



MPLS Label Distribution Protocol Configuration Guide, Cisco IOS XE Release 2

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MPLS Label Distribution Protocol (LDP)

MPLS Label Distribution Protocol (LDP) enables peer label switch routers (LSRs) in a Multiprotocol Label Switching (MPLS) network to exchange label binding information for supporting hop-by-hop forwarding in an MPLS network. This module explains the concepts related to MPLS LDP and describes how to configure MPLS LDP in a network.

- [Finding Feature Information, page 1](#)
- [Prerequisites for MPLS Label Distribution Protocol, page 1](#)
- [Information About MPLS Label Distribution Protocol, page 1](#)
- [How to Configure MPLS Label Distribution Protocol, page 5](#)
- [Configuration Examples for MPLS Label Distribution Protocol, page 19](#)
- [Additional References, page 23](#)
- [Feature Information for MPLS Label Distribution Protocol, page 24](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for MPLS Label Distribution Protocol

Label switching on a router requires that Cisco Express Forwarding (CEF) be enabled on that router.

Information About MPLS Label Distribution Protocol

- [Introduction to MPLS Label Distribution Protocol, page 2](#)
- [MPLS Label Distribution Protocol Functional Overview, page 2](#)
- [Introduction to LDP Sessions, page 2](#)
- [Introduction to LDP Label Bindings Label Spaces and LDP Identifiers, page 3](#)

Introduction to MPLS Label Distribution Protocol

MPLS LDP provides the means for LSRs to request, distribute, and release label prefix binding information to peer routers in a network. LDP enables LSRs to discover potential peers and to establish LDP sessions with those peers for the purpose of exchanging label binding information.

MPLS LDP enables one LSR to inform another LSR of the label bindings it has made. Once a pair of routers communicate the LDP parameters, they establish a label switched path (LSP). MPLS LDP enables LSRs to distribute labels along normally routed paths to support MPLS forwarding. This method of label distribution is also called hop-by-hop forwarding. With IP forwarding, when a packet arrives at a router the router looks at the destination address in the IP header, performs a route lookup, and forwards the packet to the next hop. With MPLS forwarding, when a packet arrives at a router the router looks at the incoming label, looks up the label in a table, and then forwards the packet to the next hop. MPLS LDP is useful for applications that require hop-by-hop forwarding, such as MPLS VPNs.

MPLS Label Distribution Protocol Functional Overview

Cisco MPLS LDP provides the building blocks for MPLS-enabled applications, such as MPLS Virtual Private Networks (VPNs).

LDP provides a standard methodology for hop-by-hop, or dynamic label, distribution in an MPLS network by assigning labels to routes that have been chosen by the underlying Interior Gateway Protocol (IGP) routing protocols. The resulting labeled paths, called label switch paths (LSPs), forward label traffic across an MPLS backbone to particular destinations. These capabilities enable service providers to implement MPLS-based IP VPNs and IP+ATM services across multivendor MPLS networks.

Introduction to LDP Sessions

When you enable MPLS LDP, the LSRs send out messages to try to find other LSRs with which they can create LDP sessions. The following sections explain the differences between directly connected LDP sessions and nondirectly connected LDP sessions.

- [Directly Connected MPLS LDP Sessions, page 2](#)
- [Nondirectly Connected MPLS LDP Sessions, page 3](#)

Directly Connected MPLS LDP Sessions

If an LSR is one hop from its neighbor, it is directly connected to its neighbor. The LSR sends out LDP link Hello messages as User Datagram Protocol (UDP) packets to all the routers on the subnet (multicast). A neighboring LSR may respond to the link Hello message, allowing the two routers to establish an LDP session. This is called basic discovery.

To initiate an LDP session between routers, the routers determine which router will take the active role and which router will take the passive role. The router that takes the active role establishes the LDP TCP connection session and initiates the negotiation of the LDP session parameters. To determine the roles, the two routers compare their transport addresses. The router with the higher IP address takes the active role and establishes the session.

After the LDP TCP connection session is established, the LSRs negotiate the session parameters, including the method of label distribution to be used. Two methods are available:

- Downstream Unsolicited: An LSR advertises label mappings to peers without being asked to.

- Downstream on Demand: An LSR advertises label mappings to a peer only when the peer asks for them.

For information about creating LDP sessions, see the [Enabling Directly Connected LDP Sessions](#), page 5.

Nondirectly Connected MPLS LDP Sessions

If the LSR is more than one hop from its neighbor, it is nondirectly connected to its neighbor. For these nondirectly connected neighbors, the LSR sends out a targeted Hello message as a UDP packet, but as a unicast message specifically addressed to that LSR. The nondirectly connected LSR responds to the Hello message and the two routers begin to establish an LDP session. This is called extended discovery.

An MPLS LDP targeted session is a label distribution session between routers that are not directly connected. When you create an MPLS traffic engineering tunnel interface, you need to establish a label distribution session between the tunnel headend and the tailend routers. You establish nondirectly connected MPLS LDP sessions by enabling the transmission of targeted Hello messages.

You can use the **mpls ldp neighbor targeted** command to set up a targeted session when other means of establishing targeted sessions do not apply, such as configuring **mpls ip** on a traffic engineering (TE) tunnel or configuring Any Transport over MPLS (AToM) virtual circuits (VCs). For example, you can use this command to create 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, and there is an alternate route between neighbors, the targeted Hellos would 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.

The exchange of targeted Hello messages between two nondirectly connected neighbors can occur in several ways, including the following:

- Router 1 sends targeted Hello messages carrying a response request to Router 2. Router 2 sends targeted Hello messages in response if its configuration permits. In this situation, Router 1 is considered to be active and Router 2 is considered to be passive.
- Router 1 and Router 2 both send targeted Hello messages to each other. Both routers are considered to be active. Both, one, or neither router can also be passive, if they have been configured to respond to requests for targeted Hello messages from each other.

The default behavior of an LSR is to ignore requests from other LSRs that send targeted Hello messages. You can configure an LSR to respond to requests for targeted Hello messages by issuing the **mpls ldp discovery targeted-hello accept** command.

The active LSR mandates the protocol that is used for a targeted session. The passive LSR uses the protocol of the received targeted Hello messages.

For information about creating MPLS LDP targeted sessions, see the [Establishing Nondirectly Connected MPLS LDP Sessions](#), page 7.

Introduction to LDP Label Bindings Label Spaces and LDP Identifiers

An LDP label binding is an association between a destination prefix and a label. The label used in a label binding is allocated from a set of possible labels called a label space.

LDP supports two types of label spaces:

- **Interface-specific**--An interface-specific label space uses interface resources for labels. For example, label-controlled ATM (LC-ATM) interfaces use virtual path identifiers/virtual circuit identifiers (VPIs/VCI) for labels. Depending on its configuration, an LDP platform may support zero, one, or more interface-specific label spaces.
- **Platform-wide**--An LDP platform supports a single platform-wide label space for use by interfaces that can share the same labels. For Cisco platforms, all interface types, except LC-ATM, use the platform-wide label space.

LDP uses a 6-byte quantity called an LDP Identifier (or LDP ID) to name label spaces. The LDP ID is made up of the following components:

- The first four bytes, called the LDP router ID, identify the LSR that owns the label space.
- The last two bytes, called the local label space ID, identify the label space within the LSR. For the platform-wide label space, the last two bytes of the LDP ID are always both 0.

The LDP ID takes the following form:

<LDP router ID> : <local label space ID>

The following are examples of LDP IDs:

- 172.16.0.0:0
- 192.168.0.0:3

The router determines the LDP router ID as follows, if the **mpls ldp router-id** command is not executed,

- 1 The router examines the IP addresses of all operational interfaces.
- 2 If these IP addresses include loopback interface addresses, the router selects the largest loopback address as the LDP router ID.
- 3 Otherwise, the router selects the largest IP address pertaining to an operational interface as the LDP router ID.

The normal (default) method for determining the LDP router ID may result in a router ID that is not usable in certain situations. For example, the router might select an IP address as the LDP router ID that the routing protocol cannot advertise to a neighboring router. The **mpls ldp router-id** command allows you to specify the IP address of an interface as the LDP router ID. Make sure the specified interface is operational so that its IP address can be used as the LDP router ID.

When you issue the **mpls ldp router-id** command without the **force** keyword, the router selects the IP address of the specified interface (provided that the interface is operational) the next time it is necessary to select an LDP router ID, which is typically the next time the interface is shut down or the address is configured.

When you issue the **mpls ldp router-id** command with the **force** keyword, the effect of the **mpls ldp router-id** command depends on the current state of the specified interface:

- If the interface is up (operational) and if its IP address is not currently the LDP router ID, the LDP router ID changes to the IP address of the interface. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.
- If the interface is down (not operational) when the **mpls ldp router-id force** command is issued, when the interface transitions to up, the LDP router ID changes to the IP address of the interface. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.

How to Configure MPLS Label Distribution Protocol

- [Enabling Directly Connected LDP Sessions, page 5](#)
- [Establishing Nondirectly Connected MPLS LDP Sessions, page 7](#)
- [Specifying the LDP Router ID, page 10](#)
- [Preserving QoS Settings with MPLS LDP Explicit Null, page 13](#)
- [Protecting Data Between LDP Peers with MD5 Authentication, page 17](#)

Enabling Directly Connected LDP Sessions

This procedure explains how to configure MPLS LDP sessions between two directly connected routers.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. Router(config)# **interface** *type slot / subslot / port[. subinterface-number]*
6. **mpls ip**
7. **exit**
8. **exit**
9. **show mpls interfaces** [*interface*] [**detail**]
10. **show mpls ldp discovery all | vrf vpn-name** [**detail**]
11. **show mpls ldp neighbor** [[*vrf vpn-name*] [*address | interface*] [**detail**] | **all**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3 <code>mpls ip</code></p> <p>Example:</p> <pre>Router(config)# mpls ip</pre>	<p>Configures MPLS hop-by-hop forwarding globally.</p> <ul style="list-style-type: none"> The mpls ip command is enabled by default; you do not have to specify this command. Globally enabling MPLS forwarding does not enable it on the router interfaces. You must enable MPLS forwarding on the interfaces as well as for the router.
<p>Step 4 <code>mpls label protocol ldp</code></p> <p>Example:</p> <pre>Router(config)# mpls label protocol ldp</pre>	<p>Configures the use of LDP on all interfaces.</p>
<p>Step 5 <code>Router(config)# interface type slot / subslot / port[. subinterface-number]</code></p> <p>Example:</p> <pre>Router(config)# interface fastethernet03/0</pre>	<p>Specifies the interface to be configured and enters interface configuration mode.</p>
<p>Step 6 <code>mpls ip</code></p> <p>Example:</p> <pre>Router(config-if)# mpls ip</pre>	<p>Configures MPLS hop-by-hop forwarding on the interface.</p> <ul style="list-style-type: none"> You must enable MPLS forwarding on the interfaces as well as for the router.
<p>Step 7 <code>exit</code></p> <p>Example:</p> <pre>Router(config-if)# exit</pre>	<p>Exits interface configuration mode and enters global configuration mode.</p>
<p>Step 8 <code>exit</code></p> <p>Example:</p> <pre>Router(config)# exit</pre>	<p>Exits global configuration mode and enters privileged EXEC mode.</p>
<p>Step 9 <code>show mpls interfaces [interface] [detail]</code></p> <p>Example:</p> <pre>Router# show mpls interfaces</pre>	<p>Verifies that the interfaces have been configured to use LDP.</p>

	Command or Action	Purpose
Step 10	show mpls ldp discovery all vrf <i>vpn-name</i>] [detail] Example: Router# show mpls ldp discovery	Verifies that the interface is up and is sending Discovery Hello messages.
Step 11	show mpls ldp neighbor [[vrf <i>vpn-name</i>] [<i>address</i> <i>interface</i>] [detail] all] Example: Router# show mpls ldp neighbor	Displays the status of LDP sessions.

Examples

The following **show mpls interfaces** command verifies that interfaces FastEthernet 0/3/0 and 0/3/1 have been configured to use LDP:

```
Router# show mpls interfaces
Interface          IP          Tunnel  BGP  Static  Operational
FastEthernet0/3/0  Yes (ldp)  No      No   No      Yes
FastEthernet0/3/1  Yes       No      No   No      Yes
```

The following **show mpls ldp discovery** command verifies that the interface is up and is sending LDP Discovery Hello messages (as opposed to TDP Hello messages):

```
Router# show mpls ldp discovery
Local LDP Identifier:
172.16.12.1:0
Discovery Sources:
Interfaces:
  FastEthernet0/3/0 (ldp): xmit
```

The following example shows that the LDP session between routers was successfully established:

```
Router# show mpls ldp neighbor
Peer LDP Ident: 10.1.1.2:0; Local LDP Ident 10.1.1.1:0
TCP connection: 10.1.1.2.18 - 10.1.1.1.66
State: Oper; Msgs sent/rcvd: 12/11; Downstream
Up time: 00:00:10
LDP discovery sources:
FastEthernet0/1/0, Src IP addr: 10.20.10.2
Addresses bound to peer LDP Ident:
10.1.1.2  10.20.20.1  10.20.10.2
```

For examples on configuring directly connected LDP sessions, see the [Configuring Directly Connected MPLS LDP Sessions Example](#), page 19.

Establishing Nondirectly Connected MPLS LDP Sessions

This section explains how to configure nondirectly connected MPLS LDP sessions, which enable you to establish an LDP session between routers that are not directly connected.

- MPLS requires Cisco Express Forwarding.
- You must configure the routers at both ends of the tunnel to be active or enable one router to be passive with the **mpls ldp discovery targeted-hello accept** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **interface tunnel** number
6. **tunnel destination** *ip-address*
7. **mpls ip**
8. **exit**
9. **exit**
10. **show mpls ldp discovery** [**all** | **vrf** *vpn-name*] [**detail**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	mpls ip Example: Router(config)# mpls ip	Configures MPLS hop-by-hop forwarding globally. <ul style="list-style-type: none"> • The mpls ip command is enabled by default; you do not have to specify this command. • Globally enabling MPLS forwarding does not enable it on the router interfaces. You must enable MPLS forwarding on the interfaces as well as for the router.
Step 4	mpls label protocol ldp Example: Router(config)# mpls label protocol ldp	Configures the use of LDP on all interfaces.

	Command or Action	Purpose
Step 5	interface tunnel number Example: Router(config)# interface tunnell	Configures a tunnel interface and enters interface configuration mode.
Step 6	tunnel destination <i>ip-address</i> Example: Router(config-if)# tunnel destination 172.16.1.1	Assigns an IP address to the tunnel interface.
Step 7	mpls ip Example: Router(config-if)# mpls ip	Configures MPLS hop-by-hop forwarding on the interface. <ul style="list-style-type: none"> You must enable MPLS forwarding on the interfaces as well as for the router.
Step 8	exit Example: Router(config-if)# exit	Exits interface configuration mode and enters global configuration mode.
Step 9	exit Example: Router(config)# exit	Exits global configuration mode and enters privileged EXEC mode.
Step 10	show mpls ldp discovery [all vrf <i>vpn-name</i>] [detail] Example: Router# show mpls ldp discovery	Verifies that the interface is up and is sending Discovery Hello messages.

Examples

The following example shows the output of the **show mpls ldp discovery** command for a nondirectly connected LDP session:

```
Router# show mpls ldp discovery
Local LDP Identifier:
 172.16.0.0:0
Discovery Sources:
Interfaces:
POS1/2/0 (ldp): xmit/recv
LDP Id: 172.31.255.255:0
Tunnell (ldp): Targeted -> 192.168.255.255
```

```

Targeted Hellos:
172.16.0.0 -> 192.168.255.255 (ldp): active, xmit/recv
LDP Id: 192.168.255.255:0
172.16.0.0 -> 192.168.0.0 (ldp): passive, xmit/recv
LDP Id: 192.168.0.0:0

```

This command output indicates that:

- The local LSR (172.16.0.0) sent LDP link Hello messages on interface POS1/2/0 and discovered neighbor 192.31.255.255.
- The local LSR sent LDP targeted Hello messages associated with interface Tunnel1 to target 192.168.255.255. The LSR was configured to use LDP.
- The local LSR is active for targeted discovery activity with 192.168.255.255; this means that the targeted Hello messages it sends to 192.168.255.255 carry a response request. The local LSR was configured to have an LDP session with the nondirectly connected LSR 192.168.255.255.
- The local LSR is not passive from the discovery activity with 192.168.255.255 for one of the following reasons:
 - The targeted Hello messages it receives from 192.168.255.255 do not carry a response request.
 - The local LSR has not been configured to respond to such requests.
- The local LSR sent TDP directed Hello messages to the target LSR 192.168.0.0. This LSR uses TDP because the Hello messages received from the target LSR 192.168.0.0 were TDP directed Hello messages.
- The local LSR is passive in discovery activity with LSR 192.168.0.0. This means that the directed Hello messages it receives from LSR 192.168.0.0 carry a response request and that the local LSR has been configured with the **mpls ldp discovery targeted-hello accept** command to respond to such requests from LSR 192.168.0.0.
- The local LSR is not active in discovery activity with LSR 192.168.0.0, because no application that requires an LDP session with LSR 192.168.0.0 has been configured on the local LSR.

For examples of configuring LDP targeted sessions, see the [Establishing Nondirectly Connected MPLS LDP Sessions Example, page 21](#).

Specifying the LDP Router ID

The **mpls ldp router-id** command allows you to establish the IP address of an interface as the LDP router ID.

The following steps describe the normal process for determining the LDP router ID:

- 1 The router considers all the IP addresses of all operational interfaces.
- 2 If these addresses include loopback interface addresses, the router selects the largest loopback address. Configuring a loopback address helps ensure a stable LDP ID for the router, because the state of loopback addresses does not change. However, configuring a loopback interface and IP address on each router is not required.

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

1 Otherwise, the router selects the largest interface address.

The router might select a router ID that is not usable in certain situations. For example, the router might select an IP address that the routing protocol cannot advertise to a neighboring router.

The router implements the router ID the next time it is necessary to select an LDP router ID. The effect of the command is delayed until the next time it is necessary to select an LDP router ID, which is typically the next time the interface is shut down or the address is deconfigured.

If you use the **force** keyword with the **mpls ldp router-id** command, the router ID takes effect more quickly. However, implementing the router ID depends on the current state of the specified interface:

- If the interface is up (operational) and its IP address is not currently the LDP router ID, the LDP router ID is forcibly changed to the IP address of the interface. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.
- If the interface is down, the LDP router ID is forcibly changed to the IP address of the interface when the interface transitions to up. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.

Make sure the specified interface is operational before assigning it as the LDP router ID.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **mpls ldp router-id *interface* [force]**
6. **exit**
7. **show mpls ldp discovery [all | detail |vrf *vpn-name*]**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
Step 3 mpls ip Example: Router(config)# mpls ip	Configures MPLS hop-by-hop forwarding globally. <ul style="list-style-type: none"> • The mpls ip command is enabled by default; you do not have to specify this command. • Globally enabling MPLS forwarding does not enable it on the router interfaces. You must enable MPLS forwarding on the interfaces as well as for the router.
Step 4 mpls label protocol ldp Example: Router(config)# mpls label protocol ldp	Configures the use of LDP on all interfaces. configuration mode.
Step 5 mpls ldp router-id <i>interface</i> [force] Example: Router(config)# mpls ldp router-id pos2/0/0	Specifies the preferred interface for determining the LDP router ID.
Step 6 exit Example: Router(config)# exit	Exits global configuration mode and enters privileged EXEC mode.
Step 7 show mpls ldp discovery [all detail vrf <i>vpn-name</i>] Example: Router# show mpls ldp discovery	Displays the LDP identifier for the local router.

Example

The following example assigns interface pos2/0/0 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 pos2/0/0 force
```

The following example displays the LDP router ID (10.15.15.15):

```
Router# show mpls ldp discovery
Local LDP Identifier:
 10.15.15.15:0
Discovery Sources:
  Interfaces:
   FastEthernet0/3/0 (ldp): xmit/recv
   LDP Id: 10.14.14.14:0
```

Preserving QoS Settings with MPLS LDP Explicit Null

Normally, LDP advertises an Implicit Null label for directly connected routes. The Implicit Null label causes the second last (penultimate) label switched router (LSR) to remove the MPLS header from the packet. In this case, the penultimate LSR and the last LSR do not have access to the quality of service (QoS) values that the packet carried before the MPLS header was removed. To preserve the QoS values, you can configure the LSR to advertise an explicit NULL label (a label value of zero). The LSR at the penultimate hop forwards MPLS packets with a NULL label instead of forwarding IP packets.



Note

An explicit NULL label is not needed when the penultimate hop receives MPLS packets with a label stack that contains at least two labels and penultimate hop popping is performed. In that case, the inner label can still carry the QoS value needed by the penultimate and edge LSR to implement their QoS policy.

When you issue the **mpls ldp explicit-null** command, Explicit Null is advertised in place of Implicit Null for directly connected prefixes.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **interface** *type slot / subslot / port* [*, subinterface-number*]
6. **mpls ip**
7. **exit**
8. **mpls ldp explicit-null** [**for** *prefix-acl* | **to** *peer-acl* | **for** *prefix-acl to peer-acl*]
9. **exit**
10. **show mpls forwarding-table** [*network {mask | length}* | **labels** *label* [- *label*] | **interface** *interface* | *next-hop address* | **lsp-tunnel**[*tunnel-id*]] [**vrf** *vpn-name*] [**detail**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3 <code>mpls ip</code></p> <p>Example:</p> <pre>Router(config)# mpls ip</pre>	<p>Configures MPLS hop-by-hop forwarding globally.</p> <ul style="list-style-type: none"> The mpls ip command is enabled by default; you do not have to specify this command. Globally enabling MPLS forwarding does not enable it on the router interfaces. You must enable MPLS forwarding on the interfaces as well as for the router.
<p>Step 4 <code>mpls label protocol ldp</code></p> <p>Example:</p> <pre>Router(config)# mpls label protocol ldp</pre>	<p>Configures the use of LDP on all interfaces.</p>
<p>Step 5 <code>interface type slot / subslot / port [, subinterface-number]</code></p> <p>Example:</p> <pre>Router(config)# interface atm2/2/0</pre>	<p>Specifies the interface to be configured and enters interface configuration mode.</p>
<p>Step 6 <code>mpls ip</code></p> <p>Example:</p> <pre>Router(config-if)# mpls ip</pre>	<p>Configures MPLS hop-by-hop forwarding on the interface.</p> <ul style="list-style-type: none"> You must enable MPLS forwarding on the interfaces as well as for the router.
<p>Step 7 <code>exit</code></p> <p>Example:</p> <pre>Router(config-if)# exit</pre>	<p>Exits interface configuration mode and enters global configuration mode.</p>
<p>Step 8 <code>mpls ldp explicit-null [for prefix-acl to peer-acl for prefix-acl to peer-acl]</code></p> <p>Example:</p> <pre>Router(config)# mpls ldp explicit-null</pre>	<p>Advertises an Explicit Null label in situations where it would normally advertise an Implicit Null label.</p>
<p>Step 9 <code>exit</code></p> <p>Example:</p> <pre>Router(config)# exit</pre>	<p>Exits global configuration mode and enter privileged EXEC mode.</p>

Command or Action	Purpose
Step 10 <code>show mpls forwarding-table</code> [<i>network</i> { <i>mask</i> <i>length</i> } labels <i>label</i> [- <i>label</i>] interface <i>interface</i> <i>next-hop address</i> lsp-tunnel [<i>tunnel-id</i>] vrf <i>vpn-name</i>] [detail] Example: Router# <code>show mpls forwarding-table</code>	Verifies that MPLS packets are forwarded with an explicit-null label (value of 0).

Examples

Enabling explicit-null on an egress LSR causes that LSR to advertise the explicit-null label to all adjacent MPLS routers.

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

If you issue the `show mpls forwarding-table` command on an adjacent router, the output shows that MPLS packets are forwarded with an explicit-null label (value of 0). In the following example, the second column shows that entries have outgoing labels of 0, where once they were marked "Pop label".

```
Router# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes label  Outgoing   Next Hop
label  label or VC or Tunnel Id  switched    interface
19     Pop tag    10.12.12.12/32  0            Fa2/1/0    172.16.0.1
22     0          10.14.14.14/32  0            Fa2/0/0    192.168.0.2
23     0          172.24.24.24/32 0            Fa2/0/0    192.168.0.2
24     0          192.168.0.0/8   0            Fa2/0/0    192.168.0.2
25     0          10.15.15.15/32  0            Fa2/0/0    192.168.0.2
26     0          172.16.0.0/8   0            Fa2/0/0    192.168.0.2
27     25        10.16.16.16/32  0            Fa2/0/0    192.168.0.22
28     0          10.34.34.34/32  0            Fa2/0/0    192.168.0.2
```

Enabling explicit-null and specifying the `for` keyword with a standard access control list (ACL) changes all adjacent MPLS routers' tables to swap an explicit-null label for only those entries specified in the access-list. In the following example, an access-list is created that contains the 10.24.24.24/32 entry. Explicit null is configured and the access list is specified.

```
Router# configure terminal
Router(config)# mpls label protocol ldp
Router(config)# access-list 24 permit host 10.24.24.24
Router(config)# mpls ldp explicit-null for 24
```

If you issue the `show mpls forwarding-table` command on an adjacent router, the output shows that the only the outgoing labels for the addresses specified (172.24.24.24/32) change from Pop label to 0. All other Pop label outgoing labels remain the same.

```
Router# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes label  Outgoing   Next Hop
label  label or VC or Tunnel Id  switched    interface
19     Pop tag    10.12.12.12/32  0            Fa2/1/0    172.16.0.1
22     0          10.14.14.14/32  0            Fa2/0/0    192.168.0.2
23     0          172.24.24.24/32 0            Fa2/0/0    192.168.0.2
24     0          192.168.0.0/8   0            Fa2/0/0    192.168.0.2
25     0          10.15.15.15/32  0            Fa2/0/0    192.168.0.2
26     0          172.16.0.0/8   0            Fa2/0/0    192.168.0.2
27     25        10.16.16.16/32  0            Fa2/0/0    192.168.0.22
28     0          10.34.34.34/32  0            Fa2/0/0    192.168.0.2
```

Enabling explicit null and adding the **to** keyword and an access list enables you to advertise explicit-null labels to only those adjacent routers specified in the access-list. To advertise explicit-null to a particular router, you must specify the router's LDP ID in the access-list.

In the following example, an access-list contains the 10.15.15.15/32 entry, which is the LDP ID of an adjacent MPLS router. The router that is configured with explicit null advertises explicit-null labels only to that adjacent router.

```
Router# show mpls ldp discovery
Local LDP Identifier:
  10.15.15.15:0
Discovery Sources:
  Interfaces:
    FastEthernet2/0/0(ldp): xmit/recv
      TDP Id: 10.14.14.14:0
Router# configure terminal
Router(config)# mpls label protocol ldp
Router(config)# access-list 15 permit host 10.15.15.15
Router(config)# mpls ldp explicit-null to 15
```

If you issue the **show mpls forwarding-table** command, the output shows that explicit null labels are going only to the router specified in the access list.

```
Router# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes label  Outgoing   Next Hop
label  label or VC or Tunnel Id  switched     interface
19     Pop tag    10.12.12.12/32  0            Fa2/1/0    172.16.0.1
22     0         10.14.14.14/32  0            Fa2/0/0    192.168.0.2
23     0         172.24.24.24/32 0            Fa2/0/0    192.168.0.2
24     0         192.168.0.0/8   0            Fa2/0/0    192.168.0.2
25     0         10.15.15.15/32  0            Fa2/0/0    192.168.0.2
26     0         172.16.0.0/8    0            Fa2/0/0    192.168.0.2
27     25        10.16.16.16/32  0            Fa2/0/0    192.168.0.22
28     0         10.34.34.34/32  0            Fa2/0/0    192.168.0.2
```

Enabling explicit-null with both the **for** and **to** keywords enables you to specify which routes to advertise with explicit-null labels and to which adjacent routers to advertise these explicit-null labels.

```
Router# show access 15
Standard IP access list 15
  permit 10.15.15.15 (7 matches)
Router# show access 24
Standard IP access list 24
  permit 10.24.24.24 (11 matches)
Router# configure terminal
Router(config)# mpls label protocol ldp
Router(config)# mpls ldp explicit-null for 24 to 15
```

If you issue the **show mpls forwarding-table** command, the output shows that it receives explicit null labels for 10.24.24.24/32.

```
Router# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes label  Outgoing   Next Hop
label  label or VC or Tunnel Id  switched     interface
17     0 <---    10.24.24.24/32  0            Fe2/0/0    172.16.0.1
20     Pop tag    172.16.0.0/8   0            Fe2/0/0    172.16.0.1
21     20        10.12.12.12/32 0            Fe2/0/0    172.16.0.1
22     16        10.0.0.0/8     0            Fe2/0/0    172.16.0.1
23     21        10.13.13.13/32 0            Fe2/0/0    172.16.0.1
25     Pop tag    10.14.14.14/32 0            Fe2/0/0    172.16.0.1
27     Pop tag    192.168.0.0/8  0            Fe2/0/0    172.16.0.1
28     25        10.16.16.16/32 0            Fe2/0/0    172.16.0.1
29     Pop tag    192.168.34.34/32 0            Fe2/0/0    172.16.0.1
```


Protecting Data Between LDP Peers with MD5 Authentication

You can enable authentication between two LDP peers, which verifies each segment sent on the TCP connection between the peers. You must configure authentication on both LDP peers using the same password; otherwise, the peer session is not established.

Authentication uses the Message Digest 5 (MD5) algorithm to verify the integrity of the communication and authenticate the origin of the message.

To enable authentication, issue the **mpls ldp neighbor** command with the **password** keyword. This causes the router to generate an MD5 digest for every segment sent on the TCP connection and check the MD5 digest for every segment received from the TCP connection.

When you configure a password for an LDP neighbor, the router tears down existing LDP sessions and establishes new sessions with the neighbor.

If a router has a password configured for a neighbor, but the neighboring router does not have a password configured, a message such as the following appears on the console who has a password configured while the two routers attempt to establish an LDP session. The LDP session is not established.

```
%TCP-6-BADAUTH: No MD5 digest from [peer's IP address](11003) to [local router's IP address](646)
```

Similarly, if the two routers have different passwords configured, a message such as the following appears on the console. The LDP session is not established.

```
%TCP-6-BADAUTH: Invalid MD5 digest from [peer's IP address](11004) to [local router's IP address] (646)
```

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **mpls ldp neighbor** [*vrf vpn-name*] *ip-address* [**password**[0-7] *password-string*]
6. **exit**
7. **show mpls ldp neighbor** [[*vrf vpn-name*] [*address | interface*] [**detail**] | **all**]

DETAILED STEPS

Command or Action	Purpose
Step 1 enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2 configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3 <code>mpls ip</code></p> <p>Example:</p> <pre>Router(config)# mpls ip</pre>	<p>Configures MPLS hop-by-hop forwarding globally.</p> <ul style="list-style-type: none"> The mpls ip command is enabled by default; you do not have to specify this command. Globally enabling MPLS forwarding does not enable it on the router interfaces. You must enable MPLS forwarding on the interfaces as well as for the router.
<p>Step 4 <code>mpls label protocol ldp</code></p> <p>Example:</p> <pre>Router(config)# mpls label protocol ldp</pre>	<p>Configures the use of LDP on all interfaces.</p>
<p>Step 5 <code>mpls ldp neighbor [vrf vpn-name] ip-address[password[0-7] password-string]</code></p> <p>Example:</p> <pre>Router(config)# mpls ldp neighbor 172.27.0.15 password onethirty9</pre>	<p>Specifies authentication between two LDP peers.</p>
<p>Step 6 <code>exit</code></p> <p>Example:</p> <pre>Router(config)# exit</pre>	<p>Exits global configuration mode and enters privileged EXEC mode.</p>
<p>Step 7 <code>show mpls ldp neighbor [[vrf vpn-name] [address interface] [detail] all]</code></p> <p>Example:</p> <pre>Router# show mpls ldp neighbor detail</pre>	<p>Displays the status of LDP sessions.</p> <p>If the passwords have been set on both LDP peers and the passwords match, the show mpls ldp neighbor command displays that the LDP session was successfully established.</p>

Examples

The following example configures a router with the password cisco:

```
Router> enable
```

```
Router# configure terminal
```

```
Router(config)# mpls ip
Router(config)# mpls label protocol ldp
Router(config)# mpls ldp neighbor 10.1.1.1 password cisco
Router(config)# exit
```

The following example shows that the LDP session between routers was successfully established:

```
Router# show mpls ldp neighbor
Peer LDP Ident: 10.1.1.2:0; Local LDP Ident 10.1.1.1:0
TCP connection: 10.1.1.2.11118 - 10.1.1.1.646
State: Oper; Msgs sent/rcvd: 12/11; Downstream
Up time: 00:00:10
LDP discovery sources:
FastEthernet1/0/0, Src IP addr: 10.20.10.2
Addresses bound to peer LDP Ident:
10.1.1.2    10.20.20.1    10.20.10.2
```

The following **show mpls ldp neighbor detail** command shows that MD5 (shown in bold) is used for the LDP session.

```
Router# show mpls ldp neighbor 10.0.0.21 detail
Peer LDP Ident: 10.0.0.21:0; Local LDP Ident 10.0.0.22:0
TCP connection: 10.0.0.21.646 - 10.0.0.22.14709; MD5 on
State: Oper; Msgs sent/rcvd: 1020/1019; Downstream; Last TIB rev sent 2034
Up time: 00:00:39; UID: 3; Peer Id 1;
LDP discovery sources:
FastEthernet1/1/0; Src IP addr: 172.16.1.1
holdtime: 15000 ms, hello interval: 5000 ms
Addresses bound to peer LDP Ident:
10.0.0.21    10.0.38.28    10.88.88.2    172.16.0.1
172.16.1.1
Peer holdtime: 180000 ms; KA interval: 60000 ms; Peer state: estab
```

Configuration Examples for MPLS Label Distribution Protocol

- [Configuring Directly Connected MPLS LDP Sessions Example, page 19](#)
- [Establishing Nondirectly Connected MPLS LDP Sessions Example, page 21](#)

Configuring Directly Connected MPLS LDP Sessions Example

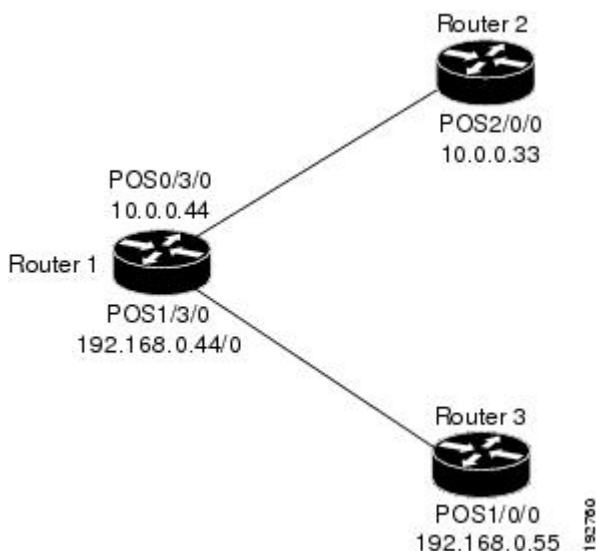
The figure below shows a sample network for configuring directly connected LDP sessions.

This example configures the following:

- MPLS hop-by-hop forwarding for the POS links between Router 1 and Router 2 and between Router 1 and Router 3.
- LDP for label distribution between Router 1 and Router 2.
- TDP for label distribution between Router 1 and Router 3.

- A loopback interface and IP address for each LSR that can be used as the LDP router ID.

Figure 1 Configuration of MPLS LDP



Note

The configuration examples below show only the commands related to configuring LDP for Router 1, Router 2, and Router 3 in the sample network shown in the figure above.

Router 1 Configuration

```

ip cef distributed                               !Assumes R1 supports distributed CEF
interface Loopback0                             !Loopback interface for LDP ID.
ip address 172.16.0.11 255.255.255.255
!
interface POS0/3/0
ip address 10.0.0.44 255.0.0.0
mpls ip                                         !Enable hop-by-hop MPLS forwarding
mpls label protocol ldp
!
interface POS1/3/0
ip address 192.168.0.44 255.0.0.0
mpls ip                                         !Enable hop-by-hop MPLS forwarding
mpls label protocol ldp

```

Router 2 Configuration

```

ip cef distributed                               !Assumes R2 supports distributed CEF
!
interface Loopback0                             !Loopback interface for LDP ID.
ip address 172.16.0.22 255.255.255.255
!
interface POS2/0/0
ip address 10.0.0.33 255.0.0.0
mpls ip                                         !Enable hop-by-hop MPLS forwarding
mpls label protocol ldp

```

Router 3 Configuration

```

ip cef                                !Assumes R3 does not support dCEF
!
interface Loopback0                   !Loopback interface for LDP ID.
ip address 172.16.0.33 255.255.255.255
!
interface POS1/0/0
ip address 192.168.0.55 255.0.0.0
mpls ip                                !Enable hop-by-hop MPLS forwarding
mpls label protocol ldp

```

The LDP configuration for Router 1 uses the **mpls label protocol ldp** command in interface configuration mode. To specify LDP for all interfaces, use the **mpls label protocol ldp** command in global configuration mode without any interface **mpls label protocol** commands.

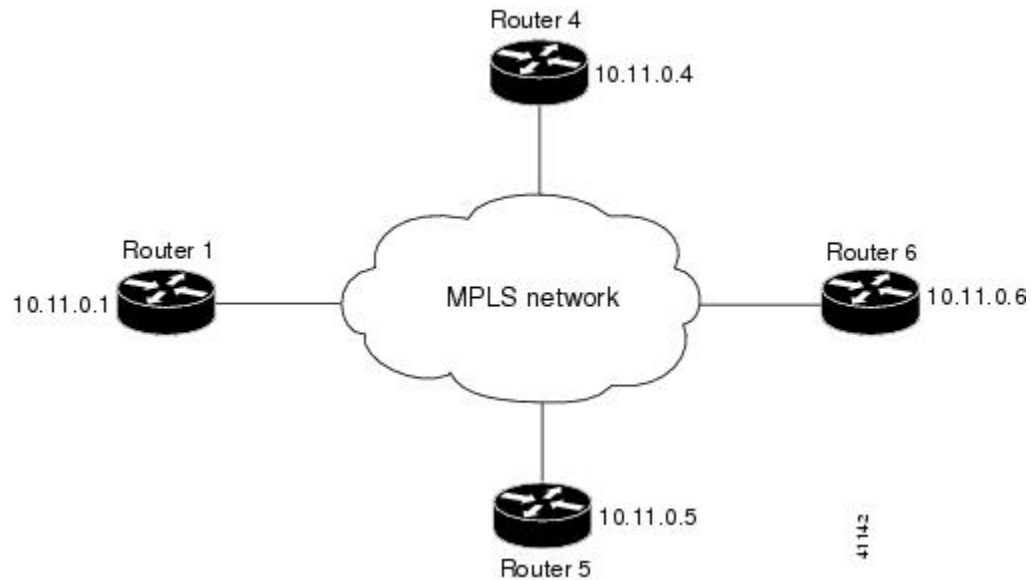
The configuration of Router 2 also uses the **mpls label protocol ldp** command in interface configuration mode. To specify LDP for all interfaces, use the **mpls label protocol ldp** command in global configuration mode without any interface **mpls label protocol** commands.

Configuring the **mpls ip** command on an interface triggers the transmission of discovery Hello messages for the interface.

Establishing Nondirectly Connected MPLS LDP Sessions Example

The following examples illustrate the configuration of platforms for MPLS LDP nondirectly connected sessions using the sample network shown in the figure below. Note that Routers 1, 4, 5, and 6 in this sample network are not directly connected to each other.

Figure 2 Sample Network for Configuring LDP for Targeted Sessions



The configuration example shows the following:

- Targeted sessions between Routers 1 and 4 use LDP. Routers 1 and 4 are both active.
- Targeted sessions between Routers 1 and 6 use LDP. Router 1 is active and Router 6 is passive.
- Targeted sessions between Routers 1 and 5 use LDP. Router 5 is active.

These examples assume that the active ends of the nondirectly connected sessions are associated with tunnel interfaces, such as MPLS traffic engineering tunnels. They show only the commands related to configuring LDP targeted sessions. The examples do not show configuration of the applications that initiate the targeted sessions.

Router 1 Configuration

Tunnel interfaces Tunnel14 and Tunnel16 specify LDP for targeted sessions associated with these interfaces. The targeted session for Router 5 requires TDP. The **mpls label protocol ldp** command in global configuration mode makes it unnecessary to explicitly specify LDP as part of the configuration from the Tunnel14 and Tunnel16.

```
ip cef distributed          !Router1 supports distributed CEF
mpls label protocol ldp   !Use LDP for all interfaces
interface Loopback0       !Loopback interface for LDP ID.
ip address 10.25.0.11 255.255.255.255
interface Tunnel14        !Tunnel to Router 4 requiring label distribution
tunnel destination 10.11.0.4 !Tunnel endpoint is Router 4
mpls ip                   !Enable hop-by-hop forwarding on the interface
interface Tunnel15        !Tunnel to Router 5 requiring label distribution
tunnel destination 10.11.0.5 !Tunnel endpoint is Router 5
mpls label protocol ldp   !Use LDP for session with Router 5
mpls ip                   !Enable hop-by-hop forwarding on the interface
interface Tunnel16        !Tunnel to Router 6 requiring label distribution
tunnel destination 10.11.0.6 !Tunnel endpoint is Router 6
mpls ip                   !Enable hop-by-hop forwarding on the interface
```

Router 4 Configuration

The **mpls label protocol ldp** command in global configuration mode makes it unnecessary to explicitly specify LDP as part of the configuration for the Tunnel41 targeted session with Router 1.

```
ip cef distributed          !Router 4 supports distributed CEF
mpls label protocol ldp   !Use LDP for all interfaces
interface Loopback0       !Loopback interface for LDP ID.
ip address 10.25.0.44 255.255.255.255
interface Tunnel41        !Tunnel to Router 1 requiring label distribution
tunnel destination 10.11.0.1 !Tunnel endpoint is Router 1
mpls ip                   !Enable hop-by-hop forwarding on the interface
```

Router 5 Configuration

Router 5 uses LDP for all targeted sessions. Therefore, its configuration includes the **mpls label protocol ldp** command.

```
ip cef                     !Router 5 supports CEF
mpls label protocol ldp   !Use LDP for all interfaces
interface Loopback0       !Loopback interface for LDP ID.
ip address 10.25.0.55 255.255.255.255
interface Tunnel51        !Tunnel to Router 1 requiring label distribution
tunnel destination 10.11.0.1 !Tunnel endpoint is Router 1
mpls ip                   !Enable hop-by-hop forwarding on the interface
```

Router 6 Configuration

By default, a router cannot be a passive neighbor in targeted sessions. Therefore, Router 1, Router 4, and Router 5 are active neighbors in any targeted sessions. The **mpls ldp discovery targeted-hello accept** command permits Router 6 to be a passive target in targeted sessions with Router 1. Router 6 can also be an active neighbor in targeted sessions, although the example does not include such a configuration.

```
ip cef distributed          !Router 6 supports distributed CEF
interface Loopback0       !Loopback interface for LDP ID.
```

```

ip address 10.25.0.66 255.255.255.255
mpls ldp discovery targeted-hellos accept from LDP_SOURCES
!Respond to requests for targeted hellos
!from sources permitted by acl LDP_SOURCES
!Define acl for targeted hello sources.
ip access-list standard LDP_SOURCES
permit 10.11.0.1
deny any
!Accept targeted hello request from Router 1.
!Deny requests from other sources.

```

Additional References

The following sections provide references related to the MPLS Label Distribution Protocol feature.

Related Documents

Related Topic	Document Title
Configures LDP on every interface associated with a specified IGP instance.	MPLS LDP Autoconfiguration
Ensures that LDP is fully established before the IGP path is used for switching.	MPLS LDP-IGP Synchronization
Allows ACLs to control the label bindings that an LSR accepts from its peer LSRs.	MPLS LDP Inbound Label Binding Filtering
Enables standard, SNMP-based network management of the label switching features in Cisco IOS XE release software.	MPLS Label Distribution Protocol MIB Version 8 Upgrade
MPLS LDP commands	<i>Cisco IOS Multiprotocol Label Switching Command Reference</i>

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> MPLS Label Distribution Protocol MIB (draft-ietf-mpls-ldp-mib-08.txt) SNMP-VACM-MIB The View-based Access Control Model (ACM) MIB for SNMP 	<p>To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mib</p>

RFCs

RFC	Title
RFC 3036	<i>LDP Specification</i>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Feature Information for MPLS Label Distribution Protocol

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 **Feature Information for MPLS Label Distribution Protocol**

Feature Name	Releases	Feature Information
MPLS Label Distribution Protocol (LDP)	Cisco IOS XE Release 2.1	<p>MPLS Label Distribution Protocol (LDP) enables peer label switch routers (LSRs) in an Multiprotocol Label Switching (MPLS) network to exchange label binding information for supporting hop-by-hop forwarding in an MPLS network. This module explains the concepts related to MPLS LDP and describes how to configure MPLS LDP in a network.</p> <p>In Cisco IOS XE Release 2.1, this feature was implemented on the Cisco ASR 1000 Series Aggregation Services Router.</p> <p>The following commands were introduced or modified: debug mpls atm-ldp failure, mpls label protocol (global configuration), mpls ldp advertise-labels, mpls ldp discovery, mpls ldp neighbor implicit-withdraw, mpls ldp neighbor targeted-session, mpls ldp router-id.</p>

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.



MPLS LDP Session Protection

The MPLS LDP Session Protection feature provides faster Label Distribution Protocol (LDP) convergence when a link recovers following an outage. MPLS LDP Session Protection protects an LDP session between directly connected neighbors or an LDP session established for a traffic engineering (TE) tunnel.

- [Finding Feature Information, page 27](#)
- [Prerequisites for MPLS LDP Session Protection, page 27](#)
- [Restrictions for MPLS LDP Session Protection, page 27](#)
- [Information About MPLS LDP Session Protection, page 28](#)
- [How to Configure MPLS LDP Session Protection, page 29](#)
- [Configuration Examples for MPLS LDP Session Protection, page 33](#)
- [Additional References, page 36](#)
- [Feature Information for MPLS LDP Session Protection, page 37](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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Prerequisites for MPLS LDP Session Protection

Label switch routers (LSRs) must be able to respond to LDP targeted hellos. Otherwise, the LSRs cannot establish a targeted adjacency. All routers that participate in MPLS LDP Session Protection must be enabled to respond to targeted hellos. Both neighbor routers must be configured for session protection or one router must be configured for session protection and the other router must be configured to respond to targeted hellos.

Restrictions for MPLS LDP Session Protection

This feature is not supported under the following circumstances:

- With extended access lists

- With LC-ATM routers

Information About MPLS LDP Session Protection

- [How MPLS LDP Session Protection Works, page 28](#)
- [MPLS LDP Session Protection Customization, page 28](#)

How MPLS LDP Session Protection Works

MPLS LDP Session Protection maintains LDP bindings when a link fails. MPLS LDP sessions are protected through the use of LDP hello messages. When you enable MPLS LDP, the LSRs send messages to find other LSRs with which they can create LDP sessions.

If the LSR is one hop from its neighbor, it is directly connected to its neighbor. The LSR sends out LDP Hello messages as User Datagram Protocol (UDP) packets to all the routers on the subnet. The hello message is called an LDP Link Hello. A neighboring LSR responds to the hello message and the two routers begin to establish an LDP session.

If the LSR is more than one hop from its neighbor, it is not directly connected to its neighbor. The LSR sends out a directed hello message as a UDP packet, but as a unicast message specifically addressed to that specific LSR. The hello message is called an LDP Targeted Hello. The nondirectly connected LSR responds to the Hello message and the two routers establish an LDP session. (If the path between two LSRs has been traffic engineered and has LDP enabled, the LDP session between them is called a targeted session.)

MPLS LDP Session Protection uses LDP Targeted Hellos to protect LDP sessions. For example, two directly connected routers have LDP enabled and can reach each other through alternate IP routes in the network. An LDP session that exists between two routers is called an LDP Link Hello Adjacency. When MPLS LDP Session Protection is enabled, an LDP Targeted Hello Adjacency is also established for the LDP session. If the link between the two routers fails, the LDP Link Adjacency also fails. However, if the LDP peer is still reachable through IP, the LDP session stays up, because the LDP Targeted Hello Adjacency still exists between the routers. When the directly connected link recovers, the session does not need to be reestablished, and LDP bindings for prefixes do not need to be relearned.

MPLS LDP Session Protection Customization

You can modify MPLS LDP Session Protection by using keywords in the `mpls ldp session protection` command. The following sections explain how to customize the feature:

- [How Long an LDP Targeted Hello Adjacency Should Be Retained, page 28](#)
- [Which Routers Should Have MPLS LDP Session Protection, page 29](#)

How Long an LDP Targeted Hello Adjacency Should Be Retained

The default behavior of the `mpls ldp session protection` command allows an LDP Targeted Hello Adjacency to exist indefinitely following the loss of an LDP Link Hello Adjacency. You can issue the **duration** keyword to specify the number of seconds (from 30 to 2,147,483) that the LDP Targeted Hello Adjacency is retained after the loss of the LDP Link Hello Adjacency. When the link is lost, a timer starts. If the timer expires, the LDP Targeted Hello Adjacency is removed.

Which Routers Should Have MPLS LDP Session Protection

The default behavior of the `mpls ldp session protection` command allows MPLS LDP Session Protection for all neighbor sessions. You can issue either the `vrf for` keyword to limit the number of neighbor sessions that are protected:

- You can use the `vrf` keyword to select which VRF is to be protected, if the router is configured with at least one VPN routing and forwarding (VRF) instance. You cannot specify more than one VRF with the `mpls ldp session protection` command. To specify multiple VRFs, issue the command multiple times.
- You can create an access list that includes several peer routers. You can specify that access list with the `for` keyword to enable LDP Session Protection for the peer routers in the access control list.

How to Configure MPLS LDP Session Protection

- [Enabling MPLS LDP Session Protection, page 29](#)
- [Verifying MPLS LDP Session Protection, page 32](#)

Enabling MPLS LDP Session Protection

To enable MPLS LDP session protection, perform the following task.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `ip cef distributed`
4. `interface loopback number`
5. `ip address prefix mask`
6. `exit`
7. `interface type slot / subslot / port [, subinterface-number]`
8. `mpls ip`
9. `mpls label protocol ldp`
10. `exit`
11. `mpls ldp session protection [vrf vpn-name] [for acl] [duration {infinite | seconds}]`
12. `exit`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip cef distributed Example: Router(config)# ip cef distributed	Configures distributed Cisco Express Forwarding.
Step 4	interface loopback number Example: Router(config)# interface Loopback0	Configures a loopback interface and enters interface configuration mode.
Step 5	ip address <i>prefix mask</i> Example: Router(config-if)# ip address 10.25.0.11 255.255.255.255	Assigns an IP address to the loopback interface.
Step 6	exit Example: Router(config-if) exit	Exits to global configuration mode.
Step 7	interface <i>type slot / subslot / port</i> [, <i>subinterface-number</i>] Example: Router(config)# interface POS0/3/0	Specifies the interface to configure and enters interface configuration mode.

	Command or Action	Purpose
Step 8	mpls ip Example: <pre>Router(config-if)# mpls ip</pre>	Configures MPLS hop-by-hop forwarding for a specified interface.
Step 9	mpls label protocol ldp Example: <pre>Router(config-if)# mpls label protocol ldp</pre>	Configures the use of LDP on a specific interface or on all interfaces. <ul style="list-style-type: none"> • In interface configuration mode, the command sets the the label distribution protocol for the interface. • In global configuration mode, the command sets all the interfaces to LDP.
Step 10	exit Example: <pre>Router(config-if)# exit</pre>	Exits from interface configuration mode and returns to global configuration mode.
Step 11	mpls ldp session protection [vrf <i>vpn-name</i>] [for <i>acl</i>] [duration { infinite <i>seconds</i> }] Example: <pre>Router(config)# mpls ldp session protection</pre>	Enables MPLS LDP session protection. <ul style="list-style-type: none"> • The vrf <i>vpn-name</i> keyword-argument pair protects LDP sessions for a specified VRF. • The for <i>acl</i> keyword-argument pair specifies a standard IP access control list (ACL) of prefixes to be protected. • The duration keyword specifies how long the router should retain the LDP Targeted Hello Adjacency following the loss of the LDP Link Hello Adjacency. • The infinite keyword specifies that the LDP Targeted Hello Adjacency should be retained forever after a link is lost. • The <i>seconds</i> argument specifies the time in seconds that the LDP Targeted Hello Adjacency should be retained after a link is lost. The valid range of values is 30 to 2,147,483 seconds. The mpls ldp session protection command entered without a keyword protects all LDP sessions.
Step 12	exit Example: <pre>Router(config)# exit</pre>	Exits to privileged EXEC mode.

- [Troubleshooting Tips, page 31](#)

Troubleshooting Tips

Use the **clear mpls ldp neighbor** command if you need to terminate an LDP session after a link goes down. This is useful for situations where the link needs to be taken out of service or needs to be connected to a different neighbor.

To enable the display of events related to MPLS LDP Session Protection, use the **debug mpls ldp session protection** command.

Verifying MPLS LDP Session Protection

To verify that LDP Session Protection has been correctly configured, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **show mpls ldp discovery**
3. **show mpls ldp neighbor**
4. **show mpls ldp neighbor detail**
5. **exit**

DETAILED STEPS

Step 1 enable

Use this command to enable privileged EXEC mode. Enter your password, if prompted. For example:

Example:

```
Router> enable
Router#
```

Step 2 show mpls ldp discovery

Use this command to verify that the output contains the term xmit/recv for the peer router. For example:

Example:

```
Router# show mpls ldp discovery
Local LDP Identifier:
 10.0.0.5:0
Discovery Sources:
Interfaces:
  ATM50/1/0.5 (ldp): xmit/recv
  LDP Id: 10.0.0.1:0
Targeted Hellos:
 10.0.0.5 -> 10.0.0.3 (ldp): active, xmit/recv
  LDP Id: 10.0.0.3:0
```

Step 3 show mpls ldp neighbor

Use this command to verify that the targeted hellos are active. For example:

Example:

```
Router# show mpls ldp neighbor

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

```

Step 4 `show mpls ldp neighbor detail`

Use this command to verify that the MPLS LDP Session Protection state is Ready or Protecting. If the second last line of the output shows Incomplete, the Targeted Hello Adjacency is not up yet. For example:

Example:

```

Router# show mpls ldp neighbor detail
Peer LDP Ident: 10.16.16.16:0; Local LDP Ident 10.15.15.15:0
TCP connection: 10.16.16.16.11013 - 10.15.15.15.646
State: Oper; Msgs sent/rcvd: 53/51; Downstream; Last TIB rev sent 74
Up time: 00:11:32; UID: 1; Peer Id 0;
LDP discovery sources:
  Targeted Hello 10.15.15.15 -> 10.16.16.16, active, passive;
    holdtime: infinite, hello interval: 10000 ms
Addresses bound to peer LDP Ident:
  10.0.0.2      10.16.16.16      10.101.101.101 11.0.0.1
Peer holdtime: 180000 ms; KA interval: 60000 ms; Peer state: estab
Clients: Dir Adj Client
LDP Session Protection enabled, state: Protecting
duration: infinite

```

Step 5 `exit`

Use this command to exit to user EXEC. For example:

Example:

```

Router# exit
Router>

```

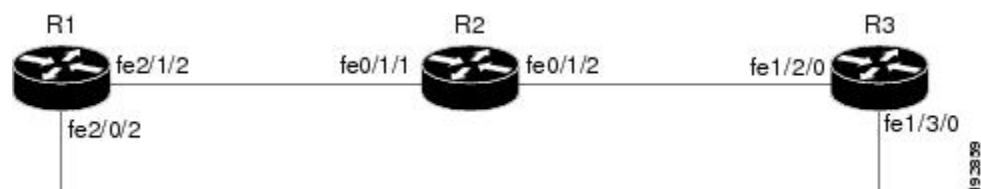
Configuration Examples for MPLS LDP Session Protection

- [Configuring MPLS LDP Session Protection Example, page 33](#)

Configuring MPLS LDP Session Protection Example

The figure below shows a sample configuration for MPLS LDP Session Protection.

Figure 3 MPLS LDP Session Protection Example



The following configuration examples for R1, R2, and R3 are based on the figure above.

R1

```

redundancy
  no keepalive-enable
  mode hsa
!
ip cef distributed
no ip domain-lookup
multilink bundle-name both
mpls label protocol ldp
mpls ldp session protection
no mpls traffic-eng auto-bw timers frequency 0
mpls ldp router-id Loopback0 force
!
interface Loopback0
 ip address 10.0.0.1 255.255.255.255
 no ip directed-broadcast
 no ip mroute-cache
!
interface Multilink4
 no ip address
 no ip directed-broadcast
 no ip mroute-cache
 load-interval 30
 ppp multilink
 multilink-group 4
!
interface FastEthernet1/0/0
 ip address 10.3.123.1 255.255.0.0
 no ip directed-broadcast
!
interface FastEthernet2/0/0
 no ip address
 no ip directed-broadcast
 shutdown
!
interface FastEthernet2/0/1
 description -- ip address 10.0.0.2 255.255.255.0
 no ip address
 no ip directed-broadcast
 shutdown
!
interface FastEthernet2/0/2
 ip address 10.0.0.1 255.0.0.0
 no ip directed-broadcast
 mpls label protocol ldp
 mpls ip
!
interface FastEthernet2/1/2
 ip address 10.0.0.1 255.0.0.0
 no ip directed-broadcast
 mpls label protocol ldp
 mpls ip
!
interface FastEthernet2/2/2
 ip address 10.0.0.1 255.0.0.0
 no ip directed-broadcast
 mpls label protocol ldp
 mpls ip
!
router ospf 100
 log-adjacency-changes
 redistribute connected
 network 10.0.0.1 0.0.0.0 area 100
 network 10.0.0.0 0.255.255.255 area 100
 network 10.0.0.0 0.255.255.255 area 100
 network 10.0.0.0 0.255.255.255 area 100
 network 10.0.0.0 0.255.255.255 area 100
!
ip classless

```

R2

```

redundancy
  no keepalive-enable
  mode hsa
!
ip subnet-zero
ip cef distributed
mpls label protocol ldp
mpls ldp session protection
no mpls traffic-eng auto-bw timers frequency 0
mpls ldp router-id Loopback0 force
!
interface Loopback0
  ip address 10.0.0.3 255.255.255.255
  no ip directed-broadcast
!
interface FastEthernet0/1/0
  no ip address
  no ip directed-broadcast
  shutdown
  full-duplex
!
interface FastEthernet0/1/2
  ip address 10.0.0.1 255.0.0.0
  no ip directed-broadcast
  full-duplex
  mpls label protocol ldp
  mpls ip
!
interface FastEthernet0/1/1
  ip address 10.0.0.2 255.0.0.0
  no ip directed-broadcast
  ip load-sharing per-packet
  full-duplex
  mpls label protocol ldp
  mpls ip
!
interface FastEthernet0/2/0
  ip address 10.3.123.112 255.255.0.0
  no ip directed-broadcast
!
router ospf 100
  log-adjacency-changes
  redistribute connected
  network 10.0.0.3 0.0.0.0 area 100
  network 10.0.0.0 0.255.255.255 area 100
  network 10.0.0.0 0.255.255.255 area 100
!
ip classless

```

R3

```

ip cef distributed
no ip domain-lookup
mpls label range 200 100000 static 16 199
mpls label protocol ldp
no mpls traffic-eng auto-bw timers frequency 0
mpls ldp router-id Loopback0 force
!
interface Loopback0
  ip address 10.0.0.5 255.255.255.255
  no ip directed-broadcast
!
interface FastEthernet1/0/0
  no ip address
  no ip directed-broadcast
  shutdown
  half-duplex
!
interface FastEthernet1/2/0

```

```

ip address 10.0.0.2 255.0.0.0
no ip directed-broadcast
full-duplex
mpls label protocol ldp
mpls ip
!
interface FastEthernet1/3/0
ip address 10.0.0.2 255.0.0.0
no ip directed-broadcast
full-duplex
mpls label protocol ldp
mpls ip
!
router ospf 100
log-adjacency-changes
redistribute connected
network 10.0.0.5 0.0.0.0 area 100
network 10.0.0.0 0.255.255.255 area 100
network 10.0.0.0 0.255.255.255 area 100
!
ip classless

```

Additional References

The following sections provide references related to the MPLS LDP Session Protection feature.

Related Documents

Related Topic	Document Title
MPLS LDP	MPLS Label Distribution Protocol
MPLS LDP-IGP synchronization	MPLS LDP-IGP Synchronization
LDP autoconfiguration	LDP Autoconfiguration
MPLS LDP commands	<i>Cisco IOS Multiprotocol Label Switching Command Reference</i>

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
MPLS LDP MIB	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 3036	LDP Specification
RFC 3037	LDP Applicability

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for MPLS LDP Session Protection

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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Table 2 **Feature Information for MPLS LDP Session Protection**

Feature Name	Releases	Feature Information
MPLS LDP Session Protection	Cisco IOS XE Release 2.1	<p>The MPLS LDP Session Protection feature provides faster label distribution protocol convergence when a link recovers following an outage. MPLS LDP Session Protection protects a label distribution protocol (LDP) session between directly connected neighbors or an LDP session established for a traffic engineering (TE) tunnel.</p> <p>In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were introduced or modified: debug mpls ldp session protection, mpls ldp session protection, show mpls ldp neighbor.</p>

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MPLS LDP Autoconfiguration

The MPLS LDP Autoconfiguration feature enables you to globally configure Label Distribution Protocol (LDP) on every interface associated with a specified Interior Gateway Protocol (IGP) instance.

- [Finding Feature Information, page 39](#)
- [Restrictions for MPLS LDP Autoconfiguration, page 39](#)
- [Information About MPLS LDP--Autoconfiguration, page 40](#)
- [How to Configure MPLS LDP Autoconfiguration, page 40](#)
- [Configuration Examples for MPLS LDP Autoconfiguration, page 48](#)
- [Additional References, page 49](#)
- [Feature Information for MPLS LDP-VRF-Aware Static Labels, page 51](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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Restrictions for MPLS LDP Autoconfiguration

- In Cisco IOS Release 12.0(32)SY, the **mpls ldp autoconfig** command is supported only with OSPF. Other IGPs are not supported.
- If LDP is disabled globally, the **mpls ldp autoconfig** command fails and generates a console message explaining that LDP must first be enabled globally by means of the global **mpls ip** command.
- If the **mpls ldp autoconfig** command is configured for an IGP instance, you cannot issue the global **no mpls ip** command. To disable LDP, you must first issue the **no mpls ldp autoconfig** command.
- For interfaces running IS-IS processes, you can enable Multiprotocol Label Switching (MPLS) for each interface, using the router mode command **mpls ldp autoconfig** or **mpls ldp igp autoconfig** at the interface level.
- You specify that the default label distribution protocol is LDP for a router or for an interface. Tag Distribution Protocol (TDP) is not supported.
- The MPLS LDP Autoconfiguration feature is not supported on traffic engineering tunnel interfaces.

Information About MPLS LDP--Autoconfiguration

- [MPLS LDP--Autoconfiguration Overview, page 40](#)

MPLS LDP--Autoconfiguration Overview

To enable LDP, you should configure it globally and on each interface where it is needed. Configuring LDP on many interfaces can be time consuming.

The MPLS LDP--Autoconfiguration feature enables you to globally enable LDP on every interface associated with an IGP instance. This feature is supported on OSPF and IS-IS IGPs. Further, it provides a means to block LDP from being enabled on interfaces that you do not want enabled. The goal of the MPLS LDP--Autoconfiguration feature is to make configuration easier, faster, and error free.

You issue the **mpls ldp autoconfig** command to enable LDP on each interface that is running an OSPF or IS-IS process. If you do not want some of the interfaces to have LDP enabled, you can issue the **no** form of the **mpls ldp igp autoconfig** command on those interfaces.

How to Configure MPLS LDP Autoconfiguration

- [Configuring MPLS LDP-Autoconfiguration with OSPF Interfaces, page 40](#)
- [Disabling MPLS LDP Autoconfiguration from Selected OSPF Interfaces, page 42](#)
- [Verifying MPLS LDP Autoconfiguration with OSPF, page 43](#)
- [Configuring MPLS LDP Autoconfiguration with IS-IS Interfaces, page 45](#)
- [Disabling MPLS LDP Autoconfiguration from Selected IS-IS Interfaces, page 47](#)

Configuring MPLS LDP-Autoconfiguration with OSPF Interfaces

To configure MPLS LDP-Autoconfiguration with OSPF interfaces, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **interface** *type slot / subslot / port* [*. subinterface-number*]
6. **ip address** *prefix mask*
7. **mpls ip**
8. **exit**
9. **router ospf** *process-id*
10. **network** *ip-address wildcard-mask area area-id*
11. **mpls ldp sync**
12. **exit**
13. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
Step 3	<p>mpls ip</p> <p>Example:</p> <pre>Router(config)# mpls ip</pre>	<p>Globally enables hop-by-hop forwarding.</p>
Step 4	<p>mpls label protocol ldp</p> <p>Example:</p> <pre>Router(config)# mpls label protocol ldp</pre>	<p>Specifies LDP as the default label distribution protocol.</p>
Step 5	<p>interface <i>type slot / subslot / port</i> [<i>. subinterface-number</i>]</p> <p>Example:</p> <pre>Router(config)# interface POS0/3/0</pre>	<p>Specifies the interface to configure and enters interface configuration mode.</p>
Step 6	<p>ip address <i>prefix mask</i></p> <p>Example:</p> <pre>Router(config-if)# ip address 10.25.0.11 255.255.255.255</pre>	<p>Assigns an IP address to the interface.</p>
Step 7	<p>mpls ip</p> <p>Example:</p> <pre>Router(config-if)# mpls ip</pre>	<p>Enables hop-by-hop forwarding on the interface.</p>

	Command or Action	Purpose
Step 8	exit Example: <pre>Router(config-if)# exit</pre>	Exits interface configuration mode.
Step 9	router ospf <i>process-id</i> Example: <pre>Router(config)# router ospf 1</pre>	Enables OSPF routing and enters router configuration mode.
Step 10	network <i>ip-address wildcard-mask area area-id</i> Example: <pre>Router(config-router)# network 10.0.0.0 0.255.255.255 area 3</pre>	Defines an interface on which OSPF runs and defines the area ID for that interface.
Step 11	mpls ldp sync Example: <pre>Router(config-router)# mpls ldp sync</pre>	Enables MPLS LDP-IGP synchronization for interfaces for an OSPF or an IS-IS process.
Step 12	exit Example: <pre>Router(config-router)# exit</pre>	Exits router configuration mode and returns to global configuration mode.
Step 13	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode and returns to privileged EXEC mode.

Disabling MPLS LDP Autoconfiguration from Selected OSPF Interfaces

When you issue the **mpls ldp autoconfig** command, all the interfaces that belong to an OSPF area are enabled for LDP. To remove LDP from some interfaces, use the **no mpls ldp igp autoconfig** command on those interfaces. The following configuration steps show how to disable LDP from some of the interfaces after they were configured with the MPLS LDP Autoconfiguration feature with the **mpls ldp autoconfig** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no mpls ldp igp autoconfig**
5. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2 configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3 interface <i>type number</i> Example: Router(config)# interface POS 3/0	Specifies the interface to configure and enters interface configuration mode.
Step 4 no mpls ldp igp autoconfig Example: Router(config-if)# no mpls ldp igp autoconfig	Disables LDP for that interface.
Step 5 end Example: Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Verifying MPLS LDP Autoconfiguration with OSPF

The following steps explain how to verify the MPLS LDP Autoconfiguration feature.

SUMMARY STEPS

1. **enable**
2. **show mpls interfaces** [*type number* / **vrf vpn-name**][**all**] [**detail**] [**internal**]
3. **show mpls ldp discovery** [**vrf vpn-name** / **all**] [**detail**]

DETAILED STEPS

Step 1

enable

Enables privileged EXEC mode. Enter your password if prompted.

Step 2

show mpls interfaces [*type number* / **vrf vpn-name**][**all**] [**detail**] [**internal**]

The **show mpls interfaces** command displays the method used to enable LDP on an interface:

- If LDP is enabled by the **mpls ldp autoconfig** command, the output displays:

Example:

```
IP labeling enabled (ldp):
  IGP config
```

- If LDP is enabled by the **mpls ip** command, the output displays:

Example:

```
IP labeling enabled (ldp):
  Interface config
```

- If LDP is enabled by the **mpls ip** command and the **mpls ldp autoconfig** command, the output displays:

Example:

```
IP labeling enabled (ldp):
  Interface config
  IGP config
```

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

Example:

```
Router# show mpls interfaces Serial 2/0 detail

Interface Serial2/0:
  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
```

Step 3 `show mpls ldp discovery [vrf vpn-name / all] [detail]`

The `show mpls ldp discovery detail` command also shows how LDP was enabled on the interface. In the following example, LDP was enabled by both the `mpls ip` and `mpls ldp autoconfig` commands:

Example:

```
Router# show mpls ldp discovery detail
Local LDP Identifier:
 10.11.11.11:0
Discovery Sources:
Interfaces:
  Serial2/0 (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
```

Configuring MPLS LDP Autoconfiguration with IS-IS Interfaces

The following steps explain how to configure the MPLS LDP Autoconfiguration feature for interfaces that are running IS-IS processes.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface type number`
4. `ip address prefix mask`
5. `ip router isis`
6. `exit`
7. `mpls ip`
8. `mpls label protocol ldp`
9. `router isis`
10. `mpls ldp autoconfig [level-1 | level-2]`
11. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
Step 3	<p>interface type number</p> <p>Example:</p> <pre>Router(config)# interface POS 0/2</pre>	<p>Specifies the interface to configure and enters interface configuration mode.</p>
Step 4	<p>ip address <i>prefix mask</i></p> <p>Example:</p> <pre>Router(config-if)# ip address 10.50.72.4 255.0.0.0</pre>	<p>Assigns an IP address to the interface.</p>
Step 5	<p>ip router isis</p> <p>Example:</p> <pre>Router(config-if)# ip router isis</pre>	<p>Enables IS-IS for IP on the interface.</p>
Step 6	<p>exit</p> <p>Example:</p> <pre>Router(config-if)# exit</pre>	<p>Exits interface configuration mode.</p>
Step 7	<p>mpls ip</p> <p>Example:</p> <pre>Router(config)# mpls ip</pre>	<p>Globally enables hop-by-hop forwarding.</p>

	Command or Action	Purpose
Step 8	mpls label protocol ldp Example: Router(config)# mpls label protocol ldp	Specifies LDP as the default label distribution protocol.
Step 9	router isis Example: Router(config)# router isis	Enables an IS-IS process on the router and enters router configuration mode.
Step 10	mpls ldp autoconfig [level-1 level-2] Example: Router(config-router)# mpls ldp autoconfig	Enables the LDP for interfaces that belong to an IS-IS process.
Step 11	end Example: Router(config-router)# end	Exits router configuration mode and returns to privileged EXEC mode.

Disabling MPLS LDP Autoconfiguration from Selected IS-IS Interfaces

When you issue the **mpls ldp autoconfig** command, all the interfaces that belong to an IS-IS process are enabled for LDP. To remove LDP from some interfaces, use the **no mpls ldp igp autoconfig** command on those interfaces. The following configuration steps show how to disable LDP from some of the interfaces after they were configured with the MPLS LDP Autoconfiguration feature with the **mpls ldp autoconfig** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no mpls ldp igp autoconfig**
5. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 <code>enable</code> Example: <pre>Router> enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2 <code>configure terminal</code> Example: <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3 <code>interface type number</code> Example: <pre>Router(config)# interface POS 3/0</pre>	Specifies the interface to configure and enters interface configuration mode.
Step 4 <code>no mpls ldp igp autoconfig</code> Example: <pre>Router(config-if)# no mpls ldp igp autoconfig</pre>	Disables LDP for that interface.
Step 5 <code>end</code> Example: <pre>Router(config-if)# end</pre>	Exits interface configuration mode and returns to privileged EXEC mode.

Configuration Examples for MPLS LDP Autoconfiguration

The following sections show examples for the MPLS LDP Autoconfiguration feature with OSPF and IS-IS processes.

- [MPLS LDP Autoconfiguration with IS-IS Examples, page 48](#)
- [MPLS LDP Autoconfiguration with OSPF Example, page 49](#)

MPLS LDP Autoconfiguration with IS-IS Examples

The following example shows the configuration of the MPLS LDP Autoconfiguration feature on POS0/2 and 0/3 interfaces, which are running IS-IS processes:

```
configure terminal
```



```

interface POS 0/2
 ip address 10.0.0.1 255.0.0.1
 ip router isis
!
interface POS 0/3
 ip address 10.1.1.1 255.0.1.0
 ip router isis
 exit

mpls ip

mpls label protocol ldp

router isis
mpls ldp autoconfig

```

MPLS LDP Autoconfiguration with OSPF Example

The following configuration commands enable LDP for OSPF process 1 area 3. The **mpls ldp autoconfig area 3** command and the OSPF **network** commands enable LDP on POS interfaces 0/0, 0/1, and 1/1. The **no mpls ldp igp autoconfig** command on POS interface 1/0 prevents LDP from being enabled on POS interface 1/0, even though OSPF is enabled for that interface.

```

configure terminal
 interface POS 0/0
  ip address 10.0.0.1 255.0.0.0
!
 interface POS 0/1
  ip address 10.0.1.1 255.0.0.1
!
 interface POS 1/1
  ip address 10.1.1.1 255.255.0.0
!
 interface POS 1/0
  ip address 10.1.0.1 0.1.0.255
  exit
!
router ospf 1
 network 10.0.0.0 0.0.255.255 area 3
 network 10.1.0.0 0.0.255.255 area 3
 mpls ldp autoconfig area 3
 end
 interface POS 1/0
  no mpls ldp igp autoconfig

```

Additional References

The following sections provide references related to the MPLS LDP Autoconfiguration feature.

Related Documents

Related Topic	Document Title
MPLS commands	<i>Cisco IOS Multiprotocol Label Switching Command Reference</i>
MPLS LDP	MPLS Label Distribution Protocol

Related Topic	Document Title
The MPLS LDP-IGP Synchronization feature	MPLS LDP-IGP Synchronization
The MPLS LDP Session Protection feature	MPLS LDP Session Protection
Configuring integrated IS-IS	Integrated IS-IS Routing Protocol Overview

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature	--

MIBs

MIB	MIBs Link
MPLS LDP MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 3036	LDP Specification
RFC 3037	LDP Applicability

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for MPLS LDP-VRF-Aware Static Labels

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 3 Feature Information for MPLS LDP-VRF-Aware Static Labels

Feature Name	Releases	Feature Information
MPLS LDP-VRF-Aware Static Labels	Cisco IOS XE Release 2.1	<p>The MPLS LDP-VRF-Aware Static Labels feature explains how to configure the MPLS LDP-VRF-Aware Static Labels feature and MPLS static labels. VRF-aware static labels can be used at the edge of an MPLS VPN, whereas MPLS static labels can be used only in the MPLS VPN provider core.</p> <p>In Cisco IOS XE Release 2.2, this feature was implemented on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were introduced or modified: debug mpls static binding, mpls label range, mpls static binding ipv4, mpls static binding ipv4 vrf, show mpls label range, show mpls static binding ipv4, and show mpls static binding ipv4 vrf.</p>

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MPLS LDP-IGP Synchronization

The MPLS LDP-IGP Synchronization feature ensures that the Label Distribution Protocol (LDP) is fully established before the Interior Gateway Protocol (IGP) path is used for switching.

- [Finding Feature Information, page 53](#)
- [Prerequisites for MPLS LDP-IGP Synchronization, page 53](#)
- [Restrictions for MPLS LDP-IGP Synchronization, page 53](#)
- [Information About MPLS LDP-IGP Synchronization, page 54](#)
- [How to Configure MPLS LDP-IGP Synchronization, page 55](#)
- [Configuration Examples for MPLS LDP-IGP Synchronization, page 66](#)
- [Additional References, page 67](#)
- [Feature Information for MPLS LDP-IGP Synchronization, page 68](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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Prerequisites for MPLS LDP-IGP Synchronization

- This feature is supported only on interfaces running Open Shortest Path First (OSPF) or Intermediate System-to-System (IS-IS) processes.
- This feature works when LDP is enabled on interfaces with either the **mpls ip** or **mpls ldp autoconfig** command.

Restrictions for MPLS LDP-IGP Synchronization

- This feature is not supported on tunnel interfaces or LC-ATM interfaces.
- This feature is not supported with interface-local label space or downstream-on-demand (DoD) requests.

- This feature does not support targeted LDP sessions. Therefore, Any Transport over MPLS (AToM) sessions are not supported.

Information About MPLS LDP-IGP Synchronization

- [How MPLS LDP-IGP Synchronization Works](#), page 54
- [MPLS LDP-IGP Synchronization with Peers](#), page 54
- [MPLS LDP-IGP Synchronization Delay Timer](#), page 55
- [MPLS LDP-IGP Synchronization Incompatibility with IGP Nonstop Forwarding](#), page 55
- [MPLS LDP-IGP Synchronization Compatibility with LDP Graceful Restart](#), page 55

How MPLS LDP-IGP Synchronization Works

Packet loss can occur because the actions of the IGP and LDP are not synchronized. Packet loss can occur in the following situations:

- When an IGP adjacency is established, the router begins forwarding packets using the new adjacency before the LDP label exchange completes between the peers on that link.
- If an LDP session closes, the router continues to forward traffic using the link associated with the LDP peer rather than an alternate pathway with a fully synchronized LDP session.

The MPLS LDP-IGP Synchronization feature does the following:

- Provides a means to synchronize LDP and IGP to minimize Multiprotocol Label Switching (MPLS) packet loss.
- Enables you to globally enable LDP-IGP synchronization on each interface associated with an IGP OSPF or IS-IS process.
- Provides a means to disable LDP-IGP synchronization on interfaces that you do not want enabled.
- Prevents MPLS packet loss due to synchronization conflicts.
- Works when LDP is enabled on interfaces using either the **mpls ipor mpls ldp autoconfig** command.

To enable LDP-IGP synchronization on each interface that belongs to an OSPF or IS-IS process, enter the **mpls ldp sync** command. If you do not want some of the interfaces to have LDP-IGP synchronization enabled, issue the **no mpls ldp igp sync** command on those interfaces.

If the LDP peer is reachable, the IGP waits indefinitely (by default) for synchronization to be achieved. To limit the length of time the IGP session must wait, enter the **mpls ldp igp sync holddown** command. If the LDP peer is not reachable, the IGP establishes the adjacency to enable the LDP session to be established.

When an IGP adjacency is established on a link but LDP-IGP synchronization is not yet achieved or is lost, the IGP advertises the max-metric on that link.

MPLS LDP-IGP Synchronization with Peers

When the MPLS LDP-IGP Synchronization feature is enabled on an interface, LDP determines if any peer connected by the interface is reachable by looking up the peer's transport address in the routing table. If a routing entry (including longest match or default routing entry) for the peer exists, LDP assumes that LDP-IGP synchronization is required for the interface and notifies the IGP to wait for LDP convergence.

LDP-IGP synchronization with peers requires that the routing table be accurate for the peer's transport address. If the routing table shows there is a route for the peer's transport address, that route must be able to

reach the peer's transport address. However, if the route is a summary route, a default route, or a statically configured route, it may not be the correct route for the peer. You must verify that the route in the routing table can reach the peer's transport address.

When the routing table has an inaccurate route for the peer's transport address, LDP cannot set up a session with the peer, which causes the IGP to wait for LDP convergence unnecessarily for the sync hold-down time.

MPLS LDP-IGP Synchronization Delay Timer

The MPLS LDP-IGP Synchronization feature provides the option to configure a delay time for MPLS LDP and IGP synchronization on an interface-by-interface basis. If you want to configure a delay time on an interface, use the **mpls ldp igp sync delay *delay-time*** command in interface configuration mode. To remove the delay timer from a specified interface, enter 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 you did not configure a delay time, if synchronization is disabled or down, or if an interface was removed from an IGP process, LDP stops the timer and immediately notifies the OSPF process.

If you configure a new delay time while a timer is running, LDP saves the new delay time but does not reconfigure the running timer.

MPLS LDP-IGP Synchronization Incompatibility with IGP Nonstop Forwarding

The MPLS LDP-IGP Synchronization feature is not supported during the startup period if IGP nonstop forwarding (NSF) is configured. The MPLS LDP-IGP Synchronization feature conflicts with IGP NSF when the IGP is performing NSF during startup. After the NSF startup is complete, the MPLS LDP-IGP Synchronization feature is supported.

MPLS LDP-IGP Synchronization Compatibility with LDP Graceful Restart

LDP Graceful Restart protects traffic when an LDP session is lost. If an interface that supports a Graceful Restart-enabled LDP session fails, MPLS LDP-IGP synchronization is still achieved on the interface while it is protected by Graceful Restart. MPLS LDP-IGP synchronization is eventually lost under the following circumstances:

- If LDP fails to restart before the LDP Graceful Restart reconnect timer expires.
- If an LDP session restarts through other interfaces, but the LDP session on the protected interface fails to recover when the LDP Graceful Restart recovery timer expires.

How to Configure MPLS LDP-IGP Synchronization

- [Configuring MPLS LDP Autoconfiguration with OSPF Interfaces, page 56](#)
- [Disabling MPLS LDP-IGP Synchronization from Some OSPF Interfaces, page 58](#)
- [Verifying MPLS LDP-IGP Synchronization with OSPF, page 59](#)

- [Configuring MPLS LDP-IGP Synchronization with IS-IS Interfaces, page 60](#)
- [Disabling MPLS LDP-IGP Synchronization from Some IS-IS Interfaces, page 64](#)

Configuring MPLS LDP Autoconfiguration with OSPF Interfaces

The following steps explain how to configure LDP for interfaces running OSPF processes.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **interface *type number***
6. **ip address *prefix mask***
7. **exit**
8. **router ospf *process-id***
9. **network *ip-address wildcard-mask area area-id***
10. **mpls ldp autoconfig [*area area-id*]**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	mpls ip Example: Router(config)# mpls ip	Globally enables hop-by-hop forwarding.

	Command or Action	Purpose
Step 4	mpls label protocol ldp Example: <pre>Router(config)# mpls label protocol ldp</pre>	Specifies LDP as the default label distribution protocol.
Step 5	interface <i>type number</i> Example: <pre>Router(config)# interface POS 3/0</pre>	Specifies the interface to configure and enters interface configuration mode.
Step 6	ip address <i>prefix mask</i> Example: <pre>Router(config-if)# ip address 10.0.0.11 255.255.255.255</pre>	Assigns an IP address to the interface.
Step 7	exit Example: <pre>Router(config-if)# exit</pre>	Exits interface configuration mode.
Step 8	router ospf <i>process-id</i> Example: <pre>Router(config)# router ospf 1</pre>	Enables OSPF routing and enters router configuration mode.
Step 9	network <i>ip-address wildcard-mask area area-id</i> Example: <pre>Router(config-router)# network 10.0.0.0 0.0.255.255 area 3</pre>	Specifies the interface on which OSPF runs and defines the area ID for that interface.
Step 10	mpls ldp autoconfig [<i>area area-id</i>] Example: <pre>Router(config-router)# mpls ldp autoconfig area 3</pre>	Enables the MPLS LDP Autoconfiguration feature to enable LDP on interfaces belonging to an OSPF process. <ul style="list-style-type: none"> If no area is specified, the command applies to all interfaces associated with the OSPF process. If an area ID is specified, then only interfaces associated with that OSPF area are enabled with LDP.

Command or Action	Purpose
Step 11 <code>end</code> Example: <code>Router(config-router)# end</code>	Exits router configuration mode and returns to privileged EXEC mode.

Disabling MPLS LDP-IGP Synchronization from Some OSPF Interfaces

When you issue the **mpls ldp sync** command, all of the interfaces that belong to an OSPF process are enabled for LDP-IGP synchronization. To remove LDP-IGP synchronization from some interfaces, use the **no** form of the **mpls ldp igp sync** command on those interfaces.

Perform the following task to disable LDP-IGP synchronization from some OSPF interfaces after they are configured with LDP-IGP synchronization through the **mpls ldp sync** command.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface type slot / subslot / port [. subinterface-number]`
4. `no mpls ldp igp sync`
5. `exit`
6. `exit`

DETAILED STEPS

Command or Action	Purpose
Step 1 <code>enable</code> Example: <code>Router> enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2 <code>configure terminal</code> Example: <code>Router# configure terminal</code>	Enters global configuration mode.
Step 3 <code>interface type slot / subslot / port [. subinterface-number]</code> Example: <code>Router(config)# interface POS0/3/0</code>	Specifies the interface to configure and enters interface configuration mode.

	Command or Action	Purpose
Step 4	no mpls ldp igp sync Example: <pre>Router(config-if)# no mpls ldp igp sync</pre>	Disables MPLS LDP-IGP synchronization for that interface.
Step 5	exit Example: <pre>Router(config-if)# exit</pre>	Exits interface configuration mode and returns to global configuration mode.
Step 6	exit Example: <pre>Router(config)# exit</pre>	Exits global configuration mode and returns to privileged EXEC mode.

Verifying MPLS LDP-IGP Synchronization with OSPF

After you configure the interfaces for LDP, OSPF, and LDP-IGP synchronization, verify that the configuration is working correctly using the **show mpls ldp igp sync** and **show ip ospf mpls ldp interface** commands.

SUMMARY STEPS

1. **enable**
2. **show mpls ldp igp sync**
3. **show ip ospf mpls ldp interface**
4. **exit**

DETAILED STEPS

-
- Step 1** **enable**
Use this command to enable privileged EXEC mode. Enter your password if prompted. For example:
- Example:**
- ```
Router> enable
Router#
```
- Step 2**    **show mpls ldp igp sync**  
Use this command to show that MPLS LDP-IGP synchronization is configured correctly, because LDP is configured and the SYNC status shows that synchronization is enabled.

**Example:**

```
Router# show mpls ldp igp sync
FastEthernet0/0/0:
 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
```

If MPLS LDP-IGP synchronization is not enabled on an interface, the output appears as follows:

**Example:**

```
FastEthernet0/3/1:
 LDP configured; LDP-IGP Synchronization not enabled.
```

**Step 3****show ip ospf mpls ldp interface**

Use the output of the **show ip ospf mpls ldp interface** command to show that the interfaces are properly configured:

**Example:**

```
Router# show ip ospf mpls ldp interface
FastEthernet0/3/1
 Process ID 1, Area 0
 LDP is configured through LDP autoconfig
 LDP-IGP Synchronization: Yes
 Holddown timer is not configured
 Timer is not running
FastEthernet0/0/2
 Process ID 1, Area 0
 LDP is configured through LDP autoconfig
 LDP-IGP Synchronization: Yes
 Holddown timer is not configured
 Timer is not running
```

**Step 4****exit**

Use this command to exit from privileged EXEC mode. For example:

**Example:**

```
Router# exit
Router>
```

## Configuring MPLS LDP-IGP Synchronization with IS-IS Interfaces

The following sections contain the steps and examples for configuring MPLS LDP-IGP synchronization for interfaces running IS-IS processes:

- [Configuring MPLS LDP-IGP Synchronization on All IS-IS Interfaces, page 60](#)
- [Configuring MPLS LDP-IGP Synchronization on an IS-IS Interface, page 62](#)

### Configuring MPLS LDP-IGP Synchronization on All IS-IS Interfaces

Perform the following task to configure the MPLS LDP-IGP Synchronization feature on all interfaces running IS-IS processes.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ip**
4. **mpls label protocol ldp**
5. **router isis** *process-name*
6. **mpls ldp sync**
7. **interface** *type slot / subslot / port* [*, subinterface-number*]
8. **ip address** *prefix mask*
9. **ip router isis** *process-name*
10. **exit**
11. **exit**

### DETAILED STEPS

|        | Command or Action                                                                                | Purpose                                                                                                            |
|--------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                                           | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                   | Enters global configuration mode.                                                                                  |
| Step 3 | <b>mpls ip</b><br><br><b>Example:</b><br>Router(config)# mpls ip                                 | Globally enables hop-by-hop forwarding.                                                                            |
| Step 4 | <b>mpls label protocol ldp</b><br><br><b>Example:</b><br>Router(config)# mpls label protocol ldp | Specifies LDP as the default label distribution protocol.                                                          |

|         | Command or Action                                                                                                                                                    | Purpose                                                                                                     |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Step 5  | <p><b>router isis</b> <i>process-name</i></p> <p><b>Example:</b></p> <pre>Router(config)# router isis ISIS</pre>                                                     | Enables the IS-IS protocol on the router, specifies an IS-IS process, and enters router configuration mode. |
| Step 6  | <p><b>mpls ldp sync</b></p> <p><b>Example:</b></p> <pre>Router(config-router)# mpls ldp sync</pre>                                                                   | Enables MPLS LDP-IGP synchronization on interfaces belonging to an IS-IS process.                           |
| Step 7  | <p><b>interface</b> <i>type slot / subslot / port</i> [<i>, subinterface-number</i>]</p> <p><b>Example:</b></p> <pre>Router(config-router)# interface POS0/3/0</pre> | Specifies the interface to configure and enters interface configuration mode.                               |
| Step 8  | <p><b>ip address</b> <i>prefix mask</i></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip address 10.25.25.11 255.255.255.0</pre>                                | Assigns an IP address to the interface.                                                                     |
| Step 9  | <p><b>ip router isis</b> <i>process-name</i></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip router isis ISIS</pre>                                            | Enables IS-IS.                                                                                              |
| Step 10 | <p><b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config-if)# exit</pre>                                                                                         | Exits interface configuration mode and returns to global configuration mode.                                |
| Step 11 | <p><b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config)# exit</pre>                                                                                            | Exits global configuration mode and returns to privileged EXEC mode.                                        |

## Configuring MPLS LDP-IGP Synchronization on an IS-IS Interface

This section contains the steps for configuring the MPLS LDP-IGP Synchronization feature on an interface that is running an IS-IS process.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot / subslot / port* [*, subinterface-number*]
4. **ip address** *prefix mask*
5. **ip router isis**
6. **Exit**
7. **router isis**
8. **mpls ldp sync**
9. **exit**
10. **exit**

### DETAILED STEPS

|        | Command or Action                                                                                                                                | Purpose                                                                                                            |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                                                                                           | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                                                   | Enters global configuration mode.                                                                                  |
| Step 3 | <b>interface</b> <i>type slot / subslot / port</i> [ <i>, subinterface-number</i> ]<br><br><b>Example:</b><br>Router(config)# interface POS0/2/0 | Specifies the interface to configure and enters interface configuration mode.                                      |
| Step 4 | <b>ip address</b> <i>prefix mask</i><br><br><b>Example:</b><br>Router(config-if)# ip address 10.50.72.4 255.0.0.0                                | Assigns an IP address to the interface.                                                                            |

|         | Command or Action                                                                   | Purpose                                                                       |
|---------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Step 5  | <b>ip router isis</b><br><br><b>Example:</b><br>Router(config-if)# ip router isis   | Enables the IS-IS protocol for IP on the interface.                           |
| Step 6  | <b>Exit</b><br><br><b>Example:</b><br>Router(config-if)# exit                       | Exits to global configuration mode.                                           |
| Step 7  | <b>router isis</b><br><br><b>Example:</b><br>Router(config)# router isis            | Enters router configuration mode and enables an IS-IS process on the router.  |
| Step 8  | <b>mpls ldp sync</b><br><br><b>Example:</b><br>Router(config-router)# mpls ldp sync | Enables LDP-IGP synchronization for interfaces belonging to an IS-IS process. |
| Step 9  | <b>exit</b><br><br><b>Example:</b><br>Router(config-router)# exit                   | Exits router configuration mode and returns to global configuration mode.     |
| Step 10 | <b>exit</b><br><br><b>Example:</b><br>Router(config)# exit                          | Exits global configuration mode and returns to privileged EXEC mode.          |

## Disabling MPLS LDP-IGP Synchronization from Some IS-IS Interfaces

When you issue the **mpls ldp sync** command, all of the interfaces that belong to an IS-IS process are enabled for LDP-IGP synchronization. To remove LDP-IGP synchronization from some interfaces, use the **no** form of the **mpls ldp igp sync** command on those interfaces.

Perform the following task to disable LDP-IGP synchronization from some IS-IS interfaces after they are configured with LDP-IGP synchronization through the **mpls ldp sync** command.



**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface** *type slot / subslot / port* [*, subinterface-number*]
4. **no mpls ldp igp sync**
5. **exit**
6. **exit**

**DETAILED STEPS**

| Command or Action                                                                                                                                              | Purpose                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> <b>enable</b><br><br><b>Example:</b><br>Router> enable                                                                                           | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
| <b>Step 2</b> <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                                                   | Enters global configuration mode.                                                                                  |
| <b>Step 3</b> <b>interface</b> <i>type slot / subslot / port</i> [ <i>, subinterface-number</i> ]<br><br><b>Example:</b><br>Router(config)# interface POS0/3/0 | Specifies the interface to configure and enters interface configuration mode.                                      |
| <b>Step 4</b> <b>no mpls ldp igp sync</b><br><br><b>Example:</b><br>Router(config-if)# no mpls ldp igp sync                                                    | Disables MPLS LDP-IGP synchronization for that interface.                                                          |
| <b>Step 5</b> <b>exit</b><br><br><b>Example:</b><br>Router(config-if)# exit                                                                                    | Exits interface configuration mode and returns to global configuration mode.                                       |

| Command or Action                                                     | Purpose                                                              |
|-----------------------------------------------------------------------|----------------------------------------------------------------------|
| <b>Step 6</b> exit<br><br><b>Example:</b><br><br>Router(config)# exit | Exits global configuration mode and returns to privileged EXEC mode. |

- [Troubleshooting Tips, page 66](#)

## Troubleshooting Tips

Use the `debug mpls ldp igp sync` command to display events related to MPLS LDP-IGP synchronization.

# Configuration Examples for MPLS LDP-IGP Synchronization

The following sections show examples for the MPLS LDP-IGP synchronization feature with OSPF and IS-IS processes:

- [MPLS LDP-IGP Synchronization with OSPF Examples, page 66](#)
- [MPLS LDP-IGP Synchronization with IS-IS Examples, page 67](#)

## MPLS LDP-IGP Synchronization with OSPF Examples

The following task shows how to enable LDP for OSPF process 1. The `mpls ldp sync` and the OSPF `network` commands enable LDP on interfaces POS0/0/0, POS0/1/0, and POS1/1/0, respectively. The `no mpls ldp igp sync` command on interface POS1/0/0 prevents LDP from being enabled on interface POS1/0/0, even though OSPF is enabled for that interface.

```
Router# configure terminal
Router(config)# interface POS0/0/0
Router(config-if)# ip address 10.0.0.1
Router(config-if)# mpls ip

!
Router(config)# interface POS0/1/0
Router(config-if)# ip address 10.0.1.1

Router(config-if)# mpls ip

!
Router(config)# interface POS1/1/0

Router(config-if)# ip address 10.1.1.1

Router(config-if)# mpls ip

!
Router(config)# interface POS1/0/0
Router(config-if)# ip address 10.1.0.1

Router(config-if)# mpls ip

!
Router(config)# router ospf 1
```

```

Router(config-router)# network 10.0.0.0 0.0.255.255 area 3
Router(config-router)# network 10.1.0.0 0.0.255.255 area 3
Router(config-router)# mpls ldp sync
Router(config-router)# exit

Router(config)# interface POS1/0/0
Router(config-if)# no mpls ldp igp sync

```

## MPLS LDP-IGP Synchronization with IS-IS Examples

The following examples show the configuration commands you can use to configure MPLS LDP-IGP synchronization on interfaces POS0/2 /0 and POS0/3/0, which are running IS-IS processes:

```

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface POS0/2/0
Router(config-if)# ip router isis
Router(config-if)# exit
Router(config)# router isis
Router(config-router)# mpls ldp sync
Router(config-router)# exit
.
.
.
Router(config)# interface POS0/3/0
Router(config-if)# ip router isis
Router(config-if)# exit
Router(config)# router isis
Router(config-router)# mpls ldp sync
Router(config-router)# exit
Router(config) exit
Router#

```

## Additional References

The following sections provide references related to the MPLS LDP-IGP Synchronization feature.

### Related Documents

| Related Topic              | Document Title                                                   |
|----------------------------|------------------------------------------------------------------|
| MPLS LDP                   | MPLS Label Distribution Protocol                                 |
| MPLS LDP Autoconfiguration | MPLS LDP Autoconfiguration                                       |
| MPLS LDP commands          | <i>Cisco IOS Multiprotocol Label Switching Command Reference</i> |

### Standards

| Standards                                                                                                                             | Title |
|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | --    |

**MIBs**

| MIBs         | MIBs Link                                                                                                                                                                                                                              |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP MIB | To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

**RFCs**

| RFCs     | Title                             |
|----------|-----------------------------------|
| RFC 3036 | <a href="#">LDP Specification</a> |
| RFC 3037 | <a href="#">LDP Applicability</a> |

**Technical Assistance**

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Link                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | <a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a> |

## Feature Information for MPLS LDP-IGP Synchronization

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 4**      **Feature Information for MPLS LDP-IGP Synchronization**

| Feature Name                 | Releases                 | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP-IGP Synchronization | Cisco IOS XE Release 2.1 | <p>The MPLS LDP-IGP Synchronization feature ensures that the Label Distribution Protocol (LDP) is fully established before the Interior Gateway Protocol (IGP) path is used for switching.</p> <p>In Cisco IOS XE Release 2.1, this feature was integrated on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were modified: <b>debug mpls ldp igp sync</b>, <b>mpls ldp igp sync</b>, <b>mpls ldp igp sync holddown</b>, <b>mpls ldp sync</b>, <b>show ip ospf mpls ldp interface</b>, <b>show isis mpls ldp</b>, and <b>show mpls ldp igp sync</b>.</p> |

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# MPLS LDP Inbound Label Binding Filtering

The MPLS LDP Inbound Label Binding Filtering feature supports inbound label binding filtering. You can use the Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) feature to configure access control lists (ACLs) for controlling the label bindings a label switch router (LSR) accepts from its peer LSRs.

- [Finding Feature Information, page 71](#)
- [Restrictions for MPLS LDP Inbound Label Binding Filtering, page 71](#)
- [Information about MPLS LDP Inbound Label Binding Filtering, page 71](#)
- [How to Configure MPLS LDP Inbound Label Binding Filtering, page 72](#)
- [Configuration Examples for MPLS LDP Inbound Label Binding Filtering, page 75](#)
- [Additional References, page 75](#)
- [Feature Information for MPLS LDP Inbound Label Binding Filtering, page 77](#)
- [Glossary, page 78](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Restrictions for MPLS LDP Inbound Label Binding Filtering

Inbound label binding filtering does not support extended ACLs; it only supports standard ACLs.

## Information about MPLS LDP Inbound Label Binding Filtering

- [MPLS LDP Inbound Label Binding Filtering Benefit, page 71](#)

## MPLS LDP Inbound Label Binding Filtering Benefit

The MPLS LDP Inbound Label Binding Filtering feature may be used to control the amount of memory used to store LDP label bindings advertised by other routers. For example, in a simple MPLS Virtual

Private Network (VPN) environment, the VPN provider edge (PE) routers may require LSPs only to their peer PE routers (that is, they do not need LSPs to core routers). Inbound label binding filtering enables a PE router to accept labels only from other PE routers.

## How to Configure MPLS LDP Inbound Label Binding Filtering

- [Configuring MPLS LDP Inbound Label Binding Filtering, page 72](#)
- [Verifying that MPLS LDP Inbound Label Bindings are Filtered, page 73](#)

### Configuring MPLS LDP Inbound Label Binding Filtering

Perform this task to configure a router for inbound label filtering.

The following configuration allows the router to accept only the label for prefix 192.168.1.1 from LDP neighbor router 10.12.12.12.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip access-list standard** *access-list-number*
4. **permit** {*source* [*source-wildcard*] | **any**} [**log**]
5. **exit**
6. **mpls ldp neighbor** [*vrf vpn-name*] *nbr-address* **labels accept** *acl*
7. **end**

#### DETAILED STEPS

|        | Command or Action                                                                                                                | Purpose                                                                                                             |
|--------|----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>enable</b><br><br>Example:<br><pre>Router&gt; enable</pre>                                                                    | Enables privileged EXEC mode.<br><ul style="list-style-type: none"><li>• Enter your password if prompted.</li></ul> |
| Step 2 | <b>configure terminal</b><br><br>Example:<br><pre>Router# configure terminal</pre>                                               | Enters global configuration mode.                                                                                   |
| Step 3 | <b>ip access-list standard</b> <i>access-list-number</i><br><br>Example:<br><pre>Router(config)# ip access-list standard 1</pre> | Defines a standard IP access list with a number.                                                                    |



| Command or Action                                                                                                                                                                                | Purpose                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <p><b>Step 4</b> <code>permit {source [source-wildcard]   any} [log]</code></p> <p><b>Example:</b></p> <pre>Router(config-std-nacl)# permit 10.0.0.0</pre>                                       | Specifies one or more prefixes permitted by the access list.                          |
| <p><b>Step 5</b> <code>exit</code></p> <p><b>Example:</b></p> <pre>Router(config-std-nacl)# exit</pre>                                                                                           | Exits the current mode and goes to the next higher level.                             |
| <p><b>Step 6</b> <code>mpls ldp neighbor [vrf vpn-name] nbr-address labels accept acl</code></p> <p><b>Example:</b></p> <pre>Router(config)# mpls ldp neighbor 10.12.12.12 labels accept 1</pre> | Specifies the ACL to be used to filter label bindings for the specified LDP neighbor. |
| <p><b>Step 7</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config)# end</pre>                                                                                                      | Exits the current mode and enters privileged Exec mode.                               |

## Verifying that MPLS LDP Inbound Label Bindings are Filtered

If inbound filtering is enabled, perform the following tasks to verify that inbound label bindings are filtered.

### SUMMARY STEPS

1. `enable`
2. `show mpls ldp neighbor [vrf vpn-name] [address | interface] [detail]`
3. `show ip access-list [access-list-number | access-list-name]`
4. `show mpls ldp bindings`
5. `exit`

### DETAILED STEPS

- 
- Step 1** `enable`  
Use this command to enable privileged EXEC mode. Enter your password if prompted. For example:

**Example:**

```
Router> enable
Router#
```

**Step 2** **show mpls ldp neighbor** [*vrfl vpn-name*] [*address | interface*] [*detail*]

Enter the **show mpls ldp neighbor** command to show the status of the LDP session, including the name or number of the ACL configured for inbound filtering.

**Note** To display information about inbound label binding filtering, you must enter the **detail** keyword.

**Example:**

```
Router# show mpls ldp neighbor 10.12.12.12 detail
Peer LDP Ident: 10.12.12.12:0; Local LDP Ident 10.13.13.13:0
TCP connection: 10.12.12.12.646 - 10.13.13.13.12592
State: Oper; Msgs sent/rcvd: 49/45; Downstream; Last TIB rev sent 1257
Up time: 00:32:41; UID: 1015; Peer Id 0;
LDP discovery sources:
Serial1/0/0; Src IP addr: 192.168.1.1
holdtime: 15000 ms, hello interval: 5000 ms
Addresses bound to peer LDP Ident:
10.0.0.129 10.12.12.12 192.168.1.1
Peer holdtime: 180000 ms; KA interval: 60000 ms; Peer state: estab
LDP inbound filtering accept acl: 1
```

**Step 3** **show ip access-list** [*access-list-number | access-list-name*]

Enter the **show ip access-list** command to display the contents of all current IP access lists or of a specified access list.

**Note** It is important that you enter this command to see how the access list is defined; otherwise, you cannot verify inbound label binding filtering.

The following command output shows the contents of IP access list 1:

**Example:**

```
Router# show ip access 1
Standard IP access list 1
 permit 10.0.0.0, wildcard bits 0.0.0.255 (1 match)
```

**Step 4** **show mpls ldp bindings**

Enter the **show mpls ldp bindings** command to verify that the LSR has remote bindings only from a specified peer for prefixes permitted by the access list.

**Example:**

```
Router# show mpls ldp bindings
tib entry: 10.0.0.0/8, rev 4
 local binding: tag: imp-null
tib entry: 10.2.0.0/16, rev 1137
 local binding: tag: 16
tib entry: 10.2.0.0/16, rev 1139
 local binding: tag: 17
tib entry: 10.12.12.12/32, rev 1257
 local binding: tag: 18
tib entry: 10.13.13.13/32, rev 14
 local binding: tag: imp-null
tib entry: 10.10.0.0/16, rev 711
 local binding: tag: imp-null
tib entry: 10.0.0.0/8, rev 1135
 local binding: tag: imp-null
 remote binding: tsr: 10.12.12.12:0, tag: imp-null
```

```
tib entry: 10.0.0.0/8, rev 8
local binding: tag: imp-null
```

**Step 5****exit**

Use this command to exit to user EXEC mode. For example:

**Example:**

```
Router# exit
Router>
```

## Configuration Examples for MPLS LDP Inbound Label Binding Filtering

- [Configuring MPLS LDP Inbound Label Binding Filtering Example, page 75](#)

### Configuring MPLS LDP Inbound Label Binding Filtering Example

In the following example, the `mpls ldp neighbor labels accept` command is configured with an access control list to filter label bindings received on sessions with the neighbor 10.110.0.10.

Label bindings for prefixes that match 10.b.c.d are accepted, where b is less than or equal to 63, and c and d can be any integer between 0 and 128. Other label bindings received from 10.110.0.10 are rejected.

```
Router# configure terminal
Router(config)# access-list 1 permit 10.63.0.0 0.63.255.255
Router(config)# mpls ldp neighbor 10.110.0.10 labels accept 1
Router(config)# end
```

In the following example, the `show mpls ldp bindings neighbor` command displays label bindings that were learned from 10.110.0.10. This example verifies that the LIB does not contain label bindings for prefixes that have been excluded.

```
Router# show mpls ldp bindings neighbor 10.110.0.10
tib entry: 10.2.0.0/16, rev 4
 remote binding: tsr: 10.110.0.10:0, tag: imp-null
tib entry: 10.43.0.0/16, rev 6
 remote binding: tsr: 10.110.0.10:0, tag: 16
tib entry: 10.52.0.0/16, rev 8
 remote binding: tsr: 10.110.0.10:0, tag: imp-null
```

## Additional References

The following sections provide additional references related to MPLS LDP inbound label binding filters.

**Related Documents**

| Related Topic                          | Document Title                                                                                                                |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Configuration information for MPLS LDP | “MPLS Label Distribution Protocol (LDP)” chapter in the <i>Cisco IOS XE Multiprotocol Label Switching Configuration Guide</i> |
| MPLS LDP commands                      | <i>Cisco IOS Multiprotocol Label Switching Command Reference</i>                                                              |

**Standards**

| Standard                                                                                                                              | Title |
|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | --    |

**MIBs**

| MIB                                                                       | MIBs Link                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>MPLS Label Distribution Protocol MIB</i> ( draft-ietf-mpls-ldp-08.txt) | To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

**RFCs**

| RFC      | Title                             |
|----------|-----------------------------------|
| RFC 3036 | <a href="#">LDP Specification</a> |
| RFC 3037 | <a href="#">LDP Applicability</a> |

### Technical Assistance

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Link                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | <p><a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a></p> |

## Feature Information for MPLS LDP Inbound Label Binding Filtering

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 5** Feature Information for MPLS LDP Inbound Label Binding Filtering

| Feature Name                             | Releases                 | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP Inbound Label Binding Filtering | Cisco IOS XE Release 2.1 | <p>The MPLS LDP Inbound Label Binding Filtering feature supports inbound label binding filtering. You can use the Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) feature to configure access control lists (ACLs) for controlling the label bindings a label switch router (LSR) accepts from its peer LSRs.</p> <p>In Cisco IOS XE Release 2.1, support was added for the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were introduced or modified: <b>clear mpls ldp neighbor</b>, <b>mpls ldp neighbor labels accept</b>, <b>show mpls ldp neighbor</b>.</p> |

## Glossary

**CE router** --customer edge router. A router that is part of a customer network and that interfaces to a provider edge (PE) router.

**inbound label binding filtering** --Allows LSRs to control which label bindings it will accept from its neighboring LSRs. Consequently, an LSR does not accept or store some label bindings that its neighbors advertise.

**label** --A short fixed-length identifier that tells switching nodes how to forward data (packets or cells).

**label binding** --An association between a destination prefix and a label.

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.









# MPLS LDP--Local Label Allocation Filtering

This feature introduces command-line interface (CLI) commands to modify the way in which Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) handles local label allocation. This MPLS LDP feature enhancement enables the configuration of filtering policies for selective local label binding assignments by LDP to improve LDP scalability and convergence.

This document contains information about and instructions on how to configure the MPLS LDP--Local Label Allocation Filtering feature.

- [Finding Feature Information, page 81](#)
- [Prerequisites for MPLS LDP--Local Label Allocation Filtering, page 81](#)
- [Restrictions for MPLS LDP--Local Label Allocation Filtering, page 81](#)
- [Information About MPLS LDP--Local Label Allocation Filtering, page 82](#)
- [How to Configure MPLS LDP--Local Label Allocation Filtering, page 84](#)
- [Configuration Examples for MPLS LDP--Local Label Allocation Filtering, page 90](#)
- [Additional References, page 97](#)
- [Feature Information for MPLS LDP--Local Label Allocation Filtering, page 98](#)
- [Glossary, page 99](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for MPLS LDP--Local Label Allocation Filtering

The MPLS LDP--Local Label Allocation Filtering feature requires the MPLS Forwarding Infrastructure (MFI).

## Restrictions for MPLS LDP--Local Label Allocation Filtering

The MPLS LDP--Local Label Allocation Filtering feature does not support access lists. This feature supports prefix lists.

Restrictions for the MPLS LDP--Local Label Allocation Filtering feature in Cisco IOS XE Release 2.3.1:

- LDP local label allocation configuration for prefix list or host routes is supported only in the global routing table.
- LDP and RIB restart handling does not apply.
- Wildcard Forwarding Equivalence Class (FEC) requests are not supported.
- Remote bindings are retained for LDP table entries that are filtered.

## Information About MPLS LDP--Local Label Allocation Filtering

- [MPLS LDP Local Label Allocation Filtering Overview, page 82](#)
- [Prefix Lists for MPLS LDP Local Label Allocation Filtering Benefits and Description, page 83](#)
- [Local Label Allocation Changes and LDP Actions, page 84](#)
- [LDP Local Label Filtering and BGP Routes, page 84](#)

## MPLS LDP Local Label Allocation Filtering Overview

LDP allocates a local label for every route learned from the Interior Gateway Protocol (IGP). In the absence of inbound and outbound label filtering, these local labels are advertised to and learned by all peers.

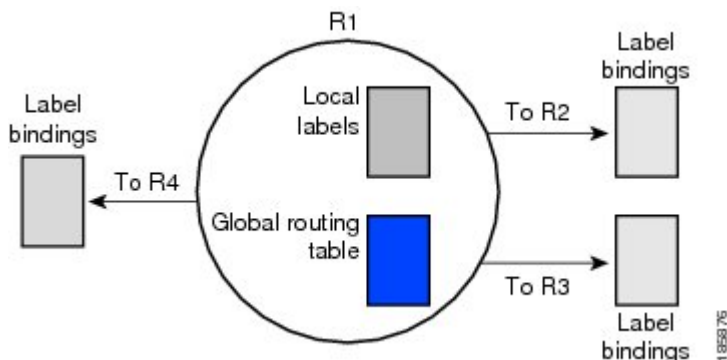
In most Layer 3 Virtual Private Network (VPN) configurations only the label switched paths (LSPs) created to reach the /32 host routes or Border Gateway Protocol (BGP) next hops between the provider edge (PE) routers carry traffic and are relevant to the Layer 3 VPNs. LSPs between the PE routers that are not members of a VPN use more memory and create additional processing in LDP across the core.

With the load increases in the service provider domain in the last decade (1997-2007), scalability has become more important in the service provider networks. Controlling the local label allocation could off-load LDP processing of non-VPN LSPs in the service provider network core devices.

The MPLS LDP Local Label Allocation Filtering feature introduces the **mplsldplabel** and **allocate** commands that allow you to configure LDP to selectively allocate local labels for a subset of the prefixes learned from the IGP. You can select that LDP allocate local labels for prefixes configured in a prefix list in the global table or for host routes in the global table.

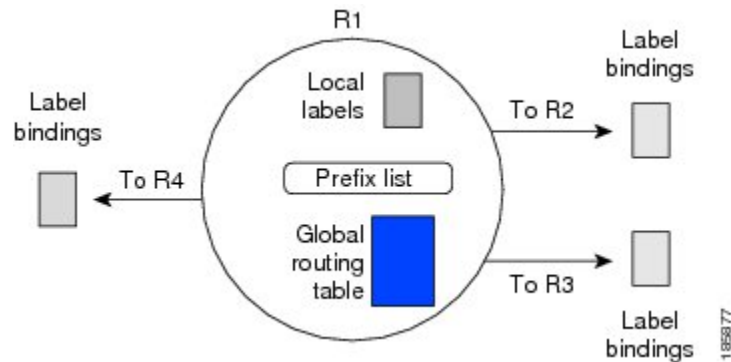
Local label allocation filtering reduces the number of local labels allocated and therefore the number of messages exchanged with peers. This improves LDP scalability and convergence. The two figures below show how controlling local label allocation can reduce local label space size and greatly reduce the number of advertisements to peers. The first figure below shows default LDP label allocation behavior. LDP allocates a local label for every route and advertises a label binding for every route learned from the IGP.

**Figure 4** Default LDP Local Label Allocation Behavior



The figure below shows LDP behavior with local label allocation control configured. The size of the local label space and the number of label binding advertisements are reduced with local label allocation filtering through the use of a prefix list. The decrease in the number of local labels and label binding advertisement messages reduces the amount of memory use and improves convergence time for LDP. The MPLS LDP Local Label Allocation Filtering feature also allows for more efficient use of the label space.

**Figure 5 LDP Behavior with Local Label Allocation Controls**



The figure above shows that router R1 learns a number of routes from its IGP neighbors on routers R2, R3, and R4. A prefix list defined on router R1 specifies the prefixes for which LDP allocates a local label.



**Note**

In general, the number of Label Information Base (LIB) entries remains the same regardless of the kind of label filtering. This is because the remote label bindings for the prefixes that are filtered are kept in the LIB. Memory use is reduced because local label filtering decreases the number of local labels allocated and the number of label bindings advertised to and stored by the peers of an LSR.

## Prefix Lists for MPLS LDP Local Label Allocation Filtering Benefits and Description

The MPLS LDP--Local Label Allocation Filtering feature allows you to configure LDP to allocate local labels for a subset of the learned prefixes. LDP accepts the prefix and allocates a local label if the prefix is permitted by a prefix list. If the prefix list is not defined, LDP accepts all prefixes and allocates local labels based on its default mode of operation.

The benefits of using prefix lists for LDP local label allocation filtering are as follows:

- Prefix lists provide more flexibility for specifying a subset of prefixes and masks.
- Prefix lists use a tree-based matching technique. This technique is more efficient than evaluating prefixes or host routes sequentially.
- Prefix lists are easy to modify.

You configure a prefix list for the MPLS LDP--Local Label Allocation Filtering feature with the **ip prefix-list** command. The format of the command is as follows: **ip prefix-list** {list-name / list-number} [seq number] {deny network/length | permit network/length} [ge ge-length] [le le-length]

## Local Label Allocation Changes and LDP Actions

The MPLS LDP--Local Label Allocation Filtering enhancement modifies the LDP's local label allocation handling. The feature supports local label allocation filtering through the specification of a prefix list or host routes.

With the introduction of this feature, LDP needs to determine whether a prefix filter is already configured to control the local label allocation on the local node. If a prefix list exists, the local label allocation is confined to the list of prefixes permitted by the configured prefix list.

LDP also needs to respond to local label allocation configuration changes and to configuration changes that affect the prefix list that LDP is using. Any of the following configuration changes can trigger LDP actions:

- Creating a local label allocation configuration
- Deleting or changing a local label allocation configuration
- Creating a new prefix list for a local label allocation configuration
- Deleting or changing a prefix list for a local label allocation configuration

LDP responds to local label allocation configuration changes by updating the LIB and the forwarding table in the global routing table. To update the LIB after a local label filter configuration change without a session reset, LDP keeps all remote bindings.

If you create a local label allocation configuration without defining a prefix list, no LDP action is required. The local label allocation configuration has no effect because the prefix list is created and permits all prefixes.

If you create or change a prefix list and prefixes that were previously allowed are rejected, LDP goes through a label withdraw and release procedure before the local labels for these prefixes are deallocated.

If you delete a prefix, LDP goes through the label withdraw and release procedure for the LIB local label. If the associated prefix is one for which no LIB entry should be allocated, LDP bypasses this procedure.

The LDP default behavior is to allocate local labels for all non-BGP prefixes. This default behavior does not change with the introduction of this feature and the **mpls ldp label** and **allocate** commands.



### Note

The local label allocation filtering has no impact on inbound label filtering because both provide LDP filtering independently. The LDP Inbound Label Binding Filtering feature controls label bindings that a label switch router (LSR) accepts from its peer LSRs through the use of access control lists (ACLs). The MPLS LDP--Local Label Allocation Filtering feature controls the allocation of local labels through the use of prefix lists or host routes.

## LDP Local Label Filtering and BGP Routes

The LDP default behavior is to allocate local labels for all non-BGP prefixes.

LDP does not apply the configured local label filter to redistributed BGP routes in the global table for which BGP allocates local label, but LDP does the advertisements (Inter-AS Option C). LDP neither forwards these entries nor releases the local labels allocated by BGP.

## How to Configure MPLS LDP--Local Label Allocation Filtering

- [Creating a Prefix List for MPLS LDP Local Label Allocation Filtering, page 85](#)

- [Configuring MPLS LDP Local Label Allocation Filtering, page 86](#)
- [Verifying MPLS LDP--Local Label Allocation Filtering Configuration, page 88](#)

## Creating a Prefix List for MPLS LDP Local Label Allocation Filtering

Perform the following task to create a prefix list for LDP local label allocation filtering. A prefix list allows LDP to selectively allocate local labels for a subset of the routes learned from the IGP. The decrease in the number of local labels in the LDP LIB and the number of label mapping advertisements reduces the amount of memory use and improves convergence time for LDP.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip prefix-list** *{list-name| list-number}* [**seq number**] **{deny network / length| permit network / length}** [**ge ge-length**] [**le le-length**]
4. **end**

### DETAILED STEPS

|        | Command or Action                                                              | Purpose                                                                                                            |
|--------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Step 1 | <b>enable</b><br><br><b>Example:</b><br>Router> enable                         | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul> |
| Step 2 | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal | Enters global configuration mode.                                                                                  |

| Command or Action                                                                                                                                                                                                                                                        | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 3</b> <code>ip prefix-list {list-name  list-number} [seq number] {deny network / length  permit network / length} [ge ge-length] [le le-length]</code></p> <p><b>Example:</b></p> <pre>Router(config)# ip prefix-list list1 permit 192.168.0.0/16 le 20</pre> | <p>Creates a prefix list or adds a prefix-list entry.</p> <ul style="list-style-type: none"> <li>• The <i>list-name</i> argument configures a name to identify the prefix list.</li> <li>• The <i>list-number</i> argument configures a number to identify the prefix list.</li> <li>• The <code>seq number</code> keyword and argument apply a sequence number to a prefix-list entry. The range of sequence numbers that can be entered is from 1 to 4294967294. If a sequence number is not entered when this command is configured, a default sequence numbering is applied to the prefix list. The number 5 is applied to the first prefix entry, and subsequent unnumbered entries are incremented by 5.</li> <li>• The <code>deny</code> keyword denies access for a matching condition.</li> <li>• The <code>permit</code> keyword permits access for a matching condition.</li> <li>• The <i>network / length</i> arguments and keyword configure the network address, and the length of the network mask in bits. The network number can be any valid IP address or prefix. The bit mask can be a number from 0 to 32.</li> <li>• The <code>ge ge-length</code> keyword and argument specify the lesser value of a range (the “from” portion of the range description) by applying the <i>ge-length</i> argument to the range specified. The <i>ge-length</i> argument represents the minimum prefix length to be matched. The <code>ge</code> keyword represents the greater than or equal to operator.</li> <li>• The <code>le le-length</code> keyword and argument specify the greater value of a range (the “to” portion of the range description) by applying the <i>le-length</i> argument to the range specified. The <i>le-length</i> argument represents the maximum prefix length to be matched. The <code>le</code> keyword represents the less than or equal to operator.</li> </ul> |
| <p><b>Step 4</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config)# end</pre>                                                                                                                                                                              | <p>Exits to privileged EXEC mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## Configuring MPLS LDP Local Label Allocation Filtering

Perform the following task to configure LDP local allocation filtering. Configuring filtering policies for selective local label binding assignments by LDP improves LDP scalability and convergence. You can configure either a prefix list or host routes as a filter for local label allocation.



### Note

The `host-routes` keyword for the `allocate` command makes it convenient for you to specify a commonly used set of prefixes.

**Note**

A maximum of one local label allocation filter is supported for the global table.

>

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **mpls ldp label**
4. **allocate global prefix-list** *{list-name | list-number}*
5. **allocate global host-routes**
6. **no allocate global** *{prefix-list {list-name | list-number} | host-routes}*
7. **no mpls ldp label**
8. **exit**
9. **exit**

**DETAILED STEPS**

| Command or Action                                                                                                                                                         | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1 enable</b><br><br><b>Example:</b><br><pre>Router&gt; enable</pre>                                                                                               | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Step 2 configure terminal</b><br><br><b>Example:</b><br><pre>Router# configure terminal</pre>                                                                          | Enters global configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Step 3 mpls ldp label</b><br><br><b>Example:</b><br><pre>Router(config)# mpls ldp label</pre>                                                                          | Enters MPLS LDP label configuration mode to specify how MPLS LDP handles local label allocation.                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Step 4 allocate global prefix-list</b> <i>{list-name   list-number}</i><br><br><b>Example:</b><br><pre>Router(config-ldp-lbl)# allocate global prefix-list list1</pre> | Configures local label allocation filters for learned routes for MPLS LDP. <ul style="list-style-type: none"> <li>• The <b>global</b> keyword specifies the global routing.</li> <li>• The <b>prefix-list</b> keyword specifies a prefix list to be used as a filter for MPLS LDP local label allocation.</li> <li>• The <i>list-name</i> argument indicates a name that identifies the prefix list.</li> <li>• The <i>list-number</i> argument indicates a number that identifies the prefix list.</li> </ul> |

| Command or Action                                                                                                                                                                      | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 5 allocate global host-routes</b></p> <p><b>Example:</b></p> <pre>Router(config-ldp-lbl)# allocate global host-routes</pre>                                                 | <p>Configures local label allocation filters for learned routes for MPLS LDP.</p> <ul style="list-style-type: none"> <li>The <b>global</b> keyword specifies the global routing.</li> <li>The <b>host-routes</b> keyword specifies that local label allocation be done for host routes only.</li> </ul>                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Step 6 no allocate global {prefix-list {list-name   list-number}   host-routes}</b></p> <p><b>Example:</b></p> <pre>Router(config-ldp-lbl)# no allocate global host-routes</pre> | <p>Removes the specific MPLS LDP local label allocation filter without resetting the LDP session.</p> <ul style="list-style-type: none"> <li>The <b>global</b> keyword specifies the global routing.</li> <li>The <b>prefix-list</b> keyword specifies a prefix list to be used as a filter for MPLS LDP local label allocation.</li> <li>The <i>list-name</i> argument indicates a name that identifies the prefix list.</li> <li>The <i>list-number</i> argument indicates a number that identifies the prefix list.</li> <li>The <b>host-routes</b> keyword specifies that host routes be used as a filter for MPLS LDP local label allocation.</li> </ul> |
| <p><b>Step 7 no mpls ldp label</b></p> <p><b>Example:</b></p> <pre>Router(config-ldp-lbl)# no mpls ldp label</pre>                                                                     | <p>Removes all local label allocation filters configured under the MPLS LDP label configuration mode and restores LDP default behavior for local label allocation without a session reset.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p><b>Step 8 exit</b></p> <p><b>Example:</b></p> <pre>Router(config-ldp-lbl)# exit</pre>                                                                                               | <p>Exits from MPLS LDP label configuration mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><b>Step 9 exit</b></p> <p><b>Example:</b></p> <pre>Router(config)# exit</pre>                                                                                                       | <p>Exits to privileged EXEC mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## Verifying MPLS LDP--Local Label Allocation Filtering Configuration

Perform the following task to verify the MPLS LDP--Local Label Allocation Filtering configuration.



## SUMMARY STEPS

1. **enable**
2. **show mpls ldp bindings detail**
3. **debug mpls ldp binding filter**
4. **exit**

## DETAILED STEPS

### Step 1

#### **enable**

Use this command to enable privileged EXEC mode. Enter your password if prompted. For example:

#### **Example:**

```
Router> enable
Router#
```

### Step 2

#### **show mpls ldp bindings detail**

Use this command to verify that local label allocation filtering is configured as you expect. For example:

#### **Example:**

```
Router# show mpls ldp bindings detail
Advertisement spec:
 Prefix acl = bar
Local label filtering spec: host routes.
 lib entry: 10.1.1.1/32, rev 9
 lib entry: 10.10.7.0/24, rev 10
 lib entry: 10.10.8.0/24, rev 11
 lib entry: 10.10.9.0/24, rev 12
 lib entry: 10.41.41.41/32, rev 17
 lib entry: 10.50.50.50/32, rev 15
 lib entry: 10.60.60.60/32, rev 18
 lib entry: 10.70.70.70/32, rev 16
 lib entry: 10.80.80.80/32, rev 14
```

The output of this command verifies that host routes are configured as the local label allocation filter for the router.

### Step 3

#### **debug mpls ldp binding filter**

Use this command to verify that local label allocation filtering was configured properly and to display how LDP accepts or withdraw labels. For example:

#### **Example:**

```
Router# debug mpls ldp binding filter
LDP Local Label Allocation Filtering changes debugging is on
.
.
.
```

### Step 4

#### **exit**

Use this command to exit to user EXEC mode. For example:

**Example:**

```
Router# exit
Router>
```

---

## Configuration Examples for MPLS LDP--Local Label Allocation Filtering

- [Creating a Prefix List for MPLS LDP Local Label Allocation Filtering Examples, page 90](#)
- [Configuring MPLS LDP Local Label Allocation Filtering Examples, page 90](#)
- [Sample MPLS LDP Local Label Allocation Filtering Configuration Example, page 91](#)

### Creating a Prefix List for MPLS LDP Local Label Allocation Filtering Examples

The following examples show how to configure a prefix list for MPLS LDP local label allocation filtering.

In this example, prefix list List1 permits only 192.168.0.0/16 prefixes. LDP accepts 192.168.0.0/16 prefixes, but would not assign a local label for the following prefixes: 192.168.0.0/24 and 192.168.2.0/24. For example:

```
configure terminal
!
ip prefix-list List1 permit 192.168.0.0/16
end
```

In the following example, prefix list List2 permits a range of prefixes from 192.168.0.0/16 to /20 prefixes. LDP would accept 192.168.0.0/16 prefixes, but would not assign local labels for the following prefixes: 192.168.0.0/24 and 192.168.2.0/24.

```
configure terminal
!
ip prefix-list List2 permit 192.168.0.0/16 le 20
end
```

In the following example, prefix list List3 permits a range of prefixes greater than /18. LDP would accept 192.168.17.0/20 and 192.168.2.0/24 prefixes, but would not assign a local label for 192.168.0.0/16.

```
configure terminal
!
ip prefix-list List3 permit 192.168.0.0/16 ge 18
end
```

### Configuring MPLS LDP Local Label Allocation Filtering Examples

The following examples show how to configure MPLS LDP local label allocation filtering.

This examples shows how to allocate a prefix list to be used as a local label allocation filter:

```
configure terminal
!
ip prefix-list List3 permit 192.168.0.0/16 ge 18
!
mpls ldp label
 allocate global prefix-list List3
 exit
exit
```

Prefix list List3, which permits a range of prefixes greater than /18, is configured as the local label allocation filter for the router. LDP would allow 192.168.17.0/20 and 192.168.2.0/24 prefixes, but would withdraw labels for prefixes not in the allowed range.

In the following example, host routes are configured as the local label allocation filter:

```
configure terminal
!
mpls ldp label
 allocate global host-routes
 exit
exit
```

LDP allocates local labels for host routes that are in the global routing table.

In the following example, a specific local label allocation filter is removed:

```
configure terminal
!
mpls ldp label
 no allocate global host-routes
 exit
exit
```

In the following example, all local label allocation filters configured in MPLS LDP label configuration mode are removed and the default LDP local label allocation is restored without a session reset:

```
configure terminal
!
no mpls ldp label
 exit
exit
```

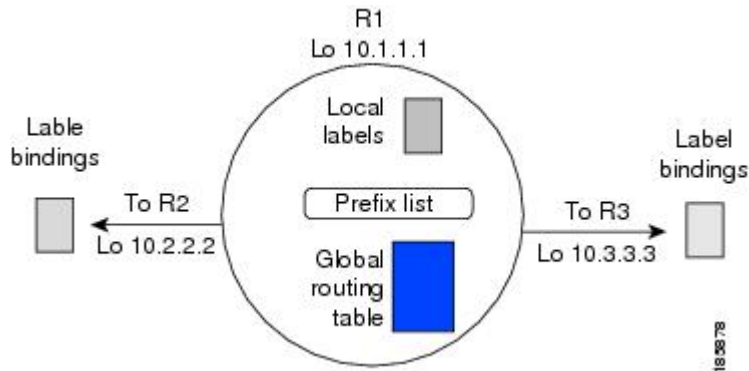
## Sample MPLS LDP Local Label Allocation Filtering Configuration Example

The figure below is a sample configuration that is used in this section to show how MPLS LDP local label allocation filtering works:

- Routers R1, R2, and R3 have loopback addresses 10.1.1.1, 10.2.2.2, and 10.3.3.3 defined and advertised by the IGP, respectively.
- 10.1.1.1 is the router ID of Router R1, 10.2.2.2 is the router ID of Router R2, and 10.3.3.3 is the router ID of Router R3.
- A prefix list is defined on Router R1 to specify the local labels for which LDP allocates a local label.

Router R1 learns a number of routes from its IGP neighbors on Routers R2 and R3.

**Figure 6** LDP Local Label Allocation Filtering Example



You can use LDP CLI commands to verify the following:

- Router R1 has allocated a local label for the correct subset of the prefixes.
- Routers R2 and R3 did not receive any remote bindings for the prefixes for which Router R1 did not assign a local label.
- [Routing Table on Router R1, page 92](#)
- [Local Label Bindings on Router R1 Router R 2 and Router R3, page 93](#)
- [Local Label Allocation Filtering Configuration on Router R1, page 94](#)
- [Local Label Allocation Filtering Changes Label Bindings on Router R1 Router R 2 and Router R3, page 95](#)
- [Command to Display the Local Label Allocation Filter, page 96](#)

## Routing Table on Router R1

You can enter the **show ip route** command to display the current state of the routing table. The following example shows the routing table on Router R1 based on the figure above:

```
R1# show ip route

Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
 D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
 N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
 E1 - OSPF external type 1, E2 - OSPF external type 2
 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
 ia - IS-IS inter area, * - candidate default, U - per-user static route
 o - ODR, P - periodic downloaded static route

Gateway of last resort is not set
 10.0.0.0/32 is subnetted, 1 subnets
C 10.1.1.1 is directly connected, Loopback0
 10.2.0.0/32 is subnetted, 1 subnets
O 10.2.2.2 [110/11] via 10.10.7.1, 00:00:36, FastEthernet1/0/0
 10.3.0.0/32 is subnetted, 1 subnets
O 10.3.3.3 [110/11] via 10.10.9.1, 00:00:36, FastEthernet3/0/0
 10.0.0.0/24 is subnetted, 3 subnets
C 10.10.7.0 is directly connected, FastEthernet1/0/0
O 10.10.8.0 [110/20] via 10.10.9.1, 00:00:36, FastEthernet3/0/0
 [110/20] via 10.10.7.1, 00:00:36, FastEthernet1/0/0
C 10.10.9.0 is directly connected, FastEthernet3/0/0
```

## Local Label Bindings on Router R1 Router R 2 and Router R3

You can enter the **show mpls ldp bindings** command on Routers R1, R2, and R3 to display the contents of the LIB on each router. In the following examples, the default LDP allocation behavior is in operation; that is, LDP allocates a local label for every route and advertises a label binding for every route learned from the IGP.

### LIB on Router R

This example shows the contents of the LIB on Router R1 based on the configuration in the figure above:

```
R1# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 16
 remote binding: lsr: 10.2.2.2:0, label: 17
lib entry: 10.2.2.2/32, rev 13
 local binding: label: 1000
 remote binding: lsr: 10.3.3.3:0, label: 18
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.3.3.3/32, rev 15
 local binding: label: 1002
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 18
lib entry: 10.10.7.0/24, rev 8
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 17
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.8.0/24, rev 11
 local binding: label: 1001
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.9.0/24, rev 9
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 16
```

The local labels assigned to 10.2.2.2 and 10.3.3.3 on Router R1 are advertised to Routers R2 and R3.

### LIB on Router R2

This example shows the contents of the LIB on Router R2 based on the configuration in the figure above:

```
R2# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 11
 local binding: label: 17
 remote binding: lsr: 10.3.3.3:0, label: 16
 remote binding: lsr: 10.1.1.1:0, label: imp-null
lib entry: 10.2.2.2/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 18
 remote binding: lsr: 10.1.1.1:0, label: 1000
lib entry: 10.3.3.3/32, rev 15
 local binding: label: 18
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1002
lib entry: 10.10.7.0/24, rev 8
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 17
 remote binding: lsr: 10.1.1.1:0, label: imp-null
lib entry: 10.10.8.0/24, rev 9
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1001
lib entry: 10.10.9.0/24, rev 13
 local binding: label: 16
```

```

remote binding: lsr: 10.3.3.3:0, label: imp-null
remote binding: lsr: 10.1.1.1:0, label: imp-null

```

### LIB on Router R3

This example shows the contents of the LIB on Router R3 based on the configuration in the figure above:

```

R3# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 13
 local binding: label: 16
 remote binding: lsr: 10.2.2.2:0, label: 17
 remote binding: lsr: 10.1.1.1:0, label: imp-null
lib entry: 10.2.2.2/32, rev 15
 local binding: label: 18
 remote binding: lsr: 10.2.2.2:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1000
lib entry: 10.3.3.3/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 18
 remote binding: lsr: 10.1.1.1:0, label: 1002
lib entry: 10.10.7.0/24, rev 11
 local binding: label: 17
 remote binding: lsr: 10.2.2.2:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: imp-null
lib entry: 10.10.8.0/24, rev 8
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1001
lib entry: 10.10.9.0/24, rev 9
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 16
 remote binding: lsr: 10.1.1.1:0, label: imp-null

```

## Local Label Allocation Filtering Configuration on Router R1

You enter the **mpls ldp label** command to configure a local label allocation filter. The following examples show how to configure a local label allocation filter by host routes only and by a prefix list.

### Local Label Allocation Filter--Host Routes Only Configuration

This example shows the selection of host routes as the only filter.

The following local label allocation filtering is defined on Router R1 under MPLS LDP label configuration mode:

```

configure terminal
!
mpls ldp label
 allocate global host-routes
exit
exit

```

### Local Label Allocation Filter--Prefix List Configuration

The following example shows how to configure a local label allocation filter that allows or denies prefixes based on a prefix list:

```

configure terminal
!
mpls ldp label
 allocate global prefix-list ListA
 exit
end

```

ListA is a prefix list defined as:

```
configure terminal
!
ip prefix-list ListA permit 0.0.0.0/32 ge 32
```

## Local Label Allocation Filtering Changes Label Bindings on Router R1 Router R 2 and Router R3

After configuring a local label allocation filter on Router R1, you can enter the **show mpls ldp bindings** command again to see the changes in the local label bindings in the LIB on each router. Changes to the output in the LIB entries are highlighted in bold text.

This sample prefix list is used for the examples in the this section:

```
ip prefix-list ListA permit 0.0.0.0/32 ge 32
```

### LIB on Router R1 After Local Label Allocation Filtering

This example shows how the configuration of a local label allocation prefix-list filter changes the contents of the LIB on Router R1:

```
R1# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 16
 remote binding: lsr: 10.2.2.2:0, label: 17
lib entry: 10.2.2.2/32, rev 13
 local binding: label: 1000
 remote binding: lsr: 10.3.3.3:0, label: 18
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.3.3.3/32, rev 15
 local binding: label: 1002
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 18
lib entry: 10.10.7.0/24, rev 8
 no local binding
 remote binding: lsr: 10.3.3.3:0, label: 17
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.8.0/24, rev 11
 no local binding
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.9.0/24, rev 9
 no local binding
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 16
```

Local label bindings for all but 10.2.2.2 and 10.3.3.3 on Router R1 are advertised as withdrawn.

### LIB on Router R2 After Local Label Allocation Filtering

This example shows how the configuration of a local label allocation prefix-list filter on Router R1 changes the contents of the LIB on Router R2:

```
R2# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 11
 local binding: label: 17
 remote binding: lsr: 10.3.3.3:0, label: 16
lib entry: 10.2.2.2/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 18
 remote binding: lsr: 10.1.1.1:0, label: 1000
lib entry: 10.3.3.3/32, rev 15
```

## Command to Display the Local Label Allocation Filter

```

 local binding: label: 18
 remote binding: lsr: 10.3.3.3:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1002
lib entry: 10.10.7.0/24, rev 8
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: 17
lib entry: 10.10.8.0/24, rev 9
 local binding: label: imp-null
 remote binding: lsr: 10.3.3.3:0, label: imp-null
lib entry: 10.10.9.0/24, rev 13
 local binding: label: 16
 remote binding: lsr: 10.3.3.3:0, label: imp-null

```

The 10.10.7.0/24, 10.10.8.0/24, and 10.10.9.0/24 prefixes are no longer assigned local labels. Therefore, Router R1 sends no label advertisement for these prefixes.

**LIB on Router R3 After Local Label Allocation Filtering**

This example shows how the configuration of a local label allocation prefix-list filter on Router R1 changes the contents of the LIB on Router R3:

```

R3# show mpls ldp bindings
lib entry: 10.1.1.1/32, rev 13
 local binding: label: 16
 remote binding: lsr: 10.2.2.2:0, label: 17
 remote binding: lsr: 10.1.1.1:0, label: imp-null
lib entry: 10.2.2.2/32, rev 15
 local binding: label: 18
 remote binding: lsr: 10.2.2.2:0, label: imp-null
 remote binding: lsr: 10.1.1.1:0, label: 1000
lib entry: 10.3.3.3/32, rev 7
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 18
 remote binding: lsr: 10.1.1.1:0, label: 1002
lib entry: 10.10.7.0/24, rev 11
 local binding: label: 17
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.8.0/24, rev 8
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: imp-null
lib entry: 10.10.9.0/24, rev 9
 local binding: label: imp-null
 remote binding: lsr: 10.2.2.2:0, label: 16

```

The 10.10.7.0/24, 10.10.8.0/24, and 10.10.9.0/24 prefixes are no longer assigned local labels. Again, Router R1 sends no label advertisement for these prefixes.

**Command to Display the Local Label Allocation Filter**

You can enter the **show mpls ldp detail** command to display the filter used for local label allocation. For example:

```

Router# show mpls ldp bindings detail
Advertisement spec:
 Prefix acl = List1
Local label filtering spec: host routes. ! <--- Local local label filtering spec

lib entry: 10.1.1.1/32, rev 9
lib entry: 10.10.7.0/24, rev 10
lib entry: 10.10.8.0/24, rev 11
lib entry: 10.10.9.0/24, rev 12
lib entry: 10.41.41.41/32, rev 17
lib entry: 10.50.50.50/32, rev 15
lib entry: 10.60.60.60/32, rev 18
lib entry: 10.70.70.70/32, rev 16
lib entry: 10.80.80.80/32, rev 14

```



## Additional References

The following sections provide references related to the MPLS LDP--Local Label Allocation Filtering feature.

### Related Documents

| Related Topic                                                        | Document Title                                                   |
|----------------------------------------------------------------------|------------------------------------------------------------------|
| Configuration tasks for MPLS LDP                                     | MPLS Label Distribution Protocol Overview                        |
| MPLS LDP commands                                                    | <i>Cisco IOS Multiprotocol Label Switching Command Reference</i> |
| Configuration tasks for inbound label binding filtering for MPLS LDP | MPLS LDP Inbound Label Binding Filtering                         |

### Standards

| Standard                                                                                                                              | Title |
|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | --    |

### MIBs

| MIB                                                                                                                         | MIBs Link                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature. | To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

### RFCs

| RFC      | Title                                                                                                                          |
|----------|--------------------------------------------------------------------------------------------------------------------------------|
| RFC 3037 | <a href="#">LDP Applicability</a>                                                                                              |
| RFC 3815 | <a href="#">Definitions of Managed Objects for the Multiprotocol Label Switching (MPLS), Label Distribution Protocol (LDP)</a> |
| RFC 5036 | <a href="#">LDP Specification</a>                                                                                              |

**Technical Assistance**

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Link                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | <a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a> |

## Feature Information for MPLS LDP--Local Label Allocation Filtering

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 6**      **Feature Information for MPLS LDP-Local Label Allocation Filtering**

| Feature Name                              | Releases                  | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP-Local Label Allocation Filtering | Cisco IOS XE Releases 2.1 | <p>This feature introduces command-line interface (CLI) commands to modify the way in which Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) handles local label allocation. This MPLS LDP feature enhancement enables the configuration of filtering policies for selective local label binding assignments by LDP to improve LDP scalability and convergence. This document contains information about and instructions on how to configure the MPLS LDP-Local Label Allocation Filtering feature.</p> <p>In Cisco IOS XE Releases 2.1, the feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.</p> |
|                                           |                           | <p>The following commands were introduced or modified: <b>allocate</b>, <b>debug mpls ldp bindings</b>, <b>mpls ldp label</b>, <b>show mpls ldp bindings</b>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## Glossary

**BGP** --Border Gateway Protocol. An interdomain routing protocol that replaces Exterior Gateway Protocol (EGP). A BGP system exchanges reachability information with other BGP systems. It is defined by RFC 1163.

**CE router** --customer edge router. A router that is part of a customer network and that interfaces to a provider edge (PE) router. CE routers do not have routes to associated Virtual Private Networks (VPNs) in their routing tables.

**FEC** --Forwarding Equivalency Class. A set of packets that can be handled equivalently for the purpose of forwarding and thus is suitable for binding to a single label. The set of packets destined for an address prefix is one example of an FEC.

**IGP** --Interior Gateway Protocol. Internet protocol used to exchange routing information within a single autonomous system. Examples of common Internet IGP protocols include Interior Gateway Routing Protocol (IGRP), Open Shortest Path First (OSPF), Intermediate System-to-Intermediate System (IS-IS), and Routing Information protocol (RIP).

**label** --A short fixed-length label that tells switching nodes how to forward data (packets or cells).

**LDP** --Label Distribution Protocol. A standard protocol between Multiprotocol Label Switching (MPLS)-enabled routers that is used for the negotiation of the labels (addresses) used to forward packets.

**LIB** --Label Information Base. A database used by a label switch router (LSR) to store labels learned from other LSRs, and labels assigned by the local LSR.

**LSP** --label switched path. A sequence of hops in which a packet travels from one router to another router by means of label switching mechanisms. A label switched path can be established dynamically, based on normal routing mechanisms, or through configuration.

**LSR** --label switch router. A device that forwards Multiprotocol Label Switching (MPLS) packets based on the value of a fixed-length label encapsulated in each packet.

**MPLS** --Multiprotocol Label Switching. A switching method that forwards IP traffic using a label. This label instructs the routers and the switches in the network where to forward the packets. The forwarding of MPLS packets is based on preestablished IP routing information

**PE router** --provider edge router. A router that is part of a service provider's network connected to a customer edge (CE) router. All Virtual Private Network (VPN) processing occurs in the PE router.

**VPN** --Virtual Private Network. A secure IP-based network that shares resources on one or more physical networks. A VPN contains geographically dispersed sites that can communicate securely over a shared backbone.

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.



# MPLS LDP--Lossless MD5 Session Authentication

---

The MPLS LDP--Lossless MD5 Session Authentication feature enables a Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) session to be password-protected without tearing down and reestablishing the LDP session.

- [Finding Feature Information, page 101](#)
- [Prerequisites for MPLS LDP--Lossless MD5 Session Authentication, page 101](#)
- [Restrictions for MPLS LDP--Lossless MD5 Session Authentication, page 102](#)
- [Information About MPLS LDP--Lossless MD5 Session Authentication, page 102](#)
- [How to Configure MPLS LDP--Lossless MD5 Session Authentication, page 105](#)
- [Configuration Examples for MPLS LDP--Lossless MD5 Session Authentication, page 113](#)
- [Additional References, page 124](#)
- [Feature Information for MPLS LDP--Lossless MD5 Session Authentication, page 126](#)

## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for MPLS LDP--Lossless MD5 Session Authentication

The MPLS LDP--Lossless MD5 Session Authentication feature is an enhancement to the MPLS LDP MD5 Global Configuration feature. Before configuring the MPLS LDP--Lossless MD5 Session Authentication feature, refer to the *MPLS--LDP MD5 Global Configuration* feature module for more information on how the message digest algorithm 5 (MD5) works with MPLS LDP to ensure that LDP segments remain properly protected.

**Note**

The MPLS LDP--Lossless MD5 Session Authentication feature must be configured before MPLS LDP is configured.

Configure the following features on the label switch router (LSR) before configuring the MPLS LDP--Lossless MD5 Session Authentication feature:

- Distributed Cisco Express Forwarding
- Static or dynamic routing
- MPLS Virtual Private Network (VPN) routing and forwarding (VRFs) instances for MPLS VPNs
- MPLS LDP--Lossless MD5 Session Authentication for the MPLS VPN VRFs

**Note**

If a VRF is deleted, then the lossless MD5 session authentication for that VRF is automatically removed.

## Restrictions for MPLS LDP--Lossless MD5 Session Authentication

MD5 protection applies to LDP sessions between peers.

## Information About MPLS LDP--Lossless MD5 Session Authentication

- [How MPLS LDP Messages in MPLS LDP--Lossless MD5 Session Authentication are Exchanged](#), page 102
- [The Evolution of MPLS LDP MD5 Password Features](#), page 103
- [Keychains Use with](#), page 103
- [Application of Rules to Overlapping Passwords](#), page 104
- [Password Rollover Period Guidelines](#), page 104
- [Resolving LDP Password Problems](#), page 105

## How MPLS LDP Messages in MPLS LDP--Lossless MD5 Session Authentication are Exchanged

MPLS LDP messages (discovery, session, advertisement, and notification messages) are exchanged between LDP peers through two channels:

- LDP discovery messages are transmitted as User Datagram Protocol (UDP) packets to the well-known LDP port.
- Session, advertisement, and notification messages are exchanged through a TCP connection established between two LDP peers.

The MPLS LDP--Lossless MD5 Session Authentication feature allows an LDP session to be password-protected without tearing down and reestablishing the LDP session. The MD5 password can be implemented and changed without interrupting the LDP session.

## The Evolution of MPLS LDP MD5 Password Features

The initial version of LDP MD5 protection allowed authentication to be enabled between two LDP peers and each segment sent on the TCP connection was verified between the peers. Authentication was configured on both LDP peers using the same password; otherwise, the peer session was not established. The `mpls ldp neighbor` command was issued with the `password` keyword. When MD5 protection was enabled, the router tore down the existing LDP sessions and established new sessions with the neighbor router.

An improved MD5 protection feature, called MPLS--LDP MD5 Global Configuration, was later introduced that allowed LDP MD5 to be enabled globally instead of on a per-peer basis. Using this feature, password requirements for a set of LDP neighbors could be configured. The MPLS LDP MD5 Global Configuration feature also improved the ability to maintain the LDP session. The LDP session with a peer was not automatically torn down when the password for that peer was changed. The new password was implemented the next time an LDP session was established with the peer.

The MPLS LDP--Lossless MD5 Session Authentication feature is based on the MPLS LDP MD5 Global Configuration feature. However, the MPLS LDP--Lossless MD5 Session Authentication feature provides the following enhancements:

- Activate or change LDP MD5 session authentication without interrupting the LDP session.
- Configure multiple passwords, so one password can be used now and other passwords later.
- Configure asymmetric passwords, which allows one password to be used for incoming TCP segments and a different password to be used for outgoing TCP segments.
- Configure passwords so that they overlap for a period of time. This functionality is beneficial when the clocks on two LSRs are not synchronized.

These enhancements are available by using the `key-chain` command, which allows different key strings to be used at different times according to the keychain configuration.

## Keychains Use with

The MPLS LDP--Lossless MD5 Session Authentication feature allows keychains to be used to specify different MD5 keys to authenticate LDP traffic exchanged in each direction.

In the following example, three passwords are configured:

```
key chain ldp-pwd
 key 1
 key-string lab
 send-lifetime 10:00:00 Nov 2 2008 10:00:00 Dec 2 2008
 accept-lifetime 00:00:00 Jan 1 1970 duration 1
 key 2
 key-string lab2
 send-lifetime 00:00:00 Jan 1 1970 duration 1
 accept-lifetime 10:00:00 Nov 2 2008 10:00:00 Nov 17 2008
 key 3
 key-string lab3
 send-lifetime 00:00:00 Jan 1 1970 duration 1
 accept-lifetime 10:00:00 Nov 17 2008 10:00:00 Dec 2 2008
!
```

`mpls ldp password option 1 for nbr-acl key-chain ldp-pwd`

- Key 1 specifies the lab password. The `send-lifetime` command enables the lab password to authenticate the outgoing TCP segments from November 2, 2008, at 10:00:00 a.m. until December 2,

2008, at 10:00:00 a.m. The **accept-lifetime** command is configured so that the lab password is never used to authenticate incoming TCP segments. The **accept-lifetime** command enables the lab password for 1 second on January 1, 1970. By setting the date to the past and by enabling a duration of 1 second, the password for incoming TCP segments immediately expires. If the **accept-lifetime** command is omitted from the keychain configuration, then the password is always valid for incoming TCP segments.

- Key 2 and key 3 specify the lab2 and lab3 passwords, respectively. The **send-lifetime** commands enable the passwords for 1 second on January 1, 1970. By setting the date to the past and by enabling a duration of 1 second, the passwords for outgoing TCP segments immediately expire. If the **send-lifetime** commands are omitted from the keychain configuration, the passwords are always valid for outgoing TCP segments. The **accept-lifetime** commands for key 2 and key 3 enable the passwords to authenticate the incoming TCP segments from November 2, 2008, at 10:00:00 a.m. until November 17, 2008, at 10:00:00 a.m. and from November 17, 2008, at 10:00:00 a.m. until December 2, 2008, at 10:00:00 a.m., respectively.

## Application of Rules to Overlapping Passwords

Overlapping passwords can be useful when two LSRs have clocks that are not synchronized. The overlapping passwords provide a window to ensure that TCP packets are not dropped. The following rules apply to overlapping passwords:

- If the send-lifetime value for the next password begins before the send-lifetime value of the current password expires, the password with the shorter key ID is used during the overlap period. The send-lifetime value of the current password can be shortened by configuring a shorter send-lifetime value. Similarly, the send-lifetime value of the current password can be lengthened by configuring a longer send-lifetime value.
- If the accept-lifetime value for the next password begins before the accept-lifetime value of the current password expires, both the next password and the current password are used concurrently. The next password information is passed to TCP. If TCP fails to authenticate the incoming segments with the current password, it tries authenticating with the next password. If TCP authenticates a segment using the new password, it discards the current password and uses the new password from that point on.
- If a password for incoming or outgoing segments expires and no additional valid password is configured, one of the following actions take place:
  - If a password is required for the neighbor, LDP drops the existing session.
  - If a password is not required for the neighbor, LDP attempts to roll over to a session that does not require authentication. This attempt also fails unless the password expires on both LSRs at the same time.

## Password Rollover Period Guidelines

Both old and new passwords are valid during a rollover period. This ensures a smooth rollover when clocks are not synchronized between two LDP neighbors. When passwords are configured using a keychain, the rollover period is equal to the accept-lifetime overlap between two successive receive passwords.

The minimum rollover period (the duration between two consecutive MD5 key updates) must be longer than the value of the LDP keepalive interval time to ensure an update of new MD5 authentication keys. If LDP session hold time is configured to its default value of 3 minutes, the LDP keepalive interval is 1 minute. The minimum rollover period should be 5 minutes. However, we recommend that the minimum rollover period is set to between 15 and 30 minutes.

To ensure a seamless rollover, follow these guidelines:



- Ensure that the local time on the peer LSRs is the same before configuring the keychain.
- Check for error messages (TCP-6-BADAUTH) that indicate keychain misconfiguration.
- Validate the correct keychain configuration by checking for the following password messages:

```
%LDP-5-PWDCFG: Password configuration changed for 10.1.1.1:0
%LDP-5-PWDRO: Password rolled over for 10.1.1.1:0
```

## Resolving LDP Password Problems

LDP displays error messages when an unexpected neighbor attempts to open an LDP session, or the LDP password configuration is invalid. Some existing LDP debugs also display password information.

When a password is required for a potential LDP neighbor, but no password is configured for it, the LSR ignores LDP hello messages from that neighbor. When the LSR processes the hello message and tries to establish a TCP connection with the neighbor, it displays the error message and stops establishing the LDP session with the neighbor. The error is rate-limited and has the following format:

```
00:00:57: %LDP-5-PWD: MD5 protection is required for peer 10.2.2.2:0(glbl), no password
configured
```

When passwords do not match between LDP peers, TCP displays the following error message on the LSR that has the lower router ID; that is, the router that has the passive role in establishing TCP connections:

```
00:01:07: %TCP-6-BADAUTH: Invalid MD5 digest from 10.2.2.2(11051) to 10.1.1.1(646)
```

If one peer has a password configured and the other one does not, TCP displays the following error messages on the LSR that has a password configured:

```
00:02:07: %TCP-6-BADAUTH: No MD5 digest from 10.1.1.1(646) to 10.2.2.2(11099)
```

## How to Configure MPLS LDP--Lossless MD5 Session Authentication

- [Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain, page 105](#)
- [Enabling the Display of MPLS LDP Password Rollover Changes and Events, page 110](#)
- [Changing MPLS LDP--Lossless MD5 Session Authentication Passwords, page 111](#)

## Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain

Perform the following task to configure the MPLS LDP--Lossless MD5 Session Authentication feature using a keychain. Keychains allow a different key string to be used at different times according to the keychain configuration. MPLS LDP queries the appropriate keychain to obtain the current live key and key ID for the specified keychain.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **access-list** *access-list-number* {**permit** | **deny**} {*type-code wildcard-mask* | *ip-address mask*}
4. **key chain** *name-of-chain*
5. **key** *key-id*
6. **key-string** *string*
7. **accept-lifetime** {*start-time* | **local** *start-time*} {**duration** *seconds* | *end-time* | **infinite**}
8. **send-lifetime** {*start-time* | **local** *start-time*} {**duration** *seconds* | *end-time* | **infinite**}
9. **exit**
10. **exit**
11. **mpls ldp** [*vrf vrf-name*] **password option number for acl** {**key-chain** *keychain-name* | [0|7] *password*}
12. **exit**
13. **show mpls ldp neighbor** [*vrf vrf-name* | **all**] [*ip-address* | *interface*] [**detail**] [**graceful-restart**]

**DETAILED STEPS**

|               | <b>Command or Action</b>                                                                                                                                                                                             | <b>Purpose</b>                                                                                                    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> | <b>enable</b><br><br><b>Example:</b><br>Router> enable                                                                                                                                                               | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter the password if prompted.</li> </ul> |
| <b>Step 2</b> | <b>configure terminal</b><br><br><b>Example:</b><br>Router# configure terminal                                                                                                                                       | Enters global configuration mode.                                                                                 |
| <b>Step 3</b> | <b>access-list</b> <i>access-list-number</i> { <b>permit</b>   <b>deny</b> } { <i>type-code wildcard-mask</i>   <i>ip-address mask</i> }<br><br><b>Example:</b><br>Router(config)# access-list 10<br>permit 10.2.2.2 | Creates an access list.                                                                                           |

| Command or Action                                                                                                                                                                                                                                                                                  | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 4</b> <b>key chain</b> <i>name-of-chain</i></p> <p><b>Example:</b></p> <pre>Router(config)# key chain ldp-pwd</pre>                                                                                                                                                                     | <p>Enables authentication for routing protocols and identifies a group of authentication keys.</p> <ul style="list-style-type: none"> <li>Enters keychain configuration mode.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Step 5</b> <b>key</b> <i>key-id</i></p> <p><b>Example:</b></p> <pre>Router(config-keychain)# key 1</pre>                                                                                                                                                                                     | <p>Identifies an authentication key on a keychain.</p> <ul style="list-style-type: none"> <li>The <i>key-id</i> value must be a numeral.</li> <li>Enters keychain key configuration mode.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Step 6</b> <b>key-string</b> <i>string</i></p> <p><b>Example:</b></p> <pre>Router(config-keychain-key)# key-string pwd1</pre>                                                                                                                                                                | <p>Specifies the authentication string for a key.</p> <ul style="list-style-type: none"> <li>The <i>string</i> value can be 1 to 80 uppercase or lowercase alphanumeric characters; the first character cannot be a numeral.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><b>Step 7</b> <b>accept-lifetime</b> { <i>start-time</i>   <b>local</b> <i>start-time</i> } { <b>duration</b> <i>seconds</i>   <i>end-time</i>   <b>infinite</b> }</p> <p><b>Example:</b></p> <pre>Router(config-keychain-key)# accept-lifetime 10:00:00 Jan 13 2007 10:00:00 Jan 13 2009</pre> | <p>Specifies the time period during which the authentication key on a keychain can be used for verifying incoming TCP segments.</p> <p>The <i>start-time</i> argument identifies the time to start and the local <i>start-time</i> argument identifies the time to start in the local time zone. Both arguments have the same parameters:</p> <p><b>Note</b> The time reference depends on the clock time zone configuration on the router. If no time zone configured, then the default time zone uses the Coordinated Universal Time (UTC) time. If it is configured, either the Eastern Standard Time (EST) or Pacific Standard Time (PST) time zone is used.</p> <ul style="list-style-type: none"> <li><i>hh:mm:ss</i> is the time format.</li> <li>Enter the number of days from 1 to 31.</li> <li>Enter the name of the month.</li> <li>Enter the year from the present to 2035.</li> </ul> <p>Once the start time is entered, select from the following:</p> <ul style="list-style-type: none"> <li>The <b>duration</b> keyword sets the key lifetime duration in seconds.</li> <li>The <i>end-time</i> argument sets the time to stop. These parameters are the same as those used for the <i>start-time</i> argument.</li> <li>The <b>infinite</b> keyword allows the accept-lifetime period to never expire.</li> </ul> <p>If the <b>no accept-lifetime</b> value is defined, the associated receive password is valid for authenticating incoming TCP segments.</p> |

| Command or Action                                                                                                                                                                                                                                                                          | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 8</b> <b>send-lifetime</b> {<i>start-time</i>   <b>local</b> <i>start-time</i>} {<b>duration</b> <i>seconds</i>  <i>end-time</i>   <b>infinite</b>}</p> <p><b>Example:</b></p> <pre>Router(config-keychain-key)# send- lifetime 10:00:00 Jan 13 2007 10:00:00 Jan 13 2009</pre> | <p>Specifies the time period during which the authentication key on a keychain can be used for verifying outgoing TCP segments. The <i>start-time</i> argument identifies the time to start and the local <i>start-time</i> argument identifies the time to start in the local time zone. Both arguments have the same parameters:</p> <p><b>Note</b> The time reference depends on the clock time zone configuration on the router. If no time zone configured, then the default time zone uses the UTC time. If it is configured, either the EST or PST time zone is used.</p> <ul style="list-style-type: none"> <li>• <i>hh:mm:ss</i> is the time format.</li> <li>• Enter the number of days from 1 to 31.</li> <li>• Enter the name of the month.</li> <li>• Enter the year from 1993 to 2035.</li> </ul> <p>Once the start time is entered, select from the following:</p> <ul style="list-style-type: none"> <li>• The <b>duration</b> keyword sets the send lifetime duration in seconds.</li> <li>• The <i>end-time</i> argument sets the time to stop. These parameters are the same as those used for the <i>start-time</i> argument.</li> <li>• The <b>infinite</b> keyword allows the send lifetime period to never expire.</li> </ul> <p>If the <b>no send-lifetime</b> value is defined, the associated send password is valid for authenticating outgoing TCP segments.</p> |
| <p><b>Step 9</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config-keychain-key)# exit</pre>                                                                                                                                                                                       | <p>Exits from keychain key configuration mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p><b>Step 10</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config-keychain)# exit</pre>                                                                                                                                                                                          | <p>Exits from keychain configuration mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Command or Action                                                                                                                                                                                                                         | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 11</b> <code>mpls ldp [vrf vrf-name] password option number for acl {key-chain keychain-name   [0 7] password}</code></p> <p><b>Example:</b></p> <pre>Router(config)# mpls ldp password option 1 for 10 keychain ldp-pwd</pre> | <p>Configures an MD5 password for LDP sessions with neighbors whose LDP router IDs are permitted by a specified access list.</p> <ul style="list-style-type: none"> <li>• The <b>vrf vrf-name</b> keyword-argument pair specifies a VRF configured on the LSR.</li> <li>• The <i>number</i> argument defines the order in which the access lists are evaluated in the determination of a neighbor password. The valid range is 1 to 32767.</li> <li>• The <b>for acl</b> keyword-argument pair specifies the name of the access list that includes the LDP router IDs of those neighbors for which the password applies. Only standard IP access list values (1 to 99) can be used for the <i>acl</i> argument.</li> <li>• The <b>key-chain keychain-name</b> keyword-argument pair specifies the name of the keychain to use.</li> <li>• The <b>0</b> and <b>7</b> keywords specify whether the password that follows is hidden (encrypted); <ul style="list-style-type: none"> <li>◦ <b>0</b> specifies an unencrypted password.</li> <li>◦ <b>7</b> specifies an encrypted password.</li> </ul> </li> <li>• The <i>password</i> argument specifies the MD5 password to be used for the specified LDP sessions.</li> </ul> |
| <p><b>Step 12</b> <code>exit</code></p> <p><b>Example:</b></p> <pre>Router(config)# exit</pre>                                                                                                                                            | <p>Exits from global configuration mode.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>Step 13</b> <code>show mpls ldp neighbor [vrf vrf-name   all] [ip-address   interface] [detail] [graceful-restart]</code></p> <p><b>Example:</b></p> <pre>Router# show mpls ldp neighbor detail</pre>                               | <p>Displays the status of LDP sessions.</p> <ul style="list-style-type: none"> <li>• The <b>vrf vrf-name</b> keyword-argument pair displays the LDP neighbors for the specified VRF instance.</li> <li>• The <i>ip-address</i> argument identifies the neighbor with the IP address for which password protection is configured.</li> <li>• The <i>interface</i> argument identifies the LDP neighbors accessible over this interface.</li> <li>• The <b>detail</b> keyword displays information in long form, including password information for this neighbor. Here are the items displayed: <ul style="list-style-type: none"> <li>◦ An indication as to whether a password is mandatory for this neighbor (required/not required)</li> <li>◦ The password source (neighbor/fallback/number [option number])</li> <li>◦ An indication as to whether the latest configured password for this neighbor is used by the TCP session (in use) or the TCP session uses an old password (stale)</li> </ul> </li> <li>• The <b>graceful-restart</b> keyword displays per-neighbor graceful restart information.</li> </ul>                                                                                                        |

## Enabling the Display of MPLS LDP Password Rollover Changes and Events

When a password is required for a neighbor, but no password is configured for the neighbor, the following debug message is displayed:

```
00:05:04: MDSym5 protection is required for peer 10.2.2.2:0(glbl), but no password configured.
```

To enable the display of events related to configuration changes and password rollover events, perform the following task.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls ldp logging password configuration** [*rate-limit number*]
4. **mpls ldp logging password rollover** [*rate-limit number*]
5. **exit**
6. **debug mpls ldp transport events**

### DETAILED STEPS

| Command or Action                                                                                                                                                                             | Purpose                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1 enable</b><br><br><b>Example:</b><br><pre>Router&gt; enable</pre>                                                                                                                   | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>                                                                                                                                                                                                       |
| <b>Step 2 configure terminal</b><br><br><b>Example:</b><br><pre>Router# configure terminal</pre>                                                                                              | Enters global configuration mode.                                                                                                                                                                                                                                                                                        |
| <b>Step 3 mpls ldp logging password configuration</b> [ <i>rate-limit number</i> ]<br><br><b>Example:</b><br><pre>Router(config)# mpls ldp logging password configuration rate-limit 30</pre> | This command is used to enable the display of events related to configuration changes. <ul style="list-style-type: none"> <li>• The output displays events when a new password is configured or an existing password has been changed or deleted. A rate limit of 1 to 60 messages a minute can be specified.</li> </ul> |
| <b>Step 4 mpls ldp logging password rollover</b> [ <i>rate-limit number</i> ]<br><br><b>Example:</b><br><pre>Router(config)# mpls ldp logging password rollover rate-limit 25</pre>           | This command is used to enable the display of events related to password rollover events. <ul style="list-style-type: none"> <li>• Events are displayed when a new password is used for authentication or when authentication is disabled. A rate limit of 1 to 60 messages a minute can be specified.</li> </ul>        |

| Command or Action                                                                                                                         | Purpose                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 5</b> <code>exit</code><br><br><b>Example:</b><br><code>Router(config)# exit</code>                                               | This command exits global configuration mode.                                                                                                                                                                                                                           |
| <b>Step 6</b> <code>debug mpls ldp transport events</code><br><br><b>Example:</b><br><code>Router# debug mpls ldp transport events</code> | This command displays notifications when a session TCP MD5 option is changed. <ul style="list-style-type: none"> <li>You can also use the <code>debug mpls ldp transport connections</code> command to display notifications when the MD5 option is changed.</li> </ul> |

**Example**

```
Router# debug mpls ldp transport events
00:03:44: ldp: MD5 setup for peer 10.2.2.2:0(global); password changed to adfas
00:05:04: ldp: MD5 setup for peer 10.52.52.2:0(vpn1(1)); password changed to [nil]
```

## Changing MPLS LDP--Lossless MD5 Session Authentication Passwords

To change an MPLS LDP--Lossless MD5 Session Authentication password, perform the following task. The MPLS LDP--Lossless MD5 Session Authentication feature allows MD5 passwords to be changed for LDP session authentication without having to close and reestablish an existing LDP session.

**SUMMARY STEPS**

- `enable`
- `configure terminal`
- `mpls ldp [vrf vrf-name] password rollover duration minutes`
- `mpls ldp [vrf vrf-name] password fallback {key-chain keychain-name | [0 | 7] password}`
- `no mpls ldp neighbor [vrf vrf-name] ip-address password password`
- `exit`
- `show mpls ldp neighbor [vrf vrf-name] [ip-address | interface] [detail] [graceful-restart]`

**DETAILED STEPS**

| Command or Action                                                                          | Purpose                                                                                                         |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> <code>enable</code><br><br><b>Example:</b><br><code>Router&gt; enable</code> | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter the password if prompted.</li> </ul> |

| Command or Action                                                                                                                                                                                                  | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 2</b> <b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>                                                                                                        | Enters global configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <p><b>Step 3</b> <b>mpls ldp [vrf vrf-name] password rollover duration minutes</b></p> <p><b>Example:</b></p> <pre>Router(config)# mpls ldp password rollover duration 7</pre>                                     | <p>Configures the duration before the new password takes effect.</p> <ul style="list-style-type: none"> <li>The <b>vrf vrf-name</b> keyword-argument pair specifies a VRF configured on the LSR.</li> <li>The <i>minutes</i> argument specifies the number of minutes from 5 to 65535 before the password rollover occurs on this router.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Step 4</b> <b>mpls ldp [vrf vrf-name] password fallback {key-chain keychain-name   [0   7] password}</b></p> <p><b>Example:</b></p> <pre>Router(config)# mpls ldp password fallback key-chain fallback</pre> | <p>Configures an MD5 password for LDP sessions with peers.</p> <ul style="list-style-type: none"> <li>The <b>vrf vrf-name</b> keyword-argument pair specifies a VRF configured on the LSR.</li> <li>The <b>key-chain keychain-name</b> keyword-argument pair specifies the name of the keychain used to specify the MD5 key that authenticates the exchange of bidirectional LDP traffic.</li> <li>The <b>0</b> and <b>7</b> keywords specify whether the password that follows is hidden (encrypted); <ul style="list-style-type: none"> <li><b>0</b> specifies an unencrypted password.</li> <li><b>7</b> specifies an encrypted password.</li> </ul> </li> <li>The <i>password</i> argument specifies the MD5 password to be used for the specified LDP sessions.</li> </ul> |
| <p><b>Step 5</b> <b>no mpls ldp neighbor [vrf vrf-name] ip-address password password</b></p> <p><b>Example:</b></p> <pre>Router(config)# no mpls ldp neighbor 10.11.11.11 password lab1</pre>                      | <p>Disables the configuration of a password for computing MD5 checksums for the session TCP connection with the specified neighbor.</p> <ul style="list-style-type: none"> <li>The <b>vrf vrf-name</b> argument optionally specifies the VRF instance for the specified neighbor.</li> <li>The <i>ip-address</i> argument identifies the neighbor router ID.</li> <li>The <b>password password</b> keyword-argument pair is necessary so that the router computes MD5 checksums for the session TCP connection with the specified neighbor.</li> </ul>                                                                                                                                                                                                                          |
| <p><b>Step 6</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config)# exit</pre>                                                                                                                            | Exits from global configuration mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



| Command or Action                                                                                                                                                                                    | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 7</b> <code>show mpls ldp neighbor [vrf vrf-name] [ip-address   interface] [detail] [graceful-restart]</code></p> <p><b>Example:</b></p> <pre>Router# show mpls ldp neighbor detail</pre> | <p>Displays the status of LDP sessions.</p> <ul style="list-style-type: none"> <li>The <b>vrf vrf-name</b> keyword-argument pair displays the LDP neighbors for the specified VRF instance.</li> <li>The <i>ip-address</i> argument identifies the neighbor with the IP address for which password protection is configured.</li> <li>The <i>interface</i> argument lists the LDP neighbors accessible over this interface.</li> <li>The <b>detail</b> keyword displays information in long form, including password information for this neighbor. Here are the items displayed: <ul style="list-style-type: none"> <li>An indication as to whether a password is mandatory for this neighbor (required/not required)</li> <li>The password source (neighbor/fallback/number [option number])</li> <li>An indication as to whether the latest configured password for this neighbor is used by the TCP session (in use) or the TCP session uses an old password (stale)</li> </ul> </li> <li>The <b>graceful-restart</b> keyword displays per-neighbor graceful restart information.</li> </ul> |

## Configuration Examples for MPLS LDP--Lossless MD5 Session Authentication

- [Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain \(Symmetrical\) Example, page 113](#)
- [Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain \(Asymmetrical\) Example, page 114](#)
- [Changing MPLS LDP--Lossless MD5 Session Authentication Password Example, page 115](#)
- [Changing MPLS LDP--Lossless MD5 Session Authentication Password Using a Rollover Without Keychain Example, page 116](#)
- [Changing MPLS LDP--Lossless MD5 Session Authentication Password Using a Rollover with a Keychain Example, page 117](#)
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### Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain (Symmetrical) Example

The following example shows a configuration of two peer LSRs that use symmetrical MD5 keys:

**LSR1**

```

access-list 10 permit 10.2.2.2
mpls ldp password required for 10
mpls ldp password option 1 for 10 ldp-pwd
!
key chain ldp-pwd
key 1
 key-string pwd1
 send-lifetime 10:00:00 Jan 1 2009 10:00:00 Feb 1 2009
 accept-lifetime 09:00:00 Jan 1 2009 11:00:00 Feb 1 2009
!
interface loopback0
 ip address 10.1.1.1 255.255.255.255
!
interface FastEthernet0/0/0
 ip address 10.0.1.1 255.255.255.254
 mpls label protocol ldp
 mpls ip

```

**LSR2**

```

access-list 10 permit 10.1.1.1
mpls ldp password required for 10
mpls ldp password option 1 for 10 ldp-pwd
!
key chain ldp-pwd
key 1
 key-string pwd1
 send-lifetime 10:00:00 Jan 1 2009 10:00:00 Feb 1 2009
 accept-lifetime 09:00:00 Jan 1 2009 11:00:00 Feb 1 2009
!
interface loopback0
 ip address 10.2.2.2 255.255.255.255
!
interface FastEthernet0/0/0
 ip address 10.0.1.2 255.255.255.254
 mpls label protocol ldp
 mpls ip

```

## Configuring MPLS LDP--Lossless MD5 Session Authentication Using a Keychain (Asymmetrical) Example

The following example shows a configuration of two peer LSRs that use asymmetrical MD5 keys:

**LSR1**

```

access-list 10 permit 10.2.2.2
mpls ldp password required for 10
mpls ldp password option 1 for 10 ldp-pwd
!
key chain ldp-pwd
key 1
 key-string pwd1
 accept-lifetime 00:00:00 Jan 1 2005 duration 1
 send-lifetime 10:00:00 Jan 1 2009 10:00:00 Feb 1 2009
key 2
 key-string pwd2
 accept-lifetime 09:00:00 Jan 1 2009 11:00:00 Feb 1 2009
 send-lifetime 00:00:00 Jan 1 2005 duration 1
!
interface loopback0
 ip address 10.1.1.1 255.255.255.255
!
interface FastEthernet0/0/0
 ip address 10.0.1.1 255.255.255.254

```

```
mpls label protocol ldp
mpls ip
```

## LSR2

```
access-list 10 permit 10.1.1.1
mpls ldp password required for 10
mpls ldp password option 1 for 10 ldp-pwd
!
key chain ldp-pwd
key 1
 key-string pwd2
 accept-lifetime 00:00:00 Jan 1 2005 duration 1
 send-lifetime 10:00:00 Jan 1 2009 10:00:00 Feb 1 2009
key 2
 key-string pwd1
 accept-lifetime 09:00:00 Jan 1 2009 11:00:00 Feb 1 2009
 send-lifetime 00:00:00 Jan 1 2005 duration 1
!
interface loopback0
 ip address 10.2.2.2 255.255.255.255
!
interface FastEthernet0/0/0
 ip address 10.0.1.2 255.255.255.254
 mpls label protocol ldp
 mpls ip
```

# Changing MPLS LDP--Lossless MD5 Session Authentication Password Example

The following example shows the existing password configuration for LSR A, LSR B, and LSR C:

## LSR A Existing Configuration

```
mpls ldp router-id loopback0 force
mpls ldp neighbor 10.11.11.11 password lab1
mpls ldp neighbor 10.12.12.12 password lab1
mpls label protocol ldp
!
interface loopback0
 ip address 10.10.10.10 255.255.255.255
!
interface FastEthernet1/0/0
 ip address 10.2.0.1 255.255.0.0
 mpls ip
!
interface FastEthernet2/0/0
 ip address 10.0.0.1 255.255.0.0
 mpls ip
```

## LSR B Existing Configuration

```
mpls ldp router-id loopback0 force
mpls ldp neighbor 10.10.10.10 password lab1
mpls label protocol ldp
!
interface loopback0
 ip address 10.11.11.11 255.255.255.255
!
interface FastEthernet1/0/0
 ip address 10.2.0.2 255.255.0.0
 mpls ip
```

### LSR C Existing Configuration

```

mpls ldp router-id loopback0 force
mpls ldp neighbor 10.10.10.10 password lab1
mpls label protocol ldp
!
interface loopback0
ip address 10.12.12.12 255.255.255.255
!
interface FastEthernet2/0/0
ip address 10.0.0.2 255.255.0.0
mpls ip
!
```

The following example shows how the lossless password change is configured using the **mpls ldp password rollover duration** command for LSR A, LSR B, and LSR C so there is enough time to change all the passwords on all of the routers:

### LSR A New Configuration

```

mpls ldp password rollover duration 10
mpls ldp password fallback lab2
no mpls ldp neighbor 10.11.11.11 password lab1
no mpls ldp neighbor 10.12.12.12 password lab1
```

### LSR B New Configuration

```

mpls ldp password rollover duration 10
mpls ldp password fallback lab2
no mpls ldp neighbor 10.10.10.10 password lab1
```

### LSR C New Configuration

```

mpls ldp password rollover duration 10
mpls ldp password fallback lab2
no mpls ldp neighbor 10.10.10.10 password lab1
```

After 10 minutes has elapsed, the password changes. The following system logging message for LSR A confirms that the password rollover was successful:

```

%LDP-5-PWDRO: Password rolled over for 10.11.11.11:0
%LDP-5-PWDRO: Password rolled over for 10.12.12.12:0
```

## Changing MPLS LDP--Lossless MD5 Session Authentication Password Using a Rollover Without Keychain Example

The MPLS LDP--Lossless MD5 Session Authentication password can be changed in a lossless way (without tearing down an existing LDP session) by using a password rollover without a keychain.

The following example shows the existing password configuration for LSR A and LSR B:

### LSR A Existing Configuration

```

mpls ldp router-id loopback0 force
mpls ldp neighbor 10.11.11.11 password lab1
mpls label protocol ldp
!
interface loopback0
ip address 10.10.10.10 255.255.255.255
!
```

```
interface FastEthernet1/0/0 ip address 10.2.0.1 255.255.0.0
mpls ip
```

### LSR B Existing Configuration

```
mpls ldp router-id loopback0 force
mpls ldp neighbor 10.10.10.10 password lab1
mpls label protocol ldp
!
interface loopback0
ip address 10.11.11.11 255.255.255.255
!
interface FastEthernet1/0/0
ip address 10.2.0.2 255.255.0.0
mpls ip
```

The following example shows the new password configuration for LSR A and LSR B:



#### Note

---

The rollover duration should be large enough so that the passwords can be changed on all impacted routers.

---

### LSR A New Configuration

```
mpls ldp password rollover duration 10
mpls ldp neighbor 10.11.11.11 password lab2
```

### LSR B New Configuration

```
mpls ldp password rollover duration 10
mpls ldp neighbor 10.10.10.10 password lab2
```

After 10 minutes (rollover duration), the password changes and the following system logging message confirms the password rollover at LSR A:

```
%LDP-5-PWDRO: Password rolled over for 10.11.11.11:0
```

## Changing MPLS LDP--Lossless MD5 Session Authentication Password Using a Rollover with a Keychain Example

The MPLS LDP--Lossless MD5 Session Authentication password can be changed in a lossless way by using a password rollover with a keychain. The following configuration example shows the new password keychain configuration for LSR A, LSR B, and LSR C, in which the new password is ldp-pwd.

In the example, the desired keychain is configured first. The first pair of keys authenticate incoming TCP segments (recv key) and compute MD5 digests for outgoing TCP segments (xmit key). These keys should be the same keys as those currently in use; that is, in lab 1. The second recv key in the keychain should be valid after a few minutes. The second xmit key becomes valid at a future time.



#### Note

---

The rollover duration should be large enough so that the passwords can be changed on all impacted routers.

---

### LSR A New Configuration

```
mpls ldp password rollover duration 10
```

```

access-list 10 permit 10.11.11.11
access-list 10 permit 10.12.12.12
!
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
accept-lifetime 10:15:00 Jan 1 2009 10:45:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
accept-lifetime 10:15:00 Feb 1 2009 10:45:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
no mpls ldp neighbor 10.11.11.11 password lab1
no mpls ldp neighbor 10.12.12.12 password lab1

```

### LSR B New Configuration

```

mpls ldp password rollover duration 10
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
accept-lifetime 10:15:00 Jan 1 2009 10:45:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
accept-lifetime 10:15:00 Feb 1 2009 10:45:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
no mpls ldp neighbor 10.10.10.10 password lab1

```

### LSR C New Configuration

```

mpls ldp password rollover duration 10
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
accept-lifetime 10:15:00 Jan 1 2009 10:45:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
accept-lifetime 10:15:00 Feb 1 2009 10:45:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
no mpls ldp neighbor 10.10.10.10 password lab1

```

After 10 minutes, the password changes and the following system logging message confirms the password rollover at LSR A.

```

%LDP-5-PWDRO: Password rolled over for 10.11.11.11:0
%LDP-5-PWDRO: Password rolled over for 10.12.12.12:0

```

## Changing MPLS LDP--Lossless MD5 Session Authentication Password Using a Fallback Password with a Keychain Example

The MPLS LDP--Lossless MD5 Session Authentication password can be changed in a lossless way by using a fallback password when doing a rollover with a keychain.



**Note**

The fallback password is used only when there is no other keychain configured. If there is a keychain configured, then the fallback password is not used.

The following example shows the existing password configuration for LSR A, LSR B, and LSR C:

### LSR A Existing Configuration

```
mpls ldp router-id loopback0 force
mpls label protocol ldp
!
interface loopback0
ip address 10.10.10.10 255.255.255.255
!
interface FastEthernet1/0/0
ip address 10.2.0.1 255.255.0.0
mpls ip
!
interface FastEthernet2/0/0
ip address 10.0.0.1 255.255.0.0
mpls ip
!
access-list 10 permit 10.11.11.11
access-list 10 permit 10.12.12.12
!
key chain ldp-pwd
key 10
key-string labl
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

### LSR B Existing Configuration

```
mpls ldp router-id loopback0 force
mpls label protocol ldp
!
interface loopback0
ip address 10.11.11.11 255.255.255.255
!
interface FastEthernet1/0/0
ip address 10.2.0.2 255.255.0.0
mpls ip
!
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string labl
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

### LSR C Existing Configuration

```

mpls ldp router-id loopback0 force
mpls label protocol ldp
!
interface loopback0
ip address 10.12.12.12 255.255.255.255
!
interface FastEthernet2/0/0
ip address 10.0.0.2 255.255.0.0
mpls ip
!
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd

```

**Note**

The fallback keychain is not used unless the keychain *ldp-pwd* is removed using the **no mpls ldp password option 5 for 10 key-chain ldp-pwd** command.

The following example shows the new configuration for LSR A, LSR B, and LSR C, where one keychain is configured with the name *ldp-pwd* and another keychain is configured with the name *fallback* for the fallback password.

**Note**

The rollover duration should be large enough so that the passwords can be changed on all impacted routers.

### LSR A New Configuration

```

mpls ldp password rollover duration 10
!
key chain fallback
key 10
key-string fbk1
!
mpls ldp password fallback key-chain fallback
!
no mpls ldp password option 5 for 10 key-chain ldp-pwd

```

### LSR B New Configuration

```

mpls ldp password rollover duration 10
!
key chain fallback
key 10
key-string fbk1
!
mpls ldp password fallback key-chain fallback
!
no mpls ldp password option 5 for 10 key-chain ldp-pwd

```

### LSR C New Configuration

```

mpls ldp password rollover duration 10
key chain fallback
key 10

```



```
key-string fbk1
!
mpls ldp password fallback key-chain fallback
!
no mpls ldp password option 5 for 10 key-chain ldp-pwd
```

After 10 minutes, the password changes and the following system logging message confirms the password rollover at LSR A:

```
%LDP-5-PWDRO: Password rolled over for 10.11.11.11:0
%LDP-5-PWDRO: Password rolled over for 10.12.12.12:0
```

## Changing MPLS LDP--Lossless MD5 Session Authentication Common Misconfiguration Examples

The following sections describe common misconfiguration examples that can occur when the MPLS LDP--Lossless MD5 Session Authentication password is migrated in a lossless way. Misconfigurations can lead to undesired behavior in an LDP session.

- [Incorrect Keychain LDP Password Configuration Example, page 121](#)
- [Avoiding Access List Configuration Problems, page 122](#)

### Incorrect Keychain LDP Password Configuration Example

Possible misconfigurations can occur when keychain-based commands are used with the **mpls ldp password option for key-chain** command. If the **accept-lifetime** or **send-lifetime** command is not specified in this configuration, then a misconfiguration can occur when more than two keys are in a keychain.

The following example shows an incorrect keychain configuration with three passwords for LSR A and LSR B in the keychain:

#### LSR A Incorrect Keychain LDP Password Configuration

```
access-list 10 permit 10.11.11.11
!
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

#### LSR B Incorrect Keychain LDP Password Configuration

```
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
key 12
```

```
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

In the example, for both LSR A and LSR B, during the period of the third **send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009** command, all three configured keys are valid as receive keys, and only the last configured key is valid as a transmit key. The keychain resolution rules dictate that keys 10 and 11 are used as receive keys, and only the last key 12 can be used as the transmit key. Because the transmit and receive keys are mismatched, the LDP session will not stay active.

**Note**

When more than two passwords are configured in a keychain, the configuration needs to have both **accept-lifetime** and **send-lifetime** commands configured correctly for effective rollovers.

The following example shows the correct keychain configuration with multiple passwords in the keychain:

**LSR A Correct Keychain LDP Password Configuration**

```
access-list 10 permit 10.11.11.11
!
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
accept-lifetime 10:15:00 Jan 1 2009 10:45:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
accept-lifetime 10:15:00 Feb 1 2009 10:45:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

**LSR B Correct Keychain LDP Password Configuration**

```
access-list 10 permit 10.10.10.10
key chain ldp-pwd
key 10
key-string lab1
send-lifetime 10:00:00 Jan 1 2009 10:30:00 Jan 1 2009
accept-lifetime 10:00:00 Jan 1 2009 10:45:00 Jan 1 2009
key 11
key-string lab2
send-lifetime 10:30:00 Jan 1 2009 10:30:00 Feb 1 2009
accept-lifetime 10:15:00 Jan 1 2009 10:45:00 Feb 1 2009
key 12
key-string lab3
send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009
accept-lifetime 10:15:00 Feb 1 2009 10:45:00 Mar 1 2009
!
mpls ldp password option 5 for 10 key-chain ldp-pwd
```

In the example above, for both LSR A and LSR B, during the period of the third **send-lifetime 10:30:00 Feb 1 2009 10:30:00 Mar 1 2009** command, only the last key 12 is valid as transmit and receive keys. Therefore, the LDP session remains active.

## Avoiding Access List Configuration Problems

Use caution when modifying or deleting an access list. Any empty access list implies “permit any” by default. So when either the **mpls ldp password option for key-chain** command or the **mpls ldp password**

**option for** command is used for MPLS LDP MD5 session authentication, if the access list specified in the command becomes empty as a result of a modification or deletion, then all LDP sessions on the router expect a password. This configuration may cause undesired behavior in LDP sessions. To avoid this scenario, ensure that the proper access list is specified for each LSR.

## Changing MPLS LDP--Lossless MD5 Session Authentication Using a Second Key to Avoid LDP Session Failure Examples

The MPLS LDP--Lossless MD5 Session Authentication feature works when a specified rollover period is configured. Typically, one rollover period overlaps the two accept lifetime values that are configured for two consecutive receive keys. The LDP process requests an update from the keychain manager for the latest valid transmit and receive keys once every minute. LDP compares the latest key set with the keys from the previous update in its database to determine if a key was removed, changed, or rolled over. When the rollover occurs, the LDP process detects the rollover and programs TCP with the next receive key.

The LDP session can fail if LDP is configured to use two keys for the MPLS LDP--Lossless MD5 Session Authentication feature where the first key uses a send and accept lifetime value and the second key is not configured. The configuration creates a special case where there are two rollovers but there is only one rollover period.

The following sections provide an example of this problem and a solution:

- [TCP Authentication and LDP Sessions Can Fail When a Second Rollover Period Is Missing Example, page 123](#)
- [Reconfigure a Keychain to Prevent TCP Authentication and LDP Session Failures Example, page 124](#)

### TCP Authentication and LDP Sessions Can Fail When a Second Rollover Period Is Missing Example

In the following configuration, the first rollover is from “secondpass” to “firstpass.” The second rollover is from “firstpass” back to “secondpass.” The only rollover period in this configuration is the overlapping between the “firstpass” and “secondpass.” Because one rollover period is missing, LDP performs only the first rollover and not the second rollover, causing TCP authentication to fail and the LDP session to fail.

```
key chain ldp-pwd
 key 1
 key-string firstpass
 accept-lifetime 01:03:00 Sep 10 2009 01:10:00 Sep 10 2009
 send-lifetime 01:05:00 Sep 10 2009 01:08:00 Sep 10 2009
 key 2
 key-string secondpass
```

TCP authentication and LDP sessions can also fail if the second key has send and accept lifetime configured. In this case the accept lifetime of the first key is a subset of the accept lifetime of the second key. For example:

```
key chain ldp-pwd
 key 1
 key-string firstpass
 accept-lifetime 01:03:00 Sep 10 2009 01:10:00 Sep 10 2009
 send-lifetime 01:05:00 Sep 10 2009 01:08:00 Sep 10 2009
 key 2
 key-string secondpass
 accept-lifetime 01:03:00 Sep 9 2009 01:10:00 Sep 11 2009
 send-lifetime 01:05:00 Sep 9 2009 01:08:00 Sep 11 2009
```

## Reconfigure a Keychain to Prevent TCP Authentication and LDP Session Failures Example

If the configuration needs to specify the last key in the keychain to always be valid, then configure the keychain to have at least two keys. Each key must be configured with both the send and accept lifetime period. For example:

```
key chain ldp-pwd
 key 1
 key-string firstpass
 accept-lifetime 01:03:00 Sep 10 2008 01:10:00 Sep 10 2008
 send-lifetime 01:05:00 Sep 10 2008 01:08:00 Sep 10 2008
 key 2
 key-string secondpass
 accept-lifetime 01:06:00 Sep 10 2008 01:17:00 Sep 10 2008
 send-lifetime 01:08:00 Sep 10 2008 01:15:00 Sep 10 2008
 key 3
 key-string thirdpass
```

If the configuration needs to specify the first keychain for the time interval, then switch to use the second key forever after that interval. This is done by configuring the start time for the second key to begin shortly before the end time of the first key, and by configuring the second key to be valid forever after that interval. For example:

```
key chain ldp-pwd
 key 1
 key-string firstpass
 accept-lifetime 00:03:00 Sep 10 2008 01:10:00 Sep 10 2008
 send-lifetime 00:05:00 Sep 10 2008 01:08:00 Sep 10 2008
 key 2
 key-string secondpass
 accept-lifetime 01:06:00 Sep 10 2008 infinite
 send-lifetime 01:08:00 Sep 10 2008 infinite
```

If the configuration needs to specify the two keys in the order of the second key, first key, and second key again, then specify three keys in that order with the proper rollover period. For example:

```
key chain ldp-pwd
 key 1
 key-string firstpass
 accept-lifetime 00:03:00 Sep 10 2008 01:10:00 Sep 10 2008
 send-lifetime 00:05:00 Sep 10 2008 01:08:00 Sep 10 2008
 key 2
 key-string secondpass
 accept-lifetime 01:06:00 Sep 10 2008 01:17:00 Sep 10 2008
 send-lifetime 01:08:00 Sep 10 2008 01:15:00 Sep 10 2008
 key 3
 key-string firstpass
 accept-lifetime 01:13:00 Sep 10 2008 infinite
 send-lifetime 01:15:00 Sep 10 2008 infinite
```

## Additional References

The following sections provide references related to the MPLS LDP--Lossless MD5 Session Authentication feature.

**Related Documents**

| Related Topic                                        | Document Title                                                   |
|------------------------------------------------------|------------------------------------------------------------------|
| MPLS Label Distribution Protocol (LDP)               | MPLS Label Distribution Protocol                                 |
| LDP implementation enhancements for the MD5 password | <i>MPLS--LDP MD5 Global Configuration</i>                        |
| MPLS LDP commands                                    | <i>Cisco IOS Multiprotocol Label Switching Command Reference</i> |

**Standards**

| Standard                                                                                                                              | Title |
|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | --    |

**MIBs**

| MIB                                                                                                                         | MIBs Link                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature. | To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

**RFCs**

| RFC                                                                                                                         | Title |
|-----------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified RFCs are supported by this release, and support for existing RFCs has not been modified by this feature. | --    |

**Technical Assistance**

| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Link                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p> | <a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a> |

## Feature Information for MPLS LDP-Lossless MD5 Session Authentication

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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**Table 7** Feature Information for MPLS LDP-Lossless MD5 Session Authentication

| Feature Name                                 | Releases                 | Feature Information                                                                                                                                                                                                                                    |
|----------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP-Lossless MD5 Session Authentication | Cisco IOS XE Release 2.1 | <p>This feature allows an LDP session to be password-protected without tearing down and reestablishing the LDP session.</p> <p>In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.</p> |

| Feature Name | Releases | Feature Information                                                                                                                                                                                                                                                                                                                                                          |
|--------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |          | The following commands were introduced or modified: <b>mpls ldp logging password configuration, mpls ldp logging password rollover, mpls ldp neighbor password, mpls ldp password fallback, mpls ldp password option, mpls ldp password required, mpls ldp password rollover duration, show mpls ldp discovery, show mpls ldp neighbor, show mpls ldp neighbor password.</b> |

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## MPLS LDP-VRF-Aware Static Labels

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This document explains how to configure the MPLS LDP--VRF-Aware Static Labels feature and Multiprotocol Label Switching (MPLS) static labels. Virtual Private Network routing and forwarding (VRF)-aware static labels can be used at the edge of an MPLS Virtual Private Network (VPN), whereas MPLS static labels can be used only in the MPLS VPN provider core.

- [Finding Feature Information, page 129](#)
- [Information About MPLS LDP-VRF-Aware Static Labels, page 129](#)
- [How to Configure MPLS LDP--VRF-Aware Static Labels, page 130](#)
- [Configuration Examples for MPLS LDP--VRF-Aware Static Labels, page 134](#)
- [Additional References, page 136](#)
- [Feature Information for MPLS LDP-VRF-Aware Static Labels, page 137](#)

### Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

### Information About MPLS LDP-VRF-Aware Static Labels

- [Overview of MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels, page 129](#)
- [Labels Reserved for Static Assignment, page 130](#)

### Overview of MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels

Label switch routers (LSRs) dynamically learn the labels they should use to label-switch packets by means of the following label distribution protocols:

- Label Distribution Protocol (LDP), the Internet Engineering Task Force (IETF) standard used to bind labels to network addresses
- Resource Reservation Protocol (RSVP) used to distribute labels for traffic engineering (TE)
- Border Gateway Protocol (BGP) used to distribute labels for MPLS VPNs

The LSR installs the dynamically learned label into its Label Forwarding Information Base (LFIB).

You can configure static labels for the following purposes:

- To bind labels to IPv4 prefixes to support MPLS hop-by-hop forwarding through neighbor routers that do not implement LDP label distribution. MPLS static labels allow you to configure entries in the MPLS forwarding table and assign label values to forwarding equivalence classes (FECs) learned by LDP. You can manually configure an LSP without running an LDP between the endpoints.
- To create static cross connects to support MPLS label switched path (LSP) midpoints when neighbor routers do not implement the LDP or RSVP label distribution, but do implement an MPLS forwarding path.
- To statically bind a VRF-aware label on a provider edge (PE) router to a customer network prefix (VPN IPv4 prefix). VRF-aware static labels can be used with nonglobal VRF tables, so the labels can be used at the VPN edge. For example, with the Carrier Supporting Carrier (CSC) feature, the backbone carrier can assign specific labels to FECs it advertises to the edge routers of customer carriers. Then, backbone carrier can monitor backbone traffic coming from particular customer carriers for billing or other purposes. Depending on how you configure VRF-aware static labels, they are advertised one of the following ways:
  - By LDP between PE and customer edge (CE) routers within a VRF instance
  - In VPNv4 BGP in the service provider's backbone

## Labels Reserved for Static Assignment

Before you can manually assign labels, you must reserve a range of labels to be used for the manual assignment. Reserving the labels ensures that the labels are not dynamically assigned.

## How to Configure MPLS LDP--VRF-Aware Static Labels

- [Reserving Labels to Use for MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels](#), page 130
- [Configuring MPLS Static Labels in the MPLS VPN Provider Core](#), page 131
- [Configuring MPLS LDP--VRF-Aware Static Labels at the Edge of the VPN](#), page 133

## Reserving Labels to Use for MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels

To reserve the labels that are to be statically assigned so that the labels are not dynamically assigned, perform the following task.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls label range** *minimum-value maximum-value* [**static** *minimum-static-value maximum-static-value*]
4. **exit**
5. **show mpls label range**

## DETAILED STEPS

| Command or Action                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>                                                                                                                                                | <p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>                                                                                                                      |
| <p><b>Step 2</b> <code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>                                                                                                                           | <p>Enters global configuration mode.</p>                                                                                                                                                                                                     |
| <p><b>Step 3</b> <code>mpls label range <i>minimum-value maximum-value</i> [static <i>minimum-static-value maximum-static-value</i>]</code></p> <p><b>Example:</b></p> <pre>Router(config)# mpls label range 200 100000 static 16 199</pre> | <p>Reserves a range of labels for static labels assignment. The default is that no labels are reserved for static assignment.</p> <p><b>Note</b> You might need to reload the router for the range of labels you reserve to take effect.</p> |
| <p><b>Step 4</b> <code>exit</code></p> <p><b>Example:</b></p> <pre>Router(config)# exit</pre>                                                                                                                                               | <p>Exits global configuration mode.</p>                                                                                                                                                                                                      |
| <p><b>Step 5</b> <code>show mpls label range</code></p> <p><b>Example:</b></p> <pre>Router# show mpls label range</pre>                                                                                                                     | <p>Displays information about the range of values for local labels, including those available for static assignment.</p>                                                                                                                     |

## Configuring MPLS Static Labels in the MPLS VPN Provider Core

To configure MPLS static labels in the MPLS VPN provider core, perform the following task.

MPLS static labels allow you to configure entries in the MPLS forwarding table and assign label values to FECs learned by LDP. You can manually configure an LSP without running a label distribution protocol between the endpoints. In MPLS VPN networks, static labels can be used only in the MPLS VPN provider core.

- Globally enable MPLS on each LSR.
- Enable Cisco Express Forwarding on each LSR.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **mpls static binding ipv4** *prefix mask {label | input label | output nexthop {explicit-null | implicit-null | label}}*
4. **exit**
5. show mpls static binding ipv4
6. show mpls forwarding-table

**DETAILED STEPS**

| Command or Action                                                                                                                                                                                                                                               | Purpose                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> <b>enable</b><br><br><b>Example:</b><br><pre>Router&gt; enable</pre>                                                                                                                                                                              | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>                                   |
| <b>Step 2</b> <b>configure terminal</b><br><br><b>Example:</b><br><pre>Router# configure terminal</pre>                                                                                                                                                         | Enters global configuration mode and returns to privileged EXEC mode.                                                                                |
| <b>Step 3</b> <b>mpls static binding ipv4</b> <i>prefix mask {label   input label   output nexthop {explicit-null   implicit-null   label}}</i><br><br><b>Example:</b><br><pre>Router(config)# mpls static binding ipv4 10.2.2.0 255.255.255.255 input 17</pre> | Specifies static binding of labels to IPv4 prefixes. Specified bindings are installed automatically in the MPLS forwarding table as routing demands. |
| <b>Step 4</b> <b>exit</b><br><br><b>Example:</b><br><pre>Router(config)# exit</pre>                                                                                                                                                                             | Exits global configuration mode and enters privileged EXEC mode.                                                                                     |
| <b>Step 5</b> show mpls static binding ipv4<br><br><b>Example:</b><br><pre>Router# show mpls static binding ipv4</pre>                                                                                                                                          | Displays the configured static labels.                                                                                                               |

| Command or Action                                                                                         | Purpose                                              |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Step 6</b> show mpls forwarding-table<br><br><b>Example:</b><br><br>Router# show mpls forwarding-table | Displays the static labels used for MPLS forwarding. |

## Configuring MPLS LDP--VRF-Aware Static Labels at the Edge of the VPN

To configure the MPLS LDP--VRF-Aware Static Labels feature at the edge of the VPN, perform the following task.

You can statically bind a VRF-aware label on a PE router to a customer network prefix (VPN IPv4 prefix). VRF-aware static labels can be used with nonglobal VRF tables, so the labels can be used at the VPN edge.

- [Restrictions, page 133](#)
- [Troubleshooting Tips, page 134](#)

### Restrictions

- Globally enable MPLS on each LSR.
- Enable Cisco Express Forwarding on each LSR.
- Ensure the MPLS VPN is configured.
- Ensure that the provider network has MPLS LDP installed and running.



#### Note

The MPLS LDP-VRF-Aware Static Labels feature is supported only with MPLS VPN Carrier Supporting Carrier networks that use MPLS LDP.

### SUMMARY STEPS

1. enable
2. configure terminal
3. mpls static binding ipv4 vrf *vpn-name prefix mask* {input label| label }
4. exit
5. show mpls static binding ipv4 vrf *vpn-name*

## DETAILED STEPS

| Command or Action                                                                                                                                                                                                         | Purpose                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Step 1</b> <code>enable</code><br><br><b>Example:</b><br><pre>Router&gt; enable</pre>                                                                                                                                  | Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>                                                                                                                             |
| <b>Step 2</b> <code>configure terminal</code><br><br><b>Example:</b><br><pre>Router# configure terminal</pre>                                                                                                             | Enters global configuration mode.                                                                                                                                                                                                            |
| <b>Step 3</b> <code>mpls static binding ipv4 vrf vpn-name prefix mask {input label} label }</code><br><br><b>Example:</b><br><pre>Router(config)# mpls static binding ipv4 vrf vpn100 10.2.0.0 255.255.0.0 input 17</pre> | Binds a prefix to a local label.<br><br>Specified bindings are installed automatically in the MPLS forwarding table as routing demands.<br><br><b>Note</b> You must configure the MPLS VPN and VRFs before creating VRF-aware static labels. |
| <b>Step 4</b> <code>exit</code><br><br><b>Example:</b><br><pre>Router(config)# exit</pre>                                                                                                                                 | Exits global configuration mode and enters privileged EXEC mode.                                                                                                                                                                             |
| <b>Step 5</b> <code>show mpls static binding ipv4 vrf vpn-name</code><br><br><b>Example:</b><br><pre>Router(config)# show mpls static binding ipv4 vrf vpn100</pre>                                                       | Displays the configured MPLS static bindings.                                                                                                                                                                                                |

## Troubleshooting Tips

To display information related to static binding events, use the `debug mpls static binding vrf` command.

## Configuration Examples for MPLS LDP--VRF-Aware Static Labels

- [Example Reserving Labels to Use for MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels, page 135](#)
- [Example Configuring MPLS Static Labels in the MPLS VPN Provider Core, page 135](#)

- [Example Configuring MPLS LDP--VRF-Aware Static Labels at the VPN Edge, page 135](#)

## Example Reserving Labels to Use for MPLS Static Labels and MPLS LDP--VRF-Aware Static Labels

In the following example, the **mpls label range** command reserves a generic range of labels from 200 to 100000 and configures a static label range of 16 to 199:

```
Router(config)# mpls label range 200 100000 static 16 199
% Label range changes take effect at the next reload.
```

In this example, the output from the **show mpls label range** command indicates that the new label ranges do not take effect until a reload occurs:

```
Router# show mpls label range

Downstream label pool: Min/Max label: 16/100000
 [Configured range for next reload: Min/Max label: 200/100000]
Range for static labels: Min/Max/Number: 16/199
```

In the following output, the **show mpls label range** command, executed after a reload, indicates that the new label ranges are in effect:

```
Router# show mpls label range

Downstream label pool: Min/Max label: 200/100000
Range for static labels: Min/Max/Number: 16/199
```

## Example Configuring MPLS Static Labels in the MPLS VPN Provider Core

The following example configures input and output labels for several prefixes:

```
Router(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 55
Router(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 output 10.0.0.66 167
Router(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 input 17

Router(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 output 10.13.0.8 explicit-null
```

The **show mpls static binding ipv4** command displays the configured static labels:

```
Router# show mpls static binding ipv4

10.0.0.0/8: Incoming label: 55
 Outgoing labels:
 10.0.0.66 167
10.66.0.0/24: Incoming label: 17
 Outgoing labels:
 10.13.0.8 explicit-null
```

## Example Configuring MPLS LDP--VRF-Aware Static Labels at the VPN Edge

In the following example, the **mpls static binding ipv4 vrf** commands configure static label bindings. They also configure input (local) labels for various prefixes.

```
Router(config)# mpls static binding ipv4 vrf vpn100 10.0.0.0 10.0.0.0 55
Router(config)# mpls static binding ipv4 vrf vpn100 10.66.0.0 255.255.0.0 input 17
```

In the following output, the **show mpls static binding ipv4 vrf** command displays the configured VRF-aware static bindings:

```
Router# show mpls static binding ipv4 vrf
vpn100
10.0.0.0/8: (vrf: vpn100) Incoming label: 55
 Outgoing labels: None
10.66.0.0/16: (vrf: vpn100) Incoming label: 17
 Outgoing labels: None
```

## Additional References

### Related Documents

| Related Topic                      | Document Title                                                   |
|------------------------------------|------------------------------------------------------------------|
| Cisco IOS commands                 | <a href="#">Cisco IOS Master Commands List, All Releases</a>     |
| MPLS commands                      | <i>Cisco IOS Multiprotocol Label Switching Command Reference</i> |
| MPLS VPN configuration information | Configuring MPLS Layer 3 VPNs                                    |

### Standards

| Standard                                                                                                                              | Title |
|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature. | --    |

### MIBs

| MIB                                                                                                                         | MIBs Link                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature. | To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL:<br><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a> |

### RFCs

| RFC                                                                                                                         | Title |
|-----------------------------------------------------------------------------------------------------------------------------|-------|
| No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature. | --    |



### Technical Assistance

| Description                                                                                                                                                                                                                                                                                                                                                                           | Link                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password. | <a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a> |

## Feature Information for MPLS LDP-VRF-Aware Static Labels

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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**Table 8**      **Feature Information for MPLS LDP-VRF-Aware Static Labels**

| Feature Name                     | Releases                 | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MPLS LDP-VRF-Aware Static Labels | Cisco IOS XE Release 2.1 | <p>The MPLS LDP-VRF-Aware Static Labels feature explains how to configure the MPLS LDP-VRF-Aware Static Labels feature and MPLS static labels. VRF-aware static labels can be used at the edge of an MPLS VPN, whereas MPLS static labels can be used only in the MPLS VPN provider core.</p> <p>In Cisco IOS XE Release 2.2, this feature was implemented on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following commands were introduced or modified: <b>debug mpls static binding</b>, <b>mpls label range</b>, <b>mpls static binding ipv4</b>, <b>mpls static binding ipv4 vrf</b>, <b>show mpls label range</b>, <b>show mpls static binding ipv4</b>, and <b>show mpls static binding ipv4 vrf</b>.</p> |

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