDP targeted hello adjacency must be retained after a link is lost. **Note** If you use this keyword, you must select either the **infinite** keyword or the *seconds* argument.
infinite	Specifies that the LDP targeted hello adjacency must be retained infinitely after a link is lost.
seconds	Time in seconds that the LDP targeted hello adjacency must be retained after a link is lost. The valid range of values is from 30 to 2,147,483 seconds.

Command Default

MPLS LDP session protection is not established.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If you issue the **mpls ldp session protection** command without the **duration** keyword, then session protection is enabled for 86400 seconds (24 hours) meaning that the LDP targeted hello adjacency is retained for 24 hours after a link is lost. This is the default timeout.

If you issue the **mpls ldp session protection duration infinite** command, then session protection is enabled infinitely, which implies that the LDP targeted hello adjacency is retained infinitely after a link is lost.

If you issue the **mpls ldp session protection duration** *seconds* command, then session protection is enabled for the number of seconds indicated, which implies that the LDP targeted hello adjacency is retained for that amount of time. For example, if you issued **mpls ldp session protection duration 100**, then the LDP targeted hello adjacency is retained for 100 seconds after a link is lost.

Examples

The following example shows how to enable MPLS LDP autoconfiguration for LDP sessions for peers whose router IDs are listed in access control list *rtr4*.

```
Router(config)# mpls ldp session protection for rtr4
```

Related Commands

Command	Description
show mpls ldp neighbor	Displays the contents of the LDP.

mpls ldp sync

To enable MPLS LDP-Interior Gateway Protocol (IGP) synchronization on interfaces for an OSPF process, use the **mpls ldp sync** command in router configuration mode. To disable this synchronization, use the **no** form of this command.

mpls ldp sync

no mpls ldp sync

Syntax Description

This command has no arguments or keywords.

Command Default

MPLS LDP-IGP synchronization is not enabled on interfaces belonging to the OSPF process.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If the **mpls ldp sync** command is configured, you cannot enter the global **no mpls ip** command. If you want to disable LDP synchronization, you must enter the **no mpls ldp igp sync** command first.

The **mpls ldp sync** command is supported with OSPF process.

Examples

The following example shows how to enable MPLS LDP-IGP synchronization for an OSPF process.

```
Router(config-router)# mpls ldp sync
```

Related Commands

Command	Description
mpls ldp igp sync	Enables MPLS LDP-IGP synchronization on an interface that belongs to an OSPF process.
no mpls ip	Disables MPLS hop-by-hop forwarding.
show mpls ldp igp sync	Displays the status of the MPLS LDP-IGP synchronization process.

mpls traffic-eng area

To configure a router running OSPF MPLS so that it floods traffic engineering for the indicated OSPF area, use the **mpls traffic-eng area** command in router configuration mode. To disable flooding of traffic engineering for the indicated OSPF area, use the **no** form of this command.

mpls traffic-eng area *number*

no mpls traffic-eng area *number*

Syntax Description

number	The OSPF area on which MPLS traffic engineering is enabled.

Command Default

Flooding is disabled.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command is in the routing protocol configuration tree and is supported for OSPF. The command affects the operation of MPLS traffic engineering only if MPLS traffic engineering is enabled for that routing protocol instance.

Examples

The following example shows how to configure a router running OSPF MPLS to flood traffic engineering for OSPF 0.

```
Router(config-router)# mpls traffic-eng area 0
```

Related Commands

Command	Description
mpls traffic-eng router-id	Specifies that the TE router identifier for the node is the IP address associated with a given interface.
router ospf	Configures an OSPF routing process on a router.
network area	Defines the interfaces on which OSPF runs and defines the area ID for those interfaces.

mpls traffic-eng link-management timers periodic-flooding

To set the length of the interval for periodic flooding, use the **mpls traffic-eng link-management timers periodic-flooding** command in global configuration mode. To disable the specified interval length for periodic flooding, use the **no** form of this command.

mpls traffic-eng link-management timers periodic-flooding *interval*

no mpls traffic-eng link-management timers periodic-flooding

Syntax Description

interval	Length of the interval (in seconds) for periodic flooding. Valid values are from 0 to 3600. A value of 0 turns off periodic flooding. If you set this value from 1 to 29, it is treated as 30.

Command Default

180 seconds (3 minutes)

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to advertise link state information changes that do not trigger immediate action. For example, a change to the amount of allocated bandwidth that does not cross a threshold.

Examples

The following example shows how to set the interval length for periodic flooding to 120 seconds:

```
Router(config)# mpls traffic-eng link-management timers periodic-flooding 120
```

Related Commands

Command	Description
mpls traffic-eng area *number*	Enables MPLS TE for the indicated OSPF area.

mpls traffic-eng lsp attributes

To create or modify a label switched path (LSP) attribute list, use the **mpls traffic-eng lsp attributes** command in global configuration mode. To remove a specified LSP attribute list from the device configuration, use the **no** form of this command.

mpls traffic-eng lsp attributes *string*

no mpls traffic-eng lsp attributes *string*

Syntax Description

string	Identifies a specific LSP attribute list.

Command Default

An LSP attribute list is not created unless you create one.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command sets up an LSP attribute list and enters LSP Attributes configuration mode, in which you can enter LSP attributes.

To associate the LSP attributes and LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where *string* is the identifier for the specific LSP attribute list.

An LSP attribute referenced by the path option takes precedence over the values configured on the tunnel interface. If an attribute is not specified in the LSP attribute list, the devices takes the attribute from the tunnel configuration. LSP attribute lists do not have default values. If the attribute is not configured on the tunnel, then the device uses tunnel default values.

Once you type the **mpls traffic-eng lsp attributes** command, you enter the LSP Attributes configuration mode where you define the attributes for the LSP attribute list that you are creating.

The mode commands are as follows:

- **affinity**—Specifies attribute flags for links that make up an LSP.
- **auto-bw**—Specifies automatic bandwidth configuration.
- **bandwidth**—Specifies LSP bandwidth.
- **lockdown**—Disables reoptimization for the LSP.
- **priority**—Specifies LSP priority.
- **protection**—Enables failure protection.

- **record-route**—Records the route used by the LSP.

The following monitoring and management commands are also available in the LSP Attributes configuration mode:

- **exit**—Exits from LSP Attributes configuration mode.
- **list**—Relists all the entries in the LSP attribute list.
- **no**—Removes a specific attribute from the LSP attribute list.

Examples

The following example shows how to set up an LSP attribute list identified with the numeral 6 with the **bandwidth** and **priority** mode commands. The example also shows how to use the **list** mode command:

```
Router(config)# mpls traffic-eng lsp attributes 6
Router(config-lsp-attr)# bandwidth 500
Router(config-lsp-attr)# list
LIST 6
bandwidth 500
Router(config-lsp-attr)# priority 1 1
Router(config-lsp-attr)# list
LIST 6
bandwidth 500
priority 1 1
Router(config-lsp-attr)# exit
```

Related Commands

Command	Description
show mpls traffic-eng lsp attributes	Displays global LSP attributes lists.

mpls traffic-eng router-id

To specify that the traffic engineering router identifier for the node is the IP address associated with a given interface, use the **mpls traffic-eng router-id** command in router configuration mode. To remove the traffic engineering router identifier, use the **no** form of this command.

mpls traffic-eng router-id *interface-name*

no mpls traffic-eng router-id

Syntax Description

interface-name	Interface whose primary IP address is the router's identifier.

Command Default

No traffic engineering router identifier is specified.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This router identifier acts as a stable IP address for the traffic engineering configuration. This IP address is flooded to all the nodes. For all traffic engineering tunnels originating at other nodes and ending at this node, you must set the tunnel destination to the traffic engineering router identifier of the destination node, because that is the address that the traffic engineering topology database at the tunnel head uses for its path calculation.

You should configure the same traffic engineering router id for all the IGP routing processes.

Examples

The following example shows how to specify the traffic engineering router identifier as the IP address associated with interface Loopback0:

```
Router(config-router)# mpls traffic-eng router-id Loopback0
```

Related Commands

Command	Description
mpls traffic-eng area *number*	Enables MPLS TE for the indicated OSPF area.

mpls traffic-eng tunnels (global configuration)

To enable MPLS traffic engineering tunnel signaling on a device, use the **mpls traffic-eng tunnels** command in global configuration mode. To disable MPLS traffic engineering tunnel signaling, use the **no** form of this command.

mpls traffic-eng tunnels

no mpls traffic-eng tunnels

Syntax Description

This command has no arguments or keywords.

Command Default

The command is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command enables MPLS traffic engineering on a device. For you to use the feature, MPLS traffic engineering must also be enabled on the desired interfaces.

Examples

The following example shows how to enable MPLS traffic engineering tunnel signaling.

```
Router(config)# mpls traffic-eng tunnels
```

Related Commands

Command	Description
show mpls traffic-eng tunnels	Displays information about tunnels.

mpls traffic-eng tunnels (interface configuration)

To enable MPLS traffic engineering tunnel signaling on an interface (assuming that it is enabled on the device), use the **mpls traffic-eng tunnels** command in interface configuration mode. To disable MPLS traffic engineering tunnel signaling on the interface, use the **no** form of this command.

mpls traffic-eng tunnels

no mpls traffic-eng tunnels

Syntax Description

This command has no arguments or keywords.

Command Default

The MPLS TE is disabled on all the interfaces.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Before you enable MPLS TE on the interface, you must enable MPLS TE on the device. An enabled interface has its resource information flooded into the appropriate IGP link-state database and accepts traffic engineering tunnel signaling requests.

You can use this command to enable MPLS traffic engineering on an interface, thereby eliminating the need to use the **ip rsvp bandwidth** command. However, if your configuration includes Call Admission Control (CAC) for IPv4 Resource Reservation Protocol (RSVP) flows, you must use the **ip rsvp bandwidth** command.

Examples

The following example shows how to enable MPLS traffic engineering tunnel signaling on an interface.

```
Router(config)# interface TenGigabitEthernet4/1
Router(config-if)# mpls traffic-eng tunnels
```

Related Commands

Command	Description
ip rsvp bandwidth	Enables RSVP for IP on an interface.
mpls traffic-eng tunnels (global configuration)	Enables MPLS traffic engineering tunnel signaling on a device.

mpls traffic-eng path-option list

To configure a path option list, use the **mpls traffic-eng path-option list** command in global configuration mode. To disable this function, use the **no** form of this command.

mpls traffic-eng path-option list [**name** *pathlist-name* | **identifier** *pathlist-number*

no mpls traffic-eng path-option list [**name** *pathlist-name* | **identifier** *pathlist-number*

Syntax Description

name *pathlist-name*	Specifies the name of the path option list.
identifier *pathlist-number*	Specifies the identification number of the path option list. Valid values are from 1 through 65535.

Command Default

There are no path option lists.

Command Modes

Global configuration (config)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

A path option list contains a list of backup paths for a primary path option. You can specify a path option list by entering its name or identifier.

After you enter the **mpls traffic-eng path-option list** command, the router enters path option list configuration mode and you can enter the following commands:

- **path-option**—Specifies the name or identification number of the next path option to add, edit, or delete.
- **list**—Lists all path options.
- **no**—Deletes a specified path option.
- **exit**—Exits from path option list configuration mode.

Then you can specify explicit backup paths by entering their name or identifier.

Examples

The following example configures the path option list named pathlist-01, adds path option 10, lists the backup path that is in the path option list, and exits from path option list configuration mode.

```
Router(config)# mpls traffic-eng path-option list name pathlist-01
Router(cfg-pathoption-list)# path-option 10 explicit name bk-path-01
Router(cfg-pathoption-list)# list
```

```
path-option 10 explicit name bk-path-01
Router(cfg-pathoption-list)# exit
```

Related Commands

Command	Description
tunnel mpls traffic-eng path option	Configures a path option for an MPLS TE tunnel.
tunnel mpls traffic-eng path-option protect	Configures a secondary path option or a path option list for an MPLS TE tunnel.

next-address

To specify the next IP address in the explicit path, use the **next-address** command in IP explicit path configuration mode.

next-address [**loose** | **strict**] *ip-address*

Syntax Description

loose	(Optional) Specifies that the previous address (if any) in the explicit path need not be directly connected to the next IP address, and that the router is free to determine the path from the previous address (if any) to the next IP address.
strict	(Optional) Specifies that the previous address (if any) in the explicit path must be directly connected to the next IP address.
ip-address	Next IP address in the explicit path.

Command Default

The next IP address in the explicit path is not specified.

Command Modes

IP explicit path configuration (cfg-ip-expl-path)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

To specify an explicit path that includes only the addresses specified, specify each address in sequence by using the **next-address** command without the **loose** keyword.

To use explicit paths for TE tunnels within an IGP area, you can specify a combination of both loose and strict hops. When specifying an explicit path for an MPLS TE tunnel, you can specify link or node addresses of the next-hop routers in an explicit path.

When specifying an explicit path, if you specify the “forward” address (the address of the interface that forwards the traffic to the next router) as the next-hop address, the explicit path might not be used. Using the forward address allows that entry to be treated as a loose hop for path calculation. Cisco recommends that you use the “receive”address (the address of the interface that receives traffic from the sending router) as the next-hop address.

Examples

The following example shows how to assign the number 60 to the IP explicit path, enable the path, and specify 10.3.27.3 as the next IP address in the list of IP addresses.

```
Router(config)# ip explicit-path identifier 60 enable
Router(cfg-ip-expl-path)# next-address 10.3.27.3
```

```
Explicit Path identifier 60:
    1: next-address 10.3.27.3
```

Related Commands

Command	Description
index	Inserts or modifies a path entry at a specified index.
ip explicit-path	Enters the subcommand mode for IP explicit paths and creates or modifies the specified path.
show ip explicit-paths	Displays the configured IP explicit paths.

ping mpls

To check MPLS label switched path (LSP) connectivity, use the **ping mpls** command in privileged EXEC mode.

ping mpls {*ipv4 destination-address*/*destination-mask-length* [**destination** *address-start address-end increment*] [**ttl** *time-to-live*] | **pseudowire** *ipv4-address vc-id* [**segment** [*segment-number*]] [**destination** *address-start address-end increment*] | **traffic-eng** *tunnel-interface tunnel-number* [**ttl** *time-to-live*]}

[**revision** {**1** | **2** | **3** | **4**}]

[**source** *source-address*]

[**repeat** *count*]

[**timeout** *seconds*]

[**size** *packet-size* | **sweep** *minimum maximum size-increment*]

[**pad** *pattern*]

[**reply dscp** *dscp-value*]

[**reply pad-tlv**]

[**reply mode** {**ipv4** | **router-alert**}]

[**interval** *ms*]

[**exp** *exp-bits*]

[**verbose**]

[**revision** *tlv-revision-number*]

[**force-explicit-null**]

[**output interface** *tx-interface* [**nexthop** *ip-address*]]

[**dsmap** [**hashkey** {**none** | **ipv4 bitmap** *bitmap-size*}]]

[**flags fec**]

Syntax Description

ipv4	Specifies the destination type as a LDP IPv4 address.
destination-address	Address prefix of the target to be tested.
/destination-mask-length	Number of bits in the network mask of the target address. The slash is required.
destination	(Optional) Specifies a network 127 address.
address-start	(Optional) Beginning network 127 address.
address-end	(Optional) Ending network 127 address.
increment	(Optional) Number by which to increment the network 127 address.
ttl *time-to-live*	(Optional) Specifies a time-to-live (TTL) value. The default is 225 seconds.

pseudowire	Specifies the destination type as an Any Transport over MPLS (AToM) virtual circuit (VC).
ipv4-address	IPv4 address of the AToM VC to be tested.
vc-id	Specifies the VC identifier of the AToM VC to be tested.
segment *segment-number*	(Optional) Specifies a segment of a multisegment pseudowire.
traffic-eng	Specifies the destination type as an MPLS-TE tunnel.
tunnel-interface	Tunnel interface to be tested.
tunnel-number	Tunnel interface number.
revision {**1** | **2** | **3** | **4**	(Optional) Selects the type, length, values (TLVs) version.
source *source-address*	(Optional) Specifies the source address or name. The default address is loopback0. This address is used as the destination address in the MPLS echo response.
repeat *count*	(Optional) Specifies the number of times to resend the same packet. The range is from 1 to 2147483647. The default is 1.
timeout *seconds*	(Optional) Specifies the timeout interval in seconds for an MPLS request packet. The range is from 0 to 3600. The default is 2 seconds.
size *packet-size*	(Optional) Specifies the size of the packet with the label stack imposed. Packet size is the number of bytes in each ping. The range is from 40 to 18024. The default is 100.
sweep	(Optional) Enables you to send a number of packets of different sizes, ranging from a start size to an end size.
minimum	(Optional) Minimum or start size for an MPLS echo packet. The lower boundary of the **sweep** range varies depending on the LSP type. The default is 100 bytes.
maximum	(Optional) Maximum or end size for an echo packet. The default is 17,986 bytes.
size-increment	(Optional) Number by which to increment the echo packet size. The default is 100 bytes.
pad *pattern*	(Optional) The pad TLV used to fill the datagram so that the MPLS echo request is the specified size. The default is 0xABCD.
reply dscp *dscp-value*	(Optional) Provides the capability to request a specific class of service (CoS) in an echo reply by providing a differentiated services code point (DSCP) value.
reply pad-tlv	(Optional) Tests the ability of the sender of an echo reply to support the copy pad TLV to echo reply.
reply mode {ipv4 | router-alert}	(Optional) Specifies the reply mode for the echo request packet. **ipv4**—Reply with an IPv4 UDP packet (default). **router-alert**—Reply with an IPv4 UDP packet with router alert.

interval *ms*	(Optional) Specifies the time, in milliseconds (ms), between successive MPLS echo requests. This parameter allows you to pace the transmission of packets so that the receiving router does not drop packets. Default is 0.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for an MPLS echo reply. Valid values are from 0 to 7. Default is 0.
verbose	(Optional) Displays the MPLS echo reply sender address of the packet and displays return codes.
revision *tlv-revision-number*	(Optional) Cisco TLV revision number.
force-explicit-null	(Optional) Forces an explicit null label to be added to the MPLS label stack even though the label was unsolicited.
output interface *tx-interface*	(Optional) Specifies the output interface for echo requests.
nexthop *ip-address*	(Optional) Causes packets to go through the specified next-hop address.
dsmap	(Optional) Interrogates a transit router for downstream mapping information.
hashkey {**none** | **ipv4 bitmap** *bitmap-size*	(Optional) Allows you to control the hash key and multipath settings. Valid values are: **none**—There is no multipath (type 0). **ipv4 bitmap** *bitmap-size*—Size of the IPv4 addresses (type 8) bitmap. If you enter the **none** keyword, multipath LSP traceroute acts like an enhanced LSP traceroute; that is, it uses multipath LSP traceroute retry logic and consistency checking.
flags fec	(Optional) Allows Forward Equivalence Class (FEC) checking on the transit router. A downstream map TLV containing the correct received labels must be present in the echo request for target FEC stack checking to be performed. Target FEC stack validation is always done at the egress router. Ensure to use this keyword in conjunction with the **ttl** keyword.

Command Default

You cannot check MPLS LSP connectivity.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command is introduced.

Usage Guidelines

Use the **ping mpls** command to validate, test, or troubleshoot IPv4 LDP LSPs, IPv4 RSVP TE tunnels, and AToM VCs.

The following keywords are not available with the **ping mpls pseudowire** command:

- **dsmap**
- **flags**
- **force-explicit-null**
- **output**
- **revision**
- **ttl**

Examples

The following example shows how to use the **ping mpls** command to test connectivity of an IPv4 LDP LSP.

```
Router# ping mpls ipv4 10.131.191.252/32 repeat 5 exp 5 verbose

Sending 5, 100-byte MPLS Echos to 10.131.191.252, timeout is 2 seconds:
Codes:
'!' - success, 'Q' - request not sent, '.' - timeout,
'L' - labeled output interface, 'B' - unlabeled output interface,
'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
'P' - no rx intf label prot, 'p' - premature termination of LSP,
'R' - transit router, 'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
! 10.131.191.230, return code 3
! 10.131.191.230, return code 3
! 10.131.191.230, return code 3
! 10.131.191.230, return code 3
! 10.131.191.230, return code 3
Success rate is 100 percent (5/5), round-trip min/avg/max = 100/102/112
ms
```

Related Commands

Command	Description
trace mpls	Discovers MPLS LSP routes that packets will actually take when traveling to their destinations.

priority

To specify the LSP priority in an LSP attribute list, use the **priority** command in LSP Attributes configuration mode. To remove the specified priority, use the **no** form of this command.

priority *setup-priority* [*hold-priority*]

no priority

Syntax Description

setup-priority	Priority used when signaling an LSP to determine which existing LSPs can be preempted. Valid values are from 0 to 7, where a lower number indicates a higher priority. Therefore, an LSP with a setup priority of 0 can preempt any LSP with a non-0 priority.
hold-priority	(Optional) Priority associated with an LSP to determine if it should be preempted by other LSPs that are being signaled. Valid values are from 0 to 7, where a lower number indicates a higher priority.

Command Default

No priority is set in the attribute list.

Command Modes

LSP Attributes configuration (config-lsp-attr)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to configure setup and hold priority for an LSP in an LSP attribute list. Setup priority and hold priority are typically configured to be equal, and setup priority cannot be better (numerically smaller) than the hold priority.

To associate the LSP priority attribute and the LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where *string* is the identifier for the specific LSP attribute list.

Examples

The following example shows how to set the LSP hold and setup property.

```
Router(config-lsp-attr)# priority 2 2
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.

Command	Description
show mpls traffic-eng lsp attributes	Displays global LSP attribute lists.

record-route

To record the route used by the LSP, use the **record-route** command in LSP Attributes configuration mode. To stop the recording the route used by the LSP, use the **no** form of this command.

record-route

no record-route

Syntax Description

This command has no arguments or keywords.

Command Default

The LSP route is not recorded.

Command Modes

LSP Attributes configuration (config-lsp-attr)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to set up the recording of the route taken by the LSP in an LSP attribute list.

To associate the LSP record-route attribute and the LSP attribute list with a path option for an LSP, you must configure the **tunnel mpls traffic-eng path option** command with the **attributes** *string* keyword and argument, where **string** is the identifier for the specific LSP attribute list.

Examples

The following example shows how to set up LSP route recording in an LSP attribute list.

```
Router(config-lsp-attr)# record-route
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show mpls traffic-eng lsp attributes	Displays global LSP attribute lists.

show ip explicit-paths

To display the configured IP explicit paths, use the **show ip explicit-paths** command in user EXEC or privileged EXEC mode.

show ip explicit-paths [**name** *pathname* | **identifier** *number*] [**detail]**

Syntax Description

name *pathname*	(Optional) Displays the pathname of the explicit path.
identifier *number*	(Optional) Displays the number of the explicit path. Valid values are from 1 to 65535.
detail	(Optional) Displays, in the long form, information about the configured IP explicit paths.

Command Default

If you enter the command without entering an optional keyword, all configured IP explicit paths are displayed.

Command Modes

User EXEC (>) and Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

An IP explicit path is a list of IP addresses, each representing a node or link in the explicit path.

Examples

The following is sample output from the **show ip explicit-paths** command.

```
Router# show ip explicit-paths

PATH 200 (strict source route, path complete, generation 6)
     1: next-address 10.3.28.3
     2: next-address 10.3.27.3
```

Related Commands

Command	Description
index	Inserts or modifies a path entry at a specific index.
ip explicit-path	Enters the subcommand mode for IP explicit paths so that you can create or modify the named path.

Command	Description
next-address	Specifies the next IP address in the explicit path.

show ip rsvp sender

To display Resource Reservation Protocol (RSVP) PATH-related sender information currently in the database, use the **show ip rsvp sender** command in user EXEC or privileged EXEC mode.

show ip rsvp sender [**detail**] [**filter** [**session-type all**]]

Syntax Description

detail	(Optional) Specifies additional sender information.
filter	(Optional) Specifies a subset of the senders to display.
session-type	(Optional) Specifies the type of RSVP sessions to display.
all	(Optional) Specifies all the types of RSVP sessions.

Command Modes

User EXEC (>) and Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use the **show ip rsvp sender** command to display the RSVP sender (PATH) information currently in the database for a specified interface or for all the interfaces.

Examples

The following is sample output from the **show ip rsvp sender** command.

```
Router# show ip rsvp sender
```

```
  To           From    Pro DPort Sport Prev Hop    I/F           BPS
172.16.1.49 172.16.4.53 1   0     0  172.16.3.53 TenGEthernet4/1 80K
172.16.2.51 172.16.5.54 1   0     0  172.16.3.54 TenGEthernet4/2 80K
```

show mpls ldp backoff

To display information about the configured session setup backoff parameters and any potential LDP peers with which session setup attempts are being throttled, use the **show mpls ldp backoff** command in user EXEC or privileged EXEC mode.

show mpls ldp backoff [all]

Syntax Description

all	(Optional) Displays LDP discovery information for all VPNs.

Command Modes

User EXEC and Privileged EXEC

Command History

Release	Modification
9.3.0	This command was introduced.

Examples

The following is sample output from the **show mpls ldp backoff** command.

```
Router# show mpls ldp backoff

LDP initial/maximum backoff: 30/240 sec
Backoff table: 2 entries
LDP Id         Backoff(sec)     Waiting(sec)
10.144.0.44:0    60               30
10.155.0.55:0    120              90
```

Related Commands

Command	Description
mpls ldp backoff	Configures session setup delay parameters for the LDP backoff mechanism.

show mpls traffic-eng lsp attributes

To display global LSP attribute lists, use the **show mpls traffic-eng lsp attributes** command in user EXEC or privileged EXEC mode.

show mpls traffic-eng lsp attributes [**name** *string*] [**internal**]

Syntax Description

name	(Optional) Identifies a specific LSP attribute list.
string	Describes the string argument.
internal	(Optional) Displays LSP attribute list internal information.

Command Default

If no keywords or arguments are specified, all LSP attribute lists are displayed.

Command Modes

User EXEC (>) and Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use this command to display information about all LSP attribute lists or a specific LSP attribute list.

Examples

The following example shows output from the **show mpls traffic-eng lsp attributes** command.

```
Router# show mpls traffic-eng lsp attributes
```

```
LIST list1
    affinity 0xFF mask 0xFFFFFFFF
    auto-bw collect-bw
    bandwidth 12
    lockdown
    priority 2 2
    record-route LIST 2
    bandwidth 5000
LIST hipriority
    priority 0 0
!
```

Related Commands

Command	Description
mpls traffic-eng lsp attributes	Creates or modifies a LSP attribute list.

show mpls traffic-eng tunnels

To display information about tunnels, use the **show mpls traffic-eng tunnels** command in user EXEC or privileged EXEC mode.

show mpls traffic-eng tunnels [[**attributes** *list-name*] [**destination** *address*] [**down**] [**interface** *type number*] [**name** *name*] [**name-regexp** *reg-exp*] [**role** {**all** | **head** | **middle** | **remote** | **tail**}] [**source-id** {*ipaddress* [*tunnel-id*]}] [**suboptimal constraints** {**current** | **max** | **none**}] [**up**]] [**accounting** | **brief** | **protection**]

Syntax Description

attributes *list-name*	(Optional) Restricts the display to tunnels that use a matching attributes list.
destination *address*	(Optional) Restricts the display to tunnels destined to the specified IP address.
down	(Optional) Displays tunnels that are not active.
interface *type number*	(Optional) Displays information for the specified interface.
name *name*	(Optional) Displays the tunnel with the specified string. The tunnel string is derived from the interface description, if specified; otherwise, it is the interface name. The tunnel string is included in the signaling message so that it is available at all hops.
name-regexp *reg-exp*	(Optional) Displays tunnels whose descriptions match the specified regular expression.
role	Restricts the display to tunnels with the indicated role (all, head, middle, tail, or remote).
all	Displays all the tunnels.
head	Displays tunnels with their head at this router.
middle	Displays tunnels with a midpoint at this router.
remote	Displays tunnels with their head at some other router; this is a combination of middle and tail.
tail	Displays tunnels with a tail at this router.
source-id	(Optional) Restricts the display to tunnels with a matching source IP address or tunnel number.
ipaddress	Source IP address.
tunnel-id	Tunnel number. The range is from 0 to 65535.
suboptimal	(Optional) Displays information about tunnels using a suboptimal path.
constraints	Specifies constraints for finding the best comparison path.

current	Displays tunnels whose path metric is greater than the current shortest path, constrained by the tunnel's configured options. Selected tunnels would have a shorter path if they were reoptimized immediately.
max	Displays information for the specified tunneling interface.
none	Displays tunnels whose path metric is greater than the shortest unconstrained path. Selected tunnels have a longer path than the IGP shortest path.
up	(Optional) Displays tunnels if the tunnel interface is up. Tunnel midpoints and tails are typically up or not present.
accounting	(Optional) Displays accounting information (the rate of the traffic flow) for tunnels.
brief	(Optional) Specifies a format with one line per tunnel.
protection	(Optional) Displays information about the protection provided by each tunnel selected by other options specified with this command. The information includes whether protection is configured for the tunnel, the protection (if any) provided to the tunnel by this router, and the bandwidth protected.

Command Default

General information about each MPLS TE tunnel known to the router is displayed.

Command Modes

User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

To select the tunnels for which information is displayed, use the **attributes**, **destination**, **interface**, **name**, **name-regexp**, **property**, **role**, **source-id**, **suboptimal constraints**, **up**, and **down** keywords singly or combined.

To select the type of information displayed about the selected tunnels, use the **accounting**, **protection**, **statistics**, and **summary** keywords.

The **name-regexp** keyword displays output for each tunnel whose name contains a specified string. For example, if there are tunnels named iou-100-t1, iou-100-t2, and iou-100-t100, the **show mpls traffic-eng tunnels name-regexp iou-100** command displays output for the three tunnels whose name contains the string iou-100.

If you specify the **name** keyword, there is command output only if the command name is an exact match; for example, iou-100-t1.

Examples

The following is sample output from the **show mpls traffic-eng tunnels brief** command. It displays brief information about every MPLS TE tunnel known to the router.

```
Router# show mpls traffic-eng tunnels brief
```

```
Signalling Summary:
    LSP Tunnels Process: running
    RSVP Process: running
    Forwarding: enabled
    Periodic reoptimization: every 3600 seconds, next in 1706 seconds
TUNNEL NAME     DESTINATION     UP IF        DOWN IF
STATE/PROT
Router_t1       10.112.0.12      -        TenGigabitEthernet4/1     up/up
Router_t2      10.112.0.12      -       TenGigabitEthernet4/1    up/down
Router_t3       10.112.0.12      -        TenGigabitEthernet4/1
admin-down
Router_t1000    10.110.0.10      -       TenGigabitEthernet4/1    up/down
Displayed 4 (of 4) heads, 0 (of 0) midpoints, 0 (of 0) tails
```

The following is sample output from the **show mpls traffic-eng tunnels accounting** command. This command displays the rate of the traffic flow for the tunnels.

```
Router# Router# show mpls traffic-eng tunnels accounting
```

```
Tunnel1 (Destination 10.103.103.103; Name iou-100_t1)
5 minute output rate 0 kbits/sec, 0 packets/sec
Tunnel2 (Destination 10.103.103.103; Name iou-100_t2)
5 minute output rate 0 kbits/sec, 0 packets/sec Tunnel100 (Destination
10.101.101.101; Name iou-100_t100)
5 minute output rate 0 kbits/sec, 0 packets/sec Totals for 3 Tunnels
5 minute output rate 0 kbits/sec, 0 packets/sec
```

The following is sample output from the **show mpls traffic-eng tunnels tunnel** command. This command displays information about just a single tunnel.

```
Router# show mpls traffic-eng tunnels tunnel 1
```

```
Name: t1 (Tunnel1) Destination: 10.0.0.4
Status:
Admin: admin-down Oper: down Path: not valid Signalling: Down
path option 1, type explicit gi7/4-R4
Config Parameters:
Bandwidth: 0 kbps (Global) Priority: 7 7 Affinity: 0x0/0xFFFF
Metric Type: TE (default)
AutoRoute: disabled LockDown: disabled Loadshare: 0 bw-based
auto-bw: disabled
Shortest Unconstrained Path Info:
Path Weight: 2 (TE)
Explicit Route: 10.1.0.1 10.1.0.2 172.0.0.1 192.0.0.4
History:
Tunnel:
Time since created: 13 days, 52 minutes
Number of LSP IDs (Tun_Instances) used: 0
```

Related Commands

Command	Description
mpls traffic-eng tunnels	Enables MPLS traffic engineering tunnel signaling on a device.

show ip ospf mpls ldp interface

To display information about interfaces belonging to an OSPF process that is configured for MPLS LDP-IGP, use the **show ip ospf mpls ldp interface** command in privileged EXEC mode.

show ip ospf [*process-id*] **mpls ldp interface** [*interface*]

Syntax Description

process-id	(Optional) Process ID. Includes information only for the specified routing process.
interface	(Optional) Defines the interface for which MPLS LDP-IGP synchronization information is displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command shows MPLS LDP-IGP synchronization information for specified interfaces or OSPF processes. If you do not specify an argument, information is displayed for each interface that was configured for MPLS LDP-IGP synchronization.

Examples

The following is a sample output of the **show ip ospf mpls ldp interface** command.

```
TenGigabitEthernet4/1
  Process ID 1, Area 0
  LDP is configured through LDP autoconfig
  LDP-IGP Synchronization: Yes
  Holddown timer is not configured
  Timer is not running
TenGigabitEthernet4/2
  Process ID 1, Area 0
  LDP is configured through LDP autoconfig
  LDP-IGP Synchronization: Yes
  Holddown timer is not configured
  Timer is not running
```

Related Commands

Command	Description
show mpls ldp igp sync	Displays the status of the MPLS LDP-IGP synchronization process.

show mpls interfaces

To display information about one or more or all interfaces that are configured for label switching, use the **show mpls interfaces** command in user EXEC or privileged EXEC mode.

show mpls interfaces [*interface*] [**all**] [**detail**] [**internal**]

Syntax Description

interface	(Optional) Defines the interface about which to display label switching information.
all	(Optional) When the **all** keyword is specified alone in this command, information about the interfaces configured for label switching is displayed for all VPNs, including the VPNs in the default routing domain.
detail	(Optional) Displays detailed label switching information.
internal	(Optional) Indicates whether MPLS egress NetFlow accounting and other internal options are enabled.

Command Default

If no optional keyword or argument is specified in this command, summary information is displayed for each interface that has been configured for label switching in the default routing domain.

Command Modes

User EXEC (>) and Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command shows MPLS information about the specified interface, or about all the interfaces for which MPLS has been configured. If no optional keyword or argument is specified in this command, summary information is displayed for each interface configured for label switching.

Examples

The following example shows that LDP was enabled on the interface by both the **mpls ip** and **mpls ldp autoconfig** commands:

```
Router# show mpls interfaces TenGigabitEthernet4/1 detail
```

```
Interface TenGigabitEthernet4/1:
   IP labeling enabled (ldp):
   Interface config
   IGP config
   LSP Tunnel labeling enabled
   BGP labeling not enabled
```

```
  MPLS operational
  Fast Switching Vectors:
    IP to MPLS Fast Switching Vector
    MPLS Turbo Vector
    MTU = 1500
```

Related Commands

Command	Description
mpls label protocol ldp	Specifies the default label distribution protocol on all the interfaces.
mpls ip	Enables MPLS hop-by-hop forwarding on all the interfaces.
mpls traffic-eng tunnels	Enables MPLS traffic engineering tunnel signaling on a device.

show mpls ldp discovery

To display the status of the LDP discovery process, use the **show mpls ldp discovery** command in user EXEC or privileged EXEC mode.

show mpls ldp discovery [all] [detail]

Syntax Description

all	(Optional) Displays LDP discovery information for all VPNs, including those in the default routing domain.
detail	(Optional) Displays detailed information about all LDP discovery sources on a label switch router (LSR).

Command Default

This command displays neighbor discovery information for the default routing domain.

Command Modes

User EXEC and Privileged EXEC

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command displays neighbor discovery information for LDP. It generates a list of interfaces over which the LDP discovery process is running.

Examples

The following example displays the LDP router ID.

```
Router# show mpls ldp discovery
```

```
Local LDP Identifier:
  10.11.11.11:0
  Discovery Sources:
  Interfaces:
    TenGigabitEthernet4/1 (ldp): xmit/recv
    Enabled: Interface config, IGP config;
    Hello interval: 5000 ms; Transport IP addr: 10.11.11.11
    LDP Id: 10.10.10.10:0
    Src IP addr: 10.0.0.1; Transport IP addr: 10.10.10.10
    Hold time: 15 sec; Proposed local/peer: 15/15 sec
```

Related Commands

Command	Description
mpls label protocol	Specifies the default label distribution protocol.
mpls ldp neighbor	Configures a password key for computing MD5 checksums for the session TCP connection with the specified neighbor.
show mpls interfaces	Displays information about one or more interfaces that have been configured for label switching.
show mpls ldp neighbor	Displays the status of LDP sessions.

show mpls ldp igp sync

To display the status of the MPLS LDP-Interior Gateway Protocol (IGP) synchronization process, use the **show mpls ldp igp sync** command in user EXEC or privileged EXEC mode.

show mpls ldp igp sync [**all** | **interface** *type number*]

Syntax Description

all	(Optional) Displays all the MPLS LDP-IGP synchronization information available.
interface *type number*	(Optional) Displays the MPLS LDP-IGP synchronization information for the specified interface.

Command Modes

User EXEC(>) and Privileged EXEC(#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If an optional argument is not specified, this command displays LDP synchronization for all the interfaces enabled for MPLS LDP-IGP synchronization.

Examples

The following example shows that MPLS LDP–IGP synchronization is configured correctly, because LDP is configured and the SYNC status shows that synchronization is enabled.

```
Router# show mpls ldp igp sync

TenGigabitEthernet4/1:
  LDP configured; SYNC enabled.
  SYNC status: sync achieved; peer reachable.
  IGP holddown time: infinite.
  Peer LDP Ident: 10.0.0.1:0
  IGP enabled: OSPF 1
```

Related Commands

Command	Description
mpls ldp igp sync	Enables MPLS LDP-IGP synchronization on an interface that belongs to an OSPF process.
mpls ldp igp sync holddown	Specifies how long an IGP should wait for LDP synchronization to be achieved.

Command	Description
mpls ldp sync	Enables MPLS LDP-IGP synchronization on interfaces for an OSPF process.

show mpls ldp neighbor

To display the status of LDP sessions, use the **show mpls ldp neighbor** command in user EXEC or privileged EXEC mode.

show mpls ldp neighbor [**all**] [*address* | *interface*] [**detail**] [**graceful-restart**]

Syntax Description

all	(Optional) Displays LDP neighbor information for all VPNs, including those in the default routing domain.
address	(Optional) Identifies the neighbor with this IP address.
interface	(Optional) Identifies the LDP neighbors accessible over this interface.
detail	(Optional) Displays information in long form, including password information for this neighbor.
graceful-restart	(Optional) Displays graceful restart information for each neighbor.

Command Default

This command displays information about LDP neighbors for the default routing domain.

Command Modes

User EXEC and Privileged EXEC

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The **show mpls ldp neighbor** command can provide information about all the LDP neighbors, or the information can be limited to the following:

- Neighbor with specific IP address
- LDP neighbors accessible over a specific interface

Note This command displays information about LDP neighbor sessions.

Examples

The following is sample output from the **show mpls ldp neighbor** command.

```
Peer LDP Ident: 10.0.0.3:0; Local LDP Ident
10.0.0.5:0
TCP connection: 10.0.0.3.646 - 10.0.0.5.11005
State: Oper; Msgs sent/rcvd: 1453/1464; Downstream
Up time: 21:09:56
LDP discovery sources:
  Targeted Hello 10.0.0.5 -> 10.0.0.3, active
Addresses bound to peer LDP Ident:
  10.3.104.3 10.0.0.2 10.0.0.3
```

Related Commands

Command	Description
show mpls interfaces	Displays information about one or more interfaces that have been configured for label switching.
show mpls ldp discovery	Displays the status of the LDP discovery process.

trace mpls

To discover MPLS LSP routes that packets actually take when traveling to their destinations, use the **trace mpls** command in privileged EXEC mode.

trace mpls

{**ipv4** *destination-address/destination-mask-length*

| **traffic-eng Tunnel** *tunnel-number*

| **pseudowire** *destination-address vc-id* **segment** *segment-number* [*segment number*]}

[**timeout** *seconds*]

[**destination** *address-start* [*address-end* | *address-increment*]]

[**revision** {**1** | **2** | **3** | **4**}]

[**source** *source-address*]

[**exp** *exp-bits*]

[**ttl** *maximum-time-to-live*]

[**reply** {**dscp** *dscp-bits* | **mode** *reply-mode* {**ipv4** | **no-reply** | **router-alert**} | **pad-tlv**}]

[**force-explicit-null**]

[**output interface** *tx-interface* [**nexthop** *ip-address*]]

[**flags fec**]

[**revision** *tlv-revision-number*]

Syntax Description

ipv4	Specifies the destination type as a LDP IPv4 address.
destination-address	Address prefix of the target to be tested.
/destination-mask-length	Number of bits in the network mask of the target address. The slash is required.
traffic-eng Tunnel *tunnel-number*	Specifies the destination type as a MPLS-TE tunnel.
destination	(Optional) Specifies a network 127 address.
address-start	(Optional) Beginning network 127 address.
address-end	(Optional) Ending network 127 address.
increment	(Optional) Number by which to increment the network 127 address.
ttl *maximum-time-to-live*	(Optional) Specifies a maximum hop count. Default is 30.
pseudowire	Specifies the destination type as an Any Transport over MPLS (AToM) virtual circuit (VC).
ipv4-address	IPv4 address of the AToM VC to be tested.

vc-id	Specifies the VC identifier of the AToM VC to be tested.
segment *segment-number*	(Optional) Specifies a segment of a multisegment pseudowire.
revision {**1** | **2** | **3** | **4**	(Optional) Selects the type, length, values (TLVs) version.
source *source-address*	(Optional) Specifies the source address or name. The default address is loopback0. This address is used as the destination address in the MPLS echo response.
timeout *seconds*	(Optional) Specifies the timeout interval in seconds for an MPLS request packet. The range is from 0 to 3600. The default is 2 seconds.
reply dscp *dscp-bits*	(Optional) Provides the capability to request a specific class of service (CoS) in an echo reply by providing a differentiated services code point (DSCP) value.
reply pad-tlv	(Optional) Tests the ability of the sender of an echo reply to support the copy pad TLV to echo reply.
reply mode *reply-mode*	(Optional) Specifies the reply mode for the echo request packet. The *reply-mode* is one of the following: **ipv4**—Reply with an IPv4 UDP packet (default). **no-reply**—Do not send an echo request packet in response. **router-alert**—Reply with an IPv4 UDP packet with router alert.
exp *exp-bits*	(Optional) Specifies the MPLS experimental field value in the MPLS header for an MPLS echo reply. Valid values are from 0 to 7. Default is 0.
revision *tlv-revision-number*	(Optional) Cisco TLV revision number.
force-explicit-null	(Optional) Forces an explicit null label to be added to the MPLS label stack even though the label was unsolicited.
output interface *tx-interface*	(Optional) Specifies the output interface for echo requests.
nexthop *ip-address*	(Optional) Causes packets to go through the specified next-hop address.
flags fec	(Optional) Requests that target Forwarding Equivalence Class (FEC) stack validation be done at the egress router. A downstream map TLV containing the correct received labels must be present in the echo request for target FEC stack checking to be performed. Ensure to use this keyword in conjunction with the **ttl** keyword.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Use the **trace mpls** command to validate, test, or troubleshoot IPv4 LDP LSPs and IPv4 RSVP TE tunnels.

The following keywords are not available with the **ping mpls pseudowire** command:

- **flags**
- **force-explicit-null**
- **output**
- **revision**
- **ttl**

Examples

The following example shows how to trace packets through a MPLS TE tunnel.

```
Router# trace mpls traffic-eng Tunnel 0
```

```
Tracing MPLS TE Label Switched Path on Tunnel0, timeout is 2 seconds
Codes:
'!' - success, 'Q' - request not sent, '.' - timeout,
'L' - labeled output interface, 'B' - unlabeled output interface,
'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
'P' - no rx intf label prot, 'p' - premature termination of LSP,
'R' - transit router, 'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
0 10.131.159.230 mtu 1500 [Labels: 22 Exp: 0]
R 1 10.131.159.225 mtu 1500 [Labels: 22 Exp: 6] 72 ms
R 2 10.131.191.229 mtu 1504 [implicit-null] 72 ms
! 3 10.131.191.252 92 ms
```

Related Commands

Command	Description
ping mpls	Checks MPLS LSP connectivity.

tunnel mode mpls traffic-eng

To set the mode of a tunnel to MPLS for traffic engineering, use the **tunnel mode mpls traffic-eng** command in interface configuration mode. To disable this feature, use the **no** form of this command.

tunnel mode mpls traffic-eng

no tunnel mode mpls traffic-eng

Syntax Description

This command has no arguments or keywords.

Command Default

Disabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

This command specifies that the tunnel interface is for an MPLS traffic engineering tunnel and enables the various tunnel MPLS configuration options.

Examples

The following example shows how to set the mode of the tunnel to MPLS traffic engineering.

```
Router(config-if)# tunnel mode mpls traffic-eng
```

Related Commands

Command	Description
tunnel mpls traffic-eng affinity	Configures an affinity for a MPLS traffic engineering tunnel.
tunnel mpls traffic-eng autoroute announce	Instructs the IGP to use the tunnel in its enhanced SPF algorithm calculation (if the tunnel is up).
tunnel mpls traffic-eng bandwidth	Configures the bandwidth required for a MPLS traffic engineering tunnel.
tunnel mpls traffic-eng path-option	Configures a path option.
tunnel mpls traffic-eng priority	Configures setup and reservation priority for a MPLS traffic engineering tunnel.

tunnel mpls traffic-eng path-option

To configure a path option for a MPLS–TE tunnel, use the **tunnel mpls traffic-eng path-option** command in interface configuration mode. To disable this function, use the **no** form of this command.

tunnel mpls traffic-eng path-option {*number* {**dynamic** [**attributes** *lsp-attributes* | **bandwidth** *kbps*] [**lockdown**] | **lockdown** [**bandwidth** *kbps*] | **explicit** {**identifier** *path-number* | **name** *path-name*} [**attributes** *lsp-attributes* [**verbatim**]] | **bandwidth** *kbps* [**lockdown**] [**verbatim**]] | **lockdown bandwidth** *kbps* [**verbatim**] | **verbatim bandwidth** *kbps* [**lockdown**]}}

no tunnel mpls traffic-eng path-option *number*

Syntax Description

number	Preference for this path option. When you configure multiple path options, lower numbered options are preferred. Valid values are from 1 to 1000.
dynamic	Dynamically calculates the path of the LSP.
attributes *lsp-attributes*	(Optional) Identifies an LSP attribute list. The attribute list used must be the same as the primary path option being configured.
bandwidth *kbps*	(Optional) Overrides the bandwidth configured on the tunnel or the attribute list. The kbps is the number of kilobits per second set aside for the path option. The range is from 1 to 4294967295. The bandwidth value must be the same as the primary path option being configured.
lockdown	(Optional) Indicates that the LSP cannot be reoptimized.
verbatim	(Optional) Bypasses the topology database verification process.
explicit	Specifies that the path of the LSP is an IP explicit path.
name *path–name*	Specifies the path name of the IP explicit path that the tunnel uses with this option.
identifier *path–number*	Specifies the path number of the IP explicit path that the tunnel uses with this option. The range is from 1 to 65535.

Command Default

No path option for an MPLS TE tunnel is configured.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

You can configure multiple path options for a single tunnel. For example, there can be several explicit path options and a dynamic option for one tunnel. Path setup preference is for lower (not higher) numbers, so option 1 is preferred.

If you specify the **dynamic** keyword, the software checks both the physical bandwidth of the interface and the available TE bandwidth to be sure that the requested amount of bandwidth does not exceed the physical bandwidth of any link. To oversubscribe links, you must specify the **explicit** keyword. If you use the **explicit** keyword, the software only checks how much bandwidth is available on the link for TE; the amount of bandwidth you configure is not limited to how much physical bandwidth is available on the link.

Examples

The following example shows how to configure the tunnel to use a named IP explicit path.

```
Router(config-if)# tunnel mpls traffic-eng path-option 1 explicit name test
```

Related Commands

Command	Description
ip explicit-path	Enters the command mode for IP explicit paths and creates or modifies the specified path.
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show ip explicit-paths	Displays the configured IP explicit paths.
tunnel mpls traffic-eng path-option protect	Configures a secondary path option for a MPLS TE tunnel.

tunnel mpls traffic-eng autoroute announce

To specify that the IGP must use the tunnel in its enhanced shortest path first (SPF) calculation, use the **tunnel mpls traffic-eng autoroute announce** command in interface configuration mode. To disable this feature, use the **no** form of this command.

tunnel mpls traffic-eng autoroute announce

no tunnel mpls traffic-eng autoroute announce

Syntax Description

This command has no arguments or keywords.

Command Default

The IGP does not use the tunnel in its enhanced SPF calculation.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

The only way to forward traffic onto a tunnel is by enabling this command or by explicitly configuring forwarding (for example, with an interface static route).

Examples

The following example shows how to specify that the IGP must use the tunnel in its enhanced SPF calculation if the tunnel is up.

```
Router(config-if)# tunnel mpls traffic-eng autoroute announce
```

Related Commands

Command	Description
tunnel mode mpls traffic-eng	Sets the mode of a tunnel to MPLS for traffic engineering.

tunnel mpls traffic-eng bandwidth

To configure the bandwidth required for a MPLS-TE tunnel, use the **tunnel mpls traffic-eng bandwidth** command in interface configuration mode. To disable this bandwidth configuration, use the **no** form of this command.

tunnel mpls traffic-eng bandwidth *kbps*

no tunnel mpls traffic-eng bandwidth

Syntax Description

kbps	The bandwidth, in kilobits per second, set aside for the MPLS TE tunnel. The range is from 1 to 4294967295. The default value is 0.

Command Default

The default tunnel is a global pool tunnel.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

If automatic bandwidth is configured for the tunnel, the **tunnel mpls traffic-eng bandwidth** command configures the initial tunnel bandwidth, which will be adjusted by the autobandwidth mechanism.

Examples

The following example shows how to configure 100 kbps of bandwidth for the MPLS traffic engineering tunnel.

```
Router(config-if)# tunnel mpls traffic-eng bandwidth 100
```

Related Commands

Command	Description
ip rsvp bandwidth	Enables RSVP for IP on an interface.
show mpls traffic-eng tunnel	Displays information about tunnels.

tunnel mpls traffic-eng priority

To configure the setup and reservation priority for MPLS-TE tunnel, use the **tunnel mpls traffic-eng priority** command in interface configuration mode. To remove the specified setup and reservation priority, use the **no** form of this command.

tunnel mpls traffic-eng priority *setup-priority* [*hold-priority*]

no tunnel mpls traffic-eng priority *setup-priority* [*hold-priority*]

Syntax Description

setup-priority	The priority used when signaling a LSP for this tunnel to determine which existing tunnels can be preempted. Valid values are from 0 to 7, where a lower number indicates a higher priority. Therefore, an LSP with a setup priority of 0 can preempt any LSP with a non-0 priority.
hold-priority	(Optional) The priority associated with an LSP for this tunnel to determine if it should be preempted by other LSPs that are being signaled. Valid values are from 0 to 7, where a lower number indicates a higher priority.

Command Default

By default, the setup priority is 7. The value of hold priority is the same as the value of setup priority.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

When an LSP is being signaled and an interface does not currently have enough bandwidth available for that LSP, the lower-priority LSPs are pre-empted so that the new LSP can be admitted.

The new LSP's priority is its setup priority and the existing LSP's priority is its hold priority. The two priorities enables the signaling of an LSP with a low setup priority (so that the LSP does not preempt other LSPs on setup) but a high hold priority (so that the LSP is not preempted after it is established).

Setup priority and hold priority are typically configured to be equal, and setup priority cannot be better (numerically smaller) than the hold priority.

Examples

The following example shows how to configure a tunnel with a setup and hold priority of 1.

```
Router(config-if)# tunnel mpls traffic-eng priority 1 1
```

Related Commands

Command	Description
tunnel mode mpls traffic-eng	Sets the mode of a tunnel to MPLS for traffic engineering.

tunnel mpls traffic–eng path–option protect

To configure a secondary path option for a MPLS–TE tunnel, use the **tunnel mpls traffic-eng path-option protect** command in interface configuration mode. To disable this function, use the **no** form of this command.

tunnel mpls traffic-eng path-option protect {*number* {**dynamic** [**attributes** *lsp-attributes* | **bandwidth** *kbps*] [**lockdown**] | **lockdown** [**bandwidth** *kbps*] | **explicit** {**identifier** *path-number* | **name** *path-name*} [**attributes** *lsp-attributes* [**verbatim**]] | **bandwidth** *kbps* [**lockdown**] [**verbatim**]] | **lockdown bandwidth** *kbps* [**lockdown**] [**verbatim**] | **verbatim** [**lockdown**]]}

no tunnel mpls traffic-eng path-option protect *number*

Syntax Description

number	The primary path option being protected. Valid values are from 1 to 1000.
dynamic	Dynamically calculates the path of the LSP.
attributes *lsp-attributes*	(Optional) Identifies an LSP attribute list. The attribute list used must be the same as the primary path option being protected.
bandwidth *kbps*	(Optional) Overrides the bandwidth configured on the tunnel or the attribute list. The *kbps* value is the number of kilobits per second set aside for the path option. The range is from 1 to 4294967295. The bandwidth value must be the same as the primary path option being configured.
lockdown	(Optional) Indicates that the LSP cannot be reoptimized.
verbatim	(Optional) Bypasses the topology database verification process.
explicit	Specifies that the path of the LSP is an IP explicit path.
name *path–name*	Specifies the path name of the IP explicit path that the tunnel uses with this option.
identifier *path–number*	Specifies the path number of the IP explicit path that the tunnel uses with this option. The range is from 1 to 65535.

Command Default

The MPLS TE tunnel does not have a secondary path option.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
9.3.0	This command was introduced.

Usage Guidelines

Cisco recommends that the primary path options being protected use explicit paths.

Calculation of a dynamic path for the path protected LSP is not available. When configuring the IP explicit path for the path protected LSP, choose hops that minimize the number of links and nodes shared with the primary path option that is being protected.

If the path option being protected uses an attribute list, configure path protection to use the same attribute list.

If the path option being protected uses bandwidth override, configure path protection to use bandwidth override with the same values.

Examples

The following example shows how to configure the tunnel to use a named IP explicit path.

```
Router(config-if)# tunnel mpls traffic-eng path-option protect 1 explicit name test
```

The following example shows how to configure path option 1 to use an LSP attribute list identified with the numeral 1.

```
Router(config-if)# tunnel mpls traffic-eng path-option protect 1 explicit name test attributes
 1
```

The following example shows how to configure bandwidth for a path option to override the bandwidth configured on the tunnel.

```
Router(config-if)# tunnel mpls traffic-eng path-option protect 3 explicit name test bandwidth
 0
```

Related Commands

Command	Description
ip explicit-path	Enters the command mode for IP explicit paths and creates or modifies the specified path.
mpls traffic-eng lsp attributes	Creates or modifies an LSP attribute list.
show ip explicit-paths	Displays the configured IP explicit paths.
tunnel mpls traffic-eng path-option	Configures a primary path for an MPLS TE tunnel.