



Configuring the MPLS Label Distribution Protocol

This chapter describes how to configure the Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) on Cisco NX-OS devices.

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Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at <https://tools.cisco.com/bugsearch/> and the release notes for your 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 “New and Changed Information” chapter or the Feature History table below.

Information About MPLS LDP

MPLS LDP enables peer label-switched routers (LSRs) to exchange label binding information for supporting hop-by-hop forwarding in an MPLS network.

The following topics provide information about MPLS LDP:

- [Introduction to MPLS LDP, page 3-25](#)
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Introduction to MPLS LDP

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 communicates 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 virtual private networks (VPNs).

MPLS LDP Functional Overview

MPLS LDP provides the building blocks for MPLS-enabled applications, such as MPLS VPNs.

MPLS 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 label-switched paths (LSPs) forward label traffic across an MPLS backbone to particular destinations. These capabilities enable operators to implement MPLS-based IP VPNs.

MPLS 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

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 process is called *basic discovery*.

To initiate an LDP session between routers, the routers determine which router takes the active role and which router takes the passive role. The router that takes the active role establishes an LDP TCP connection 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 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.



Note Downstream on demand is a feature of LDP, but it is not supported in Cisco NX-OS.

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 that is specifically addressed to that LSR (unicast). The nondirectly connected LSR responds to the hello message, and the two routers begin to establish an LDP session. This process is called *extended discovery*.

An MPLS LDP targeted session is a label distribution session between routers that are not directly connected. You establish nondirectly connected MPLS LDP sessions by enabling the transmission of targeted hello messages.

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 that carry 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 using the **discovery targeted-hello accept** command.

LDP Label Bindings and Label Spaces

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. 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 use the platform-wide label space.

LDP Identifiers

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 following steps describe the default process for determining the LDP router ID:

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.

Configuring a loopback address helps to ensure a stable LDP ID for the router because the state of loopback addresses does not change, even in the presence of link-down events. Generally, it is also desirable for the LDP router ID to be preserved across reboots.

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

- If the loopback interface has been explicitly shut down.
- If you configured a different interface to be used as the LDP router ID.



Note 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.

3. Otherwise, the router selects the largest IP address that pertains to an operational interface as the LDP router ID.



Note

Although the LDP algorithm for selecting a router ID attempts to select a loopback interface, it cannot be guaranteed across all startup scenarios. Therefore, we recommend that you explicitly configure the LDP router ID.

MPLS LDP Transport Address

The default method for determining the LDP router ID might 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. Therefore, you may want to specify the IP

address of an interface as the LDP router ID. When you do so, the router selects the IP address of the specified interface (if the interface is operational) the next time it is necessary to select an LDP router ID, which is typically the next time the current router ID interface is shut down or its address is changed.

The establishment of an LDP session between two routers requires a session TCP connection by which label advertisements can be exchanged between the routers. To establish the session TCP connection, each router must know the transport address (IP address) of the other router.

The LDP discovery mechanism allows a router to advertise the transport address for its end-of-session TCP connection. When the transport address advertisement is explicit, the transport address appears as part of the contents of the discovery hello messages that are sent to the peer. When the transport address advertisement is implicit, the transport address is not included in the discovery hello messages, and the peer uses the source IP address of the received hello messages as the peer transport address.

**Note**

When a router has multiple links that connect it to its peer device, the router must advertise the same transport address in the LDP discovery hello messages that it sends on all such interfaces.

Explicit-Null Labels

Typically, LDP advertises an implicit-null label for directly connected prefixes. The implicit-null label causes the second to last (penultimate) 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 (with a 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 this case, the inner label can still carry the QoS value needed by the penultimate and edge LSRs to implement their QoS policy.

High Availability for MPLS LDP

The Cisco NX-OS architecture and high availability infrastructure provide support for feature components to be restarted and resume operations transparently to other services on the device and on neighboring devices. This support allows for continuous operation and minimal data loss during planned software changes and unplanned software failures.

MPLS LDP supports these Cisco NX-OS high availability technologies:

- Nonstop Forwarding (NSF)
- Graceful (stateless) restart
- Stateful Switch Over (SSO)
- In-Service Software Upgrade (ISSU)

Licensing Requirements for MPLS LDP

Product	License Requirement
Cisco NX-OS	MPLS LDP requires an MPLS license. For a complete explanation of the Cisco NX-OS licensing scheme and how to obtain and apply licenses, see the <i>Cisco NX-OS Licensing Guide</i> .

Prerequisites for MPLS LDP

MPLS LDP has the following prerequisites:

- The address reserved intrusion detection system (IDS) check is disabled by default. Do not enable this check (using the **hardware ip verify address reserved** command) if you plan to enable MPLS LDP.

Guidelines and Limitations for MPLS LDP

MPLS LDP has the following configuration guidelines and limitations:

- MPLS LDP does not guarantee that a loopback interface will be selected before a physical interface during a reload. We recommend that you explicitly configure the router ID to ensure that the same router ID is selected across router reloads and configuration copies.
- Cisco NX-OS TCP does not support stateful process restarts for itself or for its clients.
- Cisco NX-OS Release 6.1 introduces support for more than four process instances for OSPFv2 per VDC. However, only the first four configured OSPFv2 instances are supported with MPLS LDP.

Default Settings for MPLS LDP

[Table 3-1](#) lists the default settings for MPLS LDP parameters.

Table 3-1 Default MPLS LDP Parameters

Parameters	Default
Global MPLS LDP	Disabled
MPLS LDP on interfaces	Disabled
Label distribution mode	Independent
Label retention mode	Liberal
Label advertisement	Downstream unsolicited
Basic hello times	15-second hold time, 5-second hello interval
Targeted hello times	90-second hold time, 10-second hello interval
Session times	180-second hold time, 60-second keepalive interval
Initial backoff time	15 seconds

Table 3-1 Default MPLS LDP Parameters (continued)

Parameters	Default
Maximum backoff time	120 seconds
Transport address	LDP router ID

Configuring MPLS LDP

This section includes the following topics:

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- [Enabling MPLS LDP on an Interface, page 3-31](#)
- [Enabling Directly Connected MPLS LDP Sessions, page 3-32](#)
- [Establishing Nondirectly Connected MPLS LDP Sessions, page 3-35](#)
- [Configuring MPLS LDP Backoff Intervals, page 3-36](#)
- [Configuring the MPLS LDP Hold Time, page 3-38](#)
- [Specifying the LDP Router ID, page 3-39](#)
- [Configuring an MPLS LDP Transport Address, page 3-40](#)
- [Preserving QoS Settings with an MPLS LDP Explicit-Null Label, page 3-41](#)
- [Shutting Down MPLS LDP Services, page 3-42](#)

Enabling MPLS LDP Globally

You can enable MPLS LDP globally on an LSR.

Prerequisites

Ensure that the MPLS feature set is installed in the default VDC and enabled in the VDC for which you are configuring LDP. For more information on the MPLS feature set, see the “Configuring the MPLS Feature Set” chapter.

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Make sure that the address reserved IDS check is disabled.



Note This check should be disabled by default. If it is enabled, use the **no hardware ip verify address reserved** command to disable it.

SUMMARY STEPS

1. **configure terminal**
2. **feature mpls ldp**
3. **(Optional) show running-config mpls ldp**
4. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	feature mpls ldp Example: switch(config)# feature mpls ldp	Enables the MPLS LDP feature on the device. Note When the MPLS LDP feature is disabled on the device, no LDP commands are available.
Step 3	show running-config mpls ldp Example: switch(config)# show running-config mpls ldp	(Optional) Displays the configuration status of MPLS LDP on the device. Note When MPLS LDP is disabled on the device, no LDP information is visible.
Step 4	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Enabling MPLS LDP on an Interface

You can enable MPLS LDP on individual interfaces. To enable LDP, you should configure it globally and on each interface where it is needed.

**Note**

Alternatively, you can globally configure MPLS LDP on every interface associated with a specified Interior Gateway Protocol (IGP) instance using the MPLS LDP autoconfiguration feature. Because you do not have to configure LDP separately on each interface, the autoconfiguration feature makes LDP configuration easier, faster, and error free. For more information, see the “Configuring the MPLS Autoconfiguration” chapter.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that the interface on which you want to enable MPLS LDP is up.

Ensure that an IP address is configured for the interface.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface slot/port*
3. **mpls ip**
4. (Optional) **show mpls interface detail**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface interface slot/port Example: switch(config)# interface ethernet 2/2 switch(config-if)#	Specifies the interface on which you are enabling MPLS LDP and enters interface configuration mode.
Step 3	mpls ip Example: switch(config-if)# mpls ip	Enables MPLS LDP on the specified interface.
Step 4	show mpls interface detail Example: switch(config-if)# show mpls interface detail	(Optional) Displays the configuration status of MPLS LDP on the interface.
Step 5	copy running-config startup-config Example: switch(config-if)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Enabling Directly Connected MPLS LDP Sessions

You can configure MPLS LDP sessions between two directly connected routers.



Note

Alternatively, you can use the **neighbor ip-address targeted** command to create a targeted session between directly connected MPLS LSRs when the MPLS label forwarding convergence time is an issue. This command can improve the label convergence time for directly connected neighbor LSRs when the links that directly connect them are down. When the links between the neighbor LSRs are up, both the link and targeted hellos maintain the LDP session. If the links between the neighbor LSRs go down, the targeted hellos maintain the session, which allows the LSRs to retain labels that are learned from each other. When a link that directly connects the LSRs comes back up, the LSRs can immediately reinstall labels for forwarding without having to reestablish their LDP session and exchange labels. See the “Configuring MPLS LDP Session Protection” chapter for information on automatically starting targeted hellos to protect directly connected LDP sessions.

Prerequisites

- Ensure that you are in the correct VDC (or use the **switchto vdc** command).
- Ensure that the interface for which you want to establish an MPLS LDP session is up.
- Ensure that an IP address is configured for the interface.

SUMMARY STEPS

1. **configure terminal**

2. **interface** *interface slot/port*
3. **mpls ip**
4. **exit**
5. **mpls ldp** configuration
6. **(Optional) discovery hello** {**holdtime** *seconds* | **interval** *seconds*}
7. **(Optional) show mpls ldp discovery** [**detail**]
8. **(Optional) show mpls ldp neighbor** [**detail**]
9. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	<code>configure terminal</code> Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	<code>interface interface slot/port</code> Example: switch(config)# interface ethernet 2/2 switch(config-if)#	Configures an interface and enters interface configuration mode.
Step 3	<code>mpls ip</code> Example: switch(config-if)# mpls ip	Configures MPLS hop-by-hop forwarding.
Step 4	<code>exit</code> Example: switch(config-if)# exit switch(config)#	Exits interface configuration mode.
Step 5	<code>mpls ldp configuration</code> Example: switch(config)# mpls ldp configuration switch(config-ldp)#	Enters LDP configuration mode.
Step 6	<code>discovery hello {holdtime seconds interval seconds}</code> Example: switch(config-ldp)# discovery hello holdtime 10	(Optional) Configures the hold time or interval for directly connected neighbors. The holdtime seconds keyword-argument pair defines the period of time that a discovered LDP neighbor is remembered without receipt of an LDP hello message from the neighbor. The range is from 1 to 65535 seconds. The interval seconds keyword-argument pair defines the period of time between the sending of consecutive hello messages. The range is from 1 to 65535 seconds. Note If the interval time is larger than a third of the hold time value, the interval is automatically adjusted to a third of the hold time value.
Step 7	<code>show mpls ldp discovery [detail]</code> Example: switch(config-ldp)# show mpls ldp discovery	(Optional) Verifies that the interface is up and is sending discovery hello messages.
Step 8	<code>show mpls ldp neighbor [detail]</code> Example: switch(config-ldp)# show mpls ldp neighbor	(Optional) Shows that the LDP session between routers was successfully established.
Step 9	<code>copy running-config startup-config</code> Example: switch(config-ldp)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Establishing Nondirectly Connected MPLS LDP Sessions

You can configure nondirectly connected MPLS LDP sessions, which enable you to establish an LDP session between routers that are not directly connected.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that the neighbor IP address is reachable, if you want to set up a targeted session to another LSR.



Note When LDP is enabled on a TE tunnel, LDP uses targeted hellos and sets up a targeted session to the tunnel tailend LSR.

Ensure that the tunnel for which you want to establish an MPLS LDP session is up.

Configure the routers at both ends of the tunnel to be active or enable one router to be passive with the **discovery targeted-hello accept** command. (See Step 4 for information on using this command.)

SUMMARY STEPS

1. **configure terminal**
2. `mpls ldp configuration`
3. `neighbor ip-address targeted`
4. `discovery targeted-hello {accept [from prefix-list] | holdtime seconds | interval seconds}`
5. **(Optional) show mpls ldp discovery [detail]**
6. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	<code>configure terminal</code> Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	<code>mpls ldp configuration</code> Example: switch(config)# mpls ldp configuration switch(config-ldp)#	Enters LDP configuration mode.
Step 3	<code>neighbor ip-address targeted</code> Example: switch(config-ldp)# neighbor 192.168.1.1 targeted	Configures a targeted session to another LSR.
Step 4	<code>discovery targeted-hello {accept [from prefix-list] holdtime seconds interval seconds}</code> Example: switch(config-ldp)# discovery targeted-hello accept	Configures the router to respond to requests for targeted-hello messages from all neighbors or from neighbors specified by the optional prefix list or configures the hold time or interval for neighbors that are not directly connected. The holdtime seconds keyword-argument pair defines the period of time that a discovered LDP neighbor is remembered without receipt of an LDP hello message from the neighbor. The range is from 1 to 65535 seconds. The interval seconds keyword-argument pair defines the period of time between the sending of consecutive hello messages. The range is from 1 to 65535 seconds. Note If the interval time is larger than a third of the hold time value, the interval is automatically adjusted to a third of the hold time value.
Step 5	<code>show mpls ldp discovery [detail]</code> Example: switch(config-ldp)# show mpls ldp discovery	(Optional) Verifies that the interface is up and is sending discovery hello messages.
Step 6	<code>copy running-config startup-config</code> Example: switch(config-ldp)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring MPLS LDP Backoff Intervals

You can configure the backoff interval to limit the time it takes to establish an LDP session and to prevent neighbors from overwhelming each other while exchanging parameter information. If you configure a backoff interval and a session setup attempt fails due to an incompatibility between routers, each LSR delays its next attempt (that is, backs off), increasing the delay exponentially with each successive failure until the maximum backoff delay is reached.

**Note**

You should change the settings from the default values only if such settings result in undesirable behavior.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that MPLS LDP is enabled on the device.

SUMMARY STEPS

1. **configure terminal**
2. **mpls ldp configuration**
3. **backoff initial-backoff max-backoff**
4. **(Optional) show mpls ldp backoff**
5. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	mpls ldp configuration Example: switch(config)# mpls ldp configuration switch(config-ldp)#	Enters LDP configuration mode.
Step 3	backoff initial-backoff max-backoff Example: switch(config-ldp)# backoff 30 240	Configures session setup delay parameters for the LDP backoff mechanism: <ul style="list-style-type: none"> • The <i>initial-backoff</i> argument defines the initial backoff value in seconds. The range is from 5 to 2147483. • The <i>max-backoff</i> argument defines the maximum backoff value in seconds. The range is from 5 to 2147483.
Step 4	show mpls ldp backoff Example: switch(config-ldp)# show mpls ldp backoff	(Optional) Displays information about the configured session setup backoff parameters and any potential LDP peers with which session setup attempts are being throttled.
Step 5	copy running-config startup-config Example: switch(config-ldp)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Configuring the MPLS LDP Hold Time

You can configure the MPLS LDP hold time to specify how long an LDP session is maintained in the absence of LDP messages from the session peer.



Note

When an LDP session is established between two LSRs, the hold time used for the session is the lower of the values configured on the two LSRs.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that MPLS LDP is enabled on the device.

SUMMARY STEPS

1. **configure terminal**
2. **mpls ldp configuration**
3. **holdtime** {seconds | infinite}
4. **(Optional) show mpls ldp parameters**
5. **(Optional) copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	mpls ldp configuration Example: switch(config)# mpls ldp configuration switch(config-ldp)#	Enters LDP configuration mode.
Step 3	holdtime {seconds infinite} Example: switch(config-ldp)# holdtime 30	Specifies how long an LDP session is maintained in the absence of LDP messages from the session peer. The range is from 15 to 65535 seconds.
Step 4	show mpls ldp parameters Example: switch(config-ldp)# show mpls ldp parameters	(Optional) Displays the LDP parameters, including the session hold time.
Step 5	copy running-config startup-config Example: switch(config-ldp)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Specifying the LDP Router ID

You can configure the IP address of an interface as the LDP router ID.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that MPLS LDP is enabled on the interface.

Ensure that the specified interface is operational before assigning it as the LDP router ID.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface slot/port*
3. **exit**
4. **mpls ldp** configuration
5. **router-id** *interface number* [**force**]
6. (Optional) **show mpls ldp discovery** [**detail**]
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface <i>interface slot/port</i> Example: switch(config)# interface loopback 2 switch(config-if)#	Configures an interface and enters interface configuration mode.
Step 3	exit Example: switch(config-if)# exit switch(config)#	Exits interface configuration mode.
Step 4	mpls ldp configuration Example: switch(config)# mpls ldp configuration switch(config-ldp)#	Enters LDP configuration mode.

Command	Purpose
<p>Step 5 <code>router-id interface number [force]</code></p> <p>Example: <code>switch(config-ldp)# router-id loopback 2</code></p>	<p>Specifies the preferred interface for determining the LDP router ID, which is typically determined the next time that the interface is shut down or the address is deconfigured.</p> <p>The force keyword enables the router ID to take effect more quickly. However, implementing the router ID depends on the current state of the specified interface. If the interface is up 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 from the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.</p> <p>Note Cisco strongly recommends that you explicitly specify the router ID and when doing so that you use the loopback interface.</p> <p>Note Beginning with Cisco NX-OS Release 5.2(5), the force option is not required, unless there is a requirement to always maintain the same router ID. As long as a loopback interface is specified, it is chosen as the router ID upon system or VDC boot-up. This rule does not apply for the physical interface. For Cisco NX-OS releases prior to 5.2(5), the force option is required so that the system boots up with the configured router ID, if it is a loopback or physical interface.</p>
<p>Step 6 <code>show mpls ldp discovery [detail]</code></p> <p>Example: <code>switch(config-ldp)# show mpls ldp discovery</code></p>	<p>(Optional) Displays the LDP identifier for the local router.</p>
<p>Step 7 <code>copy running-config startup-config</code></p> <p>Example: <code>switch(config-ldp)# copy running-config startup-config</code></p>	<p>(Optional) Copies the running configuration to the startup configuration.</p>

Configuring an MPLS LDP Transport Address

If the LDP router ID is not appropriate for your situation, you can specify the transport address advertised in the LDP discovery hello messages sent on an interface. By default, LDP advertises its LDP router ID as the transport address.

Prerequisites

- Ensure that you are in the correct VDC (or use the **switchto vdc** command).
- Ensure that MPLS LDP is enabled on the interface.

SUMMARY STEPS

1. **configure terminal**

2. **interface** *interface slot/port*
3. **mpls ldp discovery transport-address** *{ip-address | interface}*
4. (Optional) **show mpls ldp discovery detail**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface <i>interface slot/port</i> Example: switch(config)# interface ethernet 2/2 switch(config-if)#	Configures an interface and enters interface configuration mode.
Step 3	mpls ldp discovery transport-address <i>{ip-address interface}</i> Example: switch(config-if)# mpls ldp discovery transport-address 209.165.200.225	Specifies the transport address advertised in the LDP discovery hello messages sent on an interface: <ul style="list-style-type: none"> • The <i>ip-address</i> argument specifies that a specific IP address be advertised as the transport address. • The interface keyword specifies that the interface IP address be advertised as the transport address.
Step 4	show mpls ldp discovery detail Example: switch(config-if)# show mpls ldp discovery detail	(Optional) Displays the status of the LDP discovery process, including the transport address.
Step 5	copy running-config startup-config Example: switch(config-if)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

Preserving QoS Settings with an MPLS LDP Explicit-Null Label

You can configure an LSR to advertise an explicit-null label (with a value of zero) in order to preserve QoS values. An explicit-null label is advertised in place of an implicit-null label for directly connected prefixes.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that MPLS LDP is enabled on the device.

SUMMARY STEPS

1. **configure terminal**

2. `mpls ldp configuration`
3. **explicit-null** [`for prefix-list` | `to prefix-list` | **for prefix-list to prefix-list**]
4. (Optional) **show mpls forwarding statistics**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: switch# <code>configure terminal</code> switch(config)#	Enters global configuration mode.
Step 2	mpls ldp configuration Example: switch(config)# <code>mpls ldp configuration</code> switch(config-ldp)#	Enters LDP configuration mode.
Step 3	explicit-null [<code>for prefix-list</code> <code>to prefix-list</code> for prefix-list to prefix-list] Example: switch(config-ldp)# explicit-null	Advertises an explicit-null label in situations where an implicit-null label would normally be advertised.
Step 4	show mpls forwarding statistics Example: switch(config-ldp)# show mpls forwarding statistics	(Optional) Verifies that MPLS packets are forwarded with an explicit-null label (value of zero).
Step 5	copy running-config startup-config Example: switch(config-ldp)# <code>copy running-config startup-config</code>	(Optional) Copies the running configuration to the startup configuration.

Shutting Down MPLS LDP Services

You can shut down MPLS LDP services.

Prerequisites

Ensure that you are in the correct VDC (or use the **switchto vdc** command).

Ensure that an LDP session is established.

SUMMARY STEPS

1. **configure terminal**
2. `mpls ldp configuration`
3. **shutdown**
4. (Optional) **show mpls ldp neighbor** [`ip-address` | `interface`] [**detail**]

DETAILED STEPS

	Command	Purpose
Step 1	<code>configure terminal</code> Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters global configuration mode.
Step 2	<code>mpls ldp configuration</code> Example: <code>switch(config)# mpls ldp configuration</code> <code>switch(config-ldp)#</code>	Enters LDP configuration mode.
Step 3	<code>shutdown</code> Example: <code>switch(config-ldp)# shutdown</code>	Tears down all LDP sessions, withdraws all outgoing labels from the forwarding plane, and frees all local labels that have been allocated. Note The no shutdown command reactivates LDP service when LDP is shut down.
Step 4	<code>show mpls ldp neighbor [ip-address interface] [detail]</code> Example: <code>switch(config-ldp)# show mpls ldp neighbor detail</code>	(Optional) Displays the status of LDP sessions.

Verifying the MPLS LDP Configuration

To display the MPLS LDP configuration, perform one of the following tasks:

Command	Purpose
<code>show mpls interface detail</code>	Displays the configuration status of MPLS LDP on the interface.
<code>show mpls ldp backoff</code>	Displays information about the configured session setup backoff parameters and any potential LDP peers with which session setup attempts are being throttled.
<code>show mpls ldp bindings</code>	Displays the MPLS LDP label information base (LIB).
<code>show mpls ldp capabilities</code>	Displays MPLS LDP capabilities information.
<code>show mpls ldp checkpoint</code>	Displays MPLS LDP checkpoint information.
<code>show mpls ldp discovery [detail]</code>	Displays the status of the LDP discovery process.
<code>show mpls ldp neighbor [ip-address interface] [detail]</code>	Displays the status of LDP sessions.
<code>show mpls ldp parameters</code>	Displays the current LDP parameters.

Command	Purpose
show mpls switching	Displays the MPLS label switching database. This command can be used to verify the consistency of the LDP database and forwarding information.
show running-config interface [tunnel tunnel-te] <i>number</i>	Displays the running configuration for the tunnel interface.
show running-config mpls ldp	Displays the configuration status of MPLS LDP on the device.

For detailed information about the fields in the output from these commands, see the *Cisco Nexus 7000 Series NX-OS MPLS Command Reference*.

Configuration Examples for MPLS LDP

This section provides configuration examples for MPLS LDP and includes the following topics:

- [Examples: Configuring Directly Connected MPLS LDP Sessions, page 3-44](#)
- [Examples: Establishing Nondirectly Connected MPLS LDP Sessions, page 3-45](#)
- [Examples: Specifying the LDP Router ID, page 3-46](#)
- [Examples: Preserving QoS Settings with an MPLS LDP Explicit-Null Label, page 3-47](#)

Examples: Configuring Directly Connected MPLS LDP Sessions

The following example shows how to configure MPLS LDP sessions between two directly connected routers.

Router A Configuration

```
switch(config)# interface ethernet 2/1
switch(config-if)# ip address 10.1.1.1 255.255.255.0
switch(config-if)# mpls ip
switch(config-if)# exit
```

Router B Configuration

```
switch(config)# interface ethernet 2/1
switch(config-if)# ip address 10.1.1.2 255.255.255.0
switch(config-if)# mpls ip
switch(config-if)# exit
switch(config)# mpls ldp configuration
switch(config-ldp)# discovery hello interval 5
```

The following example shows how to verify that interface Ethernet 2/1 has been configured to use LDP:

```
switch# show mpls interface detail
Interface Ethernet2/1:
  mpls te lif enabled
  ldp enabled
  MPLS operational
  Label space id 0x10000001
  MPLS sub-layer Ethernet2/1-mpls layer(0x26000003)
```

The following example shows how to verify that the interface is up and is sending LDP discovery hello messages and that the period of time between the sending of consecutive hello messages is 5 seconds:

```
switch# show mpls ldp discovery detail
Local LDP Identifier:
  10.1.1.2:0
Discovery Sources:
Interfaces:
  Ethernet2/1 (ldp): xmit
  Enabled: Interface config
  Hello interval: 5000 ms; Transport IP addr: 10.1.1.2
  Clients: IPv4
```

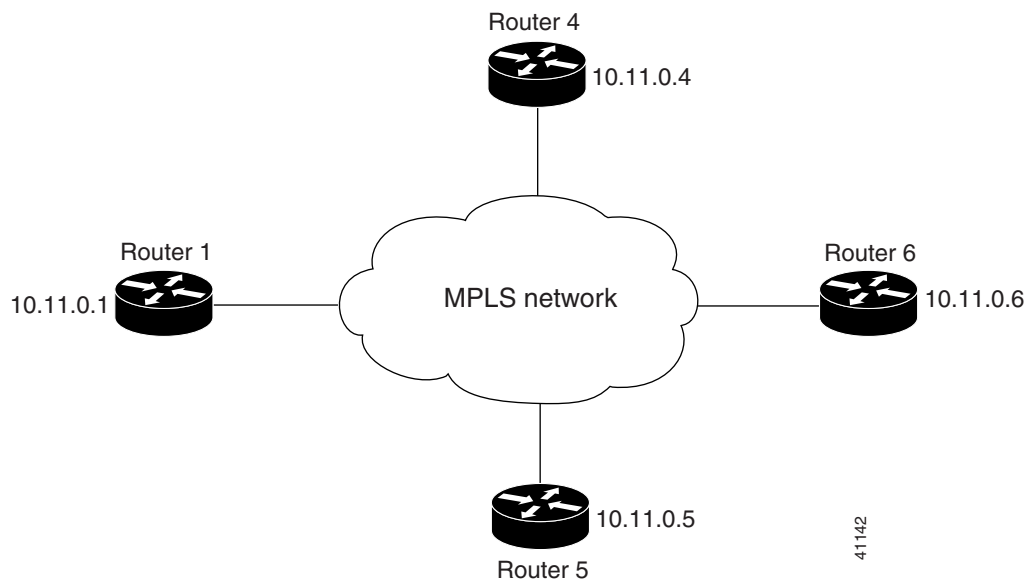
The following example shows how to verify that the LDP session between routers was successfully established:

```
switch# show mpls ldp neighbor
Peer LDP Ident: 10.1.1.1:0; Local LDP Ident 10.1.1.2:0
TCP connection: 10.1.1.1.646 - 10.1.1.2.12407
State: Oper; Msgs sent/rcvd: 12/11; Downstream
Up time: 00:00:10
LDP discovery sources:
FastEthernet1/0, 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
```

Examples: Establishing Nondirectly Connected MPLS LDP Sessions

The following examples show the configuration of platforms for MPLS LDP nondirectly connected sessions using the sample network shown in [Figure 3-1](#). Note that Routers 1, 4, 5, and 6 in this sample network are not directly connected to each other.

Figure 3-1 Sample Network for Configuring LDP for Targeted Sessions



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The configuration example shows the following:

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

Router 1 Configuration

```
interface Loopback0          !Loopback interface for LDP ID.
ip address 10.25.0.11 255.255.255.255
```

Router 4 Configuration

```
interface Loopback0          !Loopback interface for LDP ID.
ip address 10.25.0.44 255.255.255.255
```

Router 5 Configuration

```
interface Loopback0          !Loopback interface for LDP ID.
ip address 10.25.0.55 255.255.255.255
```

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 **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.

```
interface Loopback0          !Loopback interface for LDP ID.
ip address 10.25.0.66 255.255.255.255

mpls ldp configuration
discovery targeted-hello accept from LDP_SOURCES
                                !Respond to requests for targeted hellos
                                !from sources permitted by prefix list LDP_SOURCES

ip prefix-list LDP_SOURCES      !Define prefix list for targeted hello sources
permit 10.11.25.11/32           !Accept targeted hello request from Router 1
deny any                       !Deny requests from other sources
```

Examples: Specifying the LDP Router ID

The following example shows how to assign interface Ethernet 2/2 as the LDP router ID:

```
switch# configure terminal
switch(config)# mpls ldp configuration
switch(config-ldp)# router-id loopback 0 force
```

The following example shows how to display the LDP router ID (10.15.15.15):

```
switch# show mpls ldp discovery

Local LDP Identifier:
 10.15.15.15:0
Discovery Sources:
 Interfaces:
   Ethernet2/2 (ldp): xmit
```

Examples: Preserving QoS Settings with an MPLS LDP Explicit-Null Label

The following example shows how to configure an explicit-null label on an egress LSR, which causes that LSR to advertise the explicit-null label to all adjacent MPLS routers:

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

The following example shows how to configure an explicit-null label and specify the **for** keyword with a prefix list, which causes all adjacent MPLS router tables to swap an explicit-null label only for those entries specified in the prefix list:

```
switch# configure terminal
switch(config)# ip prefix-list 24 permit 10.24.24.24/32
switch(config)# mpls ldp configuration
switch(config-ldp)# explicit-null for 24
```

The following example shows how to configure an explicit-null label and specify the **to** keyword with a prefix list, which enables you to advertise explicit-null labels only to those adjacent routers specified in the prefix list. To advertise an explicit-null label to a particular router, you must specify the router's LDP ID in the prefix list.

```
switch# configure terminal
switch(config)# ip prefix-list 15 permit 10.15.15.15/32
switch(config)# mpls ldp configuration
switch(config-ldp)# explicit-null to 15
```

The following example shows how to configure an explicit-null label with both the **for** and **to** keywords, which enables you to specify which routes to advertise with explicit-null labels and to which adjacent routers to advertise these explicit-null labels:

```
switch# configure terminal
switch(config)# mpls ldp configuration
switch(config-ldp)# explicit-null for 24 to 15
```

Additional References for MPLS LDP

For additional information related to implementing MPLS LDP, see the following sections:

- [Related Documents, page 3-48](#)
- [MIBs, page 3-48](#)

Related Documents

Related Topic	Document Title
CLI commands	<i>Cisco Nexus 7000 Series NX-OS MPLS Command Reference</i>
Cisco IOS MPLS LDP	MPLS Label Distribution Protocol (LDP)

MIBs

MIB	MIBs Link
MPLS-LDP-STD-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Feature History for MPLS LDP

[Table 3-2](#) lists the release history for this feature.

Table 3-2 *Feature History for MPLS LDP*

Feature Name	Releases	Feature Information
MPLS LDP	5.2(1)	This feature was introduced.

