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.

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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 Label Distribution Protocol (LDP) sessions. Therefore, Any Transport over MPLS (AToM) sessions are not supported.
- The Tag Distribution Protocol (TDP) is not supported. You must specify that the default label distribution protocol is LDP for a device or for an interface.

Information About MPLS LDP IGP Synchronization

How MPLS LDP IGP Synchronization Works

Packet loss can occur because the actions of the Interior Gateway Protocol (IGP) and the Label Distribution Protocol (LDP) are not synchronized. Packet loss can occur in the following situations:

- When an IGP adjacency is established, the device 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 device 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 IGPs to minimize Multiprotocol Label Switching (MPLS) packet loss.
- Enables you to globally enable LDP IGP synchronization on each interface associated with an IGP Open Shortest Path First (OSPF) or Intermediate System-to-Intermediate System (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 ip** or **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 **no 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, the Label Distribution Protocol (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 Interior Gateway Protocol (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 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 provide the option to configure a delay time for Multiprotocol Label Switching (MPLS) Label Distribution Protocol (LDP) and Interior Gateway Protocol (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 Open Shortest Path First (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 the Interior Gateway Protocol (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 a Label Distribution Protocol (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 IGP Synchronization with OSPF Interfaces

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. **mpls ip**
8. **exit**
9. **router ospf** *process-id*
10. **network** *ip-address wildcard-mask* **area** *area-id*
11. **mpls ldp sync**
12. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mpls ip** **Example:** `Device(config)# mpls ip`	Globally enables hop-by-hop forwarding.
Step 4	**mpls label protocol ldp** **Example:** `Device(config)# mpls label protocol ldp`	Specifies the Label Distribution Protocol (LDP) as the default protocol.
Step 5	**interface** *type number* **Example:**	Specifies the interface to configure, and enters interface configuration mode.

	Command or Action	Purpose
	`Device(config)# interface POS 3/0`	
Step 6	**ip address** *prefix mask* **Example:** `Device(config-if)# ip address 10.0.0.11 255.255.255.255`	Assigns an IP address to the interface.
Step 7	**mpls ip** **Example:** `Device(config-if)# mpls ip`	Enables hop-by-hop forwarding on the interface.
Step 8	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 9	**router ospf** *process-id* **Example:** `Device(config)# router ospf 1`	Enables Open Shortest Path First (OSPF) routing, and enters router configuration mode.
Step 10	**network** *ip-address wildcard-mask* **area** *area-id* **Example:** `Device(config-router)# network 10.0.0.0 0.0.255.255 area 3`	Specifies the interface on which OSPF runs and defines the area ID for that interface.
Step 11	**mpls ldp sync** **Example:** `Device(config-router)# mpls ldp sync`	Enables the Multiprotocol Label Switching (MPLS) Interior Gateway Protocol (IGP) synchronization for interfaces belonging for an OSPF or an Intermediate System-to-Intermediate System (IS-IS) process.
Step 12	**end** **Example:** `Device(config-router)# end`	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 Open Shortest Path First (OSPF) process are enabled for Label Distribution Protocol (LDP) Interior Gateway Protocol (IGP) synchronization. To remove LDP IGP synchronization from some interfaces, use the **no 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 number*
4. **no mpls ldp igp sync**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface POS 0/3/0`	Specifies the interface to configure, and enters interface configuration mode.
Step 4	**no mpls ldp igp sync** **Example:** `Device(config-if)# no mpls ldp igp sync`	Disables MPLS LDP IGP synchronization for that interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Verifying MPLS LDP IGP Synchronization with OSPF

After you configure the interfaces for the Label Distribution Protocol (LDP), Open Shortest Path First (OSPF), and LDP Interior Gateway Protocol (IGP) synchronization, verify that the configuration is working correctly by 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**

Enables privileged EXEC mode. Enter your password if prompted.

Example:

```
Device> enable
Device#
```

Step 2 **show mpls ldp igp sync**

Shows that the Multiprotocol Label Switching (MPLS) LDP IGP synchronization is configured correctly because LDP is configured and the SYNC status shows that synchronization is enabled.

Example:

```
Device# 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**

Shows that the interfaces are properly configured.

Example:

```
Device# 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**

Returns to user EXEC mode.

Example:

```
Device# exit
Device>
```

Configuring MPLS LDP IGP Synchronization with IS-IS Interfaces

Configuring MPLS LDP IGP Synchronization on All IS-IS Interfaces

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 number*
8. **ip address** *prefix mask*
9. **ip router isis** *process-name*
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mpls ip** **Example:** `Device(config)# mpls ip`	Globally enables hop-by-hop forwarding.
Step 4	**mpls label protocol ldp** **Example:**	Specifies the Label Distribution Protocol (LDP) as the default label distribution protocol.

	Command or Action	Purpose
	`Device(config)# mpls label protocol ldp`	
Step 5	**router isis** *process-name* **Example:** `Device(config)# router isis ISIS`	Enables the Intermediate System-to-Intermediate System (IS-IS) protocol on the device, specifies an IS-IS process, and enters router configuration mode.
Step 6	**mpls ldp sync** **Example:** `Device(config-router)# mpls ldp sync`	Enables Multiprotocol Label Switching (MPLS) LDP Interior Gateway Protocol (IGP) synchronization on interfaces belonging to an IS-IS process.
Step 7	**interface** *type number* **Example:** `Device(config-router)# interface POS 0/3/0`	Specifies the interface to configure, and enters interface configuration mode.
Step 8	**ip address** *prefix mask* **Example:** `Device(config-if)# ip address 10.25.25.11 255.255.255.0`	Assigns an IP address to the interface.
Step 9	**ip router isis** *process-name* **Example:** `Device(config-if)# ip router isis ISIS`	Enables IS-IS.
Step 10	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

Configuring MPLS LDP IGP Synchronization on an IS-IS Interface

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *prefix mask*
5. **ip router isis**
6. **exit**
7. **router isis**
8. **mpls ldp sync**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface POS 0/2/0`	Specifies the interface to configure, and enters interface configuration mode.
Step 4	**ip address** *prefix mask* **Example:** `Device(config-if)# ip address 10.50.72.4 255.0.0.0`	Assigns an IP address to the interface.
Step 5	**ip router isis** **Example:** `Device(config-if)# ip router isis`	Enables the Intermediate System-to-Intermediate System (IS-IS) protocol for IP on the interface.
Step 6	**exit** **Example:** `Device(config-if)# exit`	Returns to global configuration mode.
Step 7	**router isis** **Example:** `Device(config)# router isis`	Enters router configuration mode, and enables an IS-IS process on the device.
Step 8	**mpls ldp sync** **Example:** `Device(config-router)# mpls ldp sync`	Enables Label Distribution Protocol (LDP) Interior Gateway Protocol (IGP) synchronization for interfaces belonging to an IS-IS process.
Step 9	**end** **Example:** `Device(config-router)# end`	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 Intermediate System-to-Intermediate System (IS-IS) process are enabled for Label Distribution Protocol (LDP) Interior Gateway Protocol (IGP) synchronization. To remove LDP IGP synchronization from some interfaces, use the **no 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 number*
4. **no mpls ldp igp sync**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface POS 0/3/0`	Specifies the interface to configure, and enters interface configuration mode.
Step 4	**no mpls ldp igp sync** **Example:** `Device(config-if)# no mpls ldp igp sync`	Disables Multiprotocol Label Switching (MPLS) LDP IGP synchronization for that interface.
Step 5	**end** **Example:** `Device(config-if)# end`	Returns to privileged EXEC mode.

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

Example: MPLS LDP IGP Synchronization with OSPF

The following task shows how to enable the Label Distribution Protocol (LDP) for Open Shortest Path First (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.

```
Device# configure terminal
Device(config)# interface POS0/0/0
Device(config-if)# ip address 10.0.0.1
Device(config-if)# mpls ip
!
Device(config)# interface POS0/1/0
Device(config-if)# ip address 10.0.1.1
Device(config-if)# mpls ip
!
Device(config)# interface POS1/1/0
Device(config-if)# ip address 10.1.1.1
Device(config-if)# mpls ip
!
Device(config)# interface POS1/0/0
Device(config-if)# ip address 10.1.0.1
Device(config-if)# mpls ip
!
Device(config)# router ospf 1
Device(config-router)# network 10.0.0.0 0.0.255.255 area 3
Device(config-router)# network 10.1.0.0 0.0.255.255 area 3
Device(config-router)# mpls ldp sync
Device(config-router)# exit
Device(config)# interface POS1/0/0
Device(config-if)# no mpls ldp igp sync
```

Example: MPLS LDP IGP Synchronization with IS-IS

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:

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

```
Device(config)# router isis
Device(config-router)# mpls ldp sync
Device(config-router)# exit
Device(config) exit
Device#
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
MPLS LDP commands	Cisco IOS Multiprotocol Label Switching Command Reference
LDP autoconfiguration	"MPLS LDP Autoconfiguration" module in the *MPLS Label Distribution Protocol Configuration Guide*

Standards and RFCs

Standard/RFC	Title
RFC 3037	LDP Applicability
RFC 5036	LDP Specification

MIBs

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

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.	http://www.cisco.com/cisco/web/support/index.html