# MPLS High Availability: Overview

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This document provides an overview of the Multiprotocol Label Switching (MPLS) high availability (HA) features. MPLS HA provides full nonstop forwarding (NSF) and stateful switchover (SSO) capability to the MPLS Label Distribution Protocol (LDP) and MPLS Virtual Private Networks (VPNs) features.

### Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for MPLS High Availability: Overview" section on page 33.

### Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

## Contents



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# Restrictions for MPLS High Availability

For information about supported hardware, see the following documents:

- For Cisco IOS Release 12.2(25)S, see the *Cross-Platform Release Notes for Cisco IOS Release 12.2S.*
- For Cisco IOS Release 12.2(28)SB, see the *Cross-Platform Release Notes for Cisco IOS Release 12.2SB.*
- For Cisco IOS Release 12.2(33)SRA, see the *Release Notes for Cisco IOS Release 12.2SR for the Cisco 7600 Series Routers*
- For Cisco IOS Release 12.2(33)SXH, see the following documents:
  - *Release Notes for Cisco IOS Release 12.2SX on the Catalyst 6500 Series MSFC*
  - *Release Notes for Cisco IOS Release 12.2SX on the Supervisor Engine 720, Supervisor Engine 32, and Supervisor Engine 2*

# Information About MPLS High Availability

This section covers the following topics:



## MPLS High Availability Overview

MPLS HA features provide SSO and NSF capability to the MPLS Label Distribution Protocol (LDP) and MPLS Virtual Private Network (VPN) features. MPLS HA includes the following new features:

- NSF/SSO—MPLS VPN
- NSF/SSO—MPLS LDP and LDP Graceful Restart
- NSF/SSO: Any Transport over MPLS and Graceful Restart

In addition, the MIBs for MPLS VPNs and MPLS LDP have been enhanced to work in the MPLS HA environment.

The following features have been changed or created to work in the MPLS HA environment:

- MPLS High Availability Infrastructure Changes
- Cisco Express Forwarding Scalability Enhancements

The following features perform normally in an NSF/SSO environment. They can exist with SSO and NSF but do not have the ability to keep duplicate information in a backup Route Processor (RP) on the Cisco 7500 series router and in a backup Performance Routing Engine2 (PRE2) on the Cisco 10000 series router.

- MPLS Traffic Engineering
- MPLS Quality of Service Applications
- IPv6 over MPLS (not supported on the Cisco 10000 series router)

- MPLS Label Switching Router MIB
- MPLS TE MIB
- MPLS Enhancements to Interfaces MIB

The following sections explain these features in more detail.

# MPLS High Availability Features

The following MPLS HA features have the ability to continue forwarding data following an RP switchover on the Cisco 7500 series router or PRE2 switchover on the Cisco 10000 series router:

- MPLS Label Distribution Protocol (LDP)
- MPLS Virtual Private Networks (VPNs)
- Any Transport over MPLS (AToM)

**Note** In Cisco IOS Release 12.2(28)SB, AToM is not enabled for high availability on the Cisco 10000 series router. However, AToM coexists with SSO. This means that AToM functions normally in an SSO environment but because state information is not maintained on the standby RP, a switchover can partially disrupt operations

When you enable MPLS HA, you get the benefit of allowing an RP on the Cisco 7500 series router or PRE2 on the Cisco 10000 series router to recover from disruption in service without losing its LDP bindings, MPLS forwarding state, and VPN prefix information.

## NSF/SSO—MPLS VPN

The NSF/SSO—MPLS VPN feature allows a router to recover from a disruption in service without losing its VPN prefix information. The NSF/SSO—MPLS VPN feature works with the BGP Graceful Restart mechanisms defined in the Graceful Restart Internet Engineering Task Force (IETF) specifications and in the *Cisco Nonstop Forwarding* feature module. The BGP Graceful Restart feature supports the VPNv4 VRFs, which allows the routers running BGP Graceful Restart to preserve VPN prefix information when a router restarts.

For information about configuring the NSF/SSO—MPLS VPN feature, see the following feature module: *NSF/SSO—MPLS VPN.*

### NSF/SSO: MPLS VPN MIB

The NSF/SSO—MPLS VPN feature works with the MPLS VPN MIB. For information about configuring the MPLS VPN MIB, see the following feature module: *MPLS VPN: SNMP MIB Support.*

## NSF/SSO—MPLS LDP and LDP Graceful Restart

MPLS LDP uses SSO, NSF, and Graceful Restart to allow an RP on the Cisco 7500 series router or PRE2 on the Cisco 10000 series router to recover from disruption in the LDP components of the control plane service without losing its MPLS forwarding state. The NSF/SSO—MPLS LDP and LDP Graceful Restart feature works with LDP sessions between directly connected peers as well as with peers that are not directly connected (targeted sessions).

For information about configuring the NSF/SSO—MPLS LDP and LDP Graceful Restart feature, see the following feature module: *NSF/SSO—MPLS LDP and LDP Graceful Restart.*

### NSF/SSO: MPLS LDP MIB

The MPLS LDP MIB with the IETF Version 8 Upgrade is supported with NSF/SSO—MPLS LDP and LDP Graceful Restart. For information about configuring the MPLS LDP MIB, see the following feature module: *MPLS Label Distribution Protocol MIB Version 8 Upgrade.*

## NSF/SSO: Any Transport over MPLS and Graceful Restart

AToM uses SSO, NSF, and Graceful Restart to allow an RP to recover from disruption in the LDP components of the control plane service without losing its MPLS forwarding state.

**Note** In Cisco IOS Release 12.2(28)SB, AToM is not enabled for high availability on the Cisco 10000 series router. However, AToM coexists with SSO. This means that AToM functions normally in an SSO environment but because state information is not maintained on the standby RP, a switchover can partially disrupt operations.

For information about configuring AToM NSF/SSO Support and Graceful Restart, see *NSF/SSO: Any Transport over MPLS and Graceful Restart.*

# MPLS High Availability Infrastructure Changes

The MPLS control plane software has been enhanced to work in an HA environment. The changes made the control plane software more modular, which helps MPLS support newer applications. Some of the control plane software changes made MPLS more scalable and flexible. See the "Cisco Express Forwarding Scalability Enhancements" section on page 4 for more information.

Changes to the MPLS Forwarding Infrastructure (MFI) and the Cisco Express Forwarding component introduced new commands and changed other existing commands.

MFI replaced the Label Forwarding Information Base (LFIB) and is responsible for managing MPLS data structures used for forwarding. For information about the MPLS command changes related to the MFI, see the following document: *MPLS High Availability: Command Changes.*

**Note** The MFI and LFIB do not coexist in the same image. Users must use MFI starting with Cisco IOS Release 12.2(25)S and later releases.

MPLS High Availability introduces the MPLS IP Rewrite Manager (IPRM), which manages the interactions between Cisco Express Forwarding, the IP Label Distribution Modules (LDMs), and the MFI. MPLS IPRM is enabled by default. You do not need to configure or customize the IPRM. See the "Command Reference" section on page 8 for show and debug commands related to IPRM.

## Cisco Express Forwarding Scalability Enhancements

Cisco Express Forwarding provides a forwarding path and maintains a complete forwarding and adjacency table for both the software and hardware forwarding engines.

With MPLS High Availability, Cisco Express Forwarding supports new features and new hardware. The Cisco Express Forwarding improvements enable Cisco Express Forwarding to work with the MPLS HA applications and the MFI infrastructure. Cisco Express Forwarding improvements increase scalability, which are outlined in Table 1.

***Table 1 Cisco Express Forwarding Scalability Enhancements***

| For the Cisco 7500 Series Router | For the Cisco 10000 Series Router |
|---|---|
| Up to 512,000 prefixes | Up to 1 million prefixes |
| Up to 128,000 adjacencies | Up to 1 million adjacencies |
| 4000 VPNs | 4000 VPNs |
| Arbitrary prefix path counts from the Routing Information Base (RIB) | Arbitrary prefix path counts from the RIB |
| 16 paths per prefix for forwarding | 8 paths per prefix for forwarding |
| 64 Cisco Express Forwarding instances (such as line cards or redundant RPs) | NA |

Cisco Express Forwarding makes the following enhancements:

- Improves memory use
- Reduces large peak memory use
- Reduces route convergence times for the Cisco 7500 series router.

For information about the Cisco Express Forwarding command changes, see *Cisco Express Forwarding: Command Changes.*

# MPLS Applications That Coexist with SSO

The following sections list the MPLS features that maintain, either partially or completely, undisturbed operation through an RP switchover on the Cisco 7500 series router or PRE2 switchover on the Cisco 10000 series router.

## MPLS Traffic Engineering

The MPLS Traffic Engineering (TE) features work with the new Cisco Express Forwarding and MFI modules. TE is SSO coexistent, which means it maintains, either partially or completely, undisturbed operation through an RP switchover on the Cisco 7500 series router or PRE2 switchover on the Cisco 10000 series router. No additional capabilities have been introduced with MPLS High Availability. The **debug mpls traffic-eng lsd-client** command is introduced with the MPLS High Availability features**.**

## MPLS Quality of Service Applications

Cisco IOS MPLS supports the IETF DiffServ architecture by enabling the quality of service (QoS) functions listed in Table 2 to act on the MPLS packets.

***Table 2 MPLS QoS Support***

| Category | Related MPLS QoS Features |
|---|---|
| Traffic classification | Access Control List matching |
| Traffic marking | Differentiated services code point (DSCP)<br>MPLS Experimental (EXP) field |
| Congestion management | Low latency queueing (LLQ)<br>Class-based weighted fair queueing (CBWFQ) |
| Congestion avoidance | Weighted Random Early Detection (WRED) |
| Traffic conditioning | Shaping and policing |

## IPv6 over MPLS

The IPv6 over MPLS application works with the new Cisco Express Forwarding and MFI modules. IPv6 over MPLS is SSO coexistent, which means it maintains, either partially or completely, undisturbed operation through an RP switchover.

**Note** The Cisco 10000 series router does not support the IPv6 over MPLS application.

Command changes are documented in the *Cisco IOS IPv6 Command Reference.*

## MPLS Label Switching Router MIB

The MPLS Label Switching Router (LSR) MIB works in the MPLS HA environment. Two indexes in the LSR MIB were changed to provide well-defined and ordered values:

- mplsXCIndex
- mplsOutSegmentIndex

This benefits the MPLS LSR MIB in the following ways:

- The MIB walk-through has a consistent and logical order.
- The same index values are maintained after a switchover.

For information about the MPLS LSR MIB, see the *MPLS Label Switching Router MIB.*

## MPLS TE MIB

The MPLS TE MIB works in the MPLS HA environment. For information about the MPLS TE MIB, see the *MPLS Traffic Engineering (TE) MIB.*

**Note** After an RP switchover on the Cisco 7500 series router or PRE2 switchover on the Cisco 10000 series router, the value of mplsTunnelCreationTime in the TE MIB does not correctly reflect the time when the tunnel was created. After an RP or PRE2 switchover, the tunnel gets a new time stamp.

### MPLS Enhancements to Interfaces MIB

The MPLS Enhancements to Interfaces MIB works in the MPLS HA environment. For information about the MPLS Enhancements to Interfaces MIB, see the *MPLS Enhancements to Interfaces MIB.*

# Additional References

The following sections provide references related to the MPLS High Availability feature.

## Related Documents

| Related Topic | Document Title |
|---|---|
| MPLS VPNs | *NSF/SSO—MPLS VPN* |
| MPLS LDP | *NSF/SSO - MPLS LDP and LDP Graceful Restart.* |
| AToM | *NSF/SSO: Any Transport over MPLS and Graceful Restart* |
| Cisco Express Forwarding | *Cisco Express Forwarding: Command Changes* |
| MIBs | • MPLS VPN: SNMP MIB Support<br>• *MPLS Label Distribution Protocol MIB Version 8 Upgrade*<br>• *MPLS Label Switching Router MIB*<br>• *MPLS Enhancements to Interfaces MIB.*<br>• *MPLS Traffic Engineering (TE) MIB* |
| NSF/SSO | *Cisco Nonstop Forwarding*<br>*MPLS High Availability: Command Changes* |

## Standards

| Standard | Title |
|---|---|
| draft-ietf-mpls-bgp-mpls-restart.txt | Graceful Restart Mechanism for BGP with MPLS |
| draft-ietf-mpls-idr-restart.txt | Graceful Restart Mechanism for BGP |

## MIBs

| MIB | MIBs Link |
|---|---|
| • MPLS VPN MIB<br>• MPLS Label Distribution Protocol MIB Version 8 Upgrade | To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:<br>http://www.cisco.com/go/mibs |

## RFCs

| RFC | Title |
|---|---|
| RFC 3478 | Graceful Restart Mechanism for Label Distribution |

## Technical Assistance

| Description | Link |
|---|---|
| The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register on Cisco.com. | http://www.cisco.com/techsupport |

# Command Reference

This section documents only commands that are new or modified.

- **clear mpls counters**
- **clear mpls ip iprm counters**
- **debug mpls ip iprm**
- **debug mpls ip iprm cef**
- **debug mpls ip iprm events**
- **debug mpls ip iprm ldm**
- **debug mpls ip iprm mfi**
- **debug mpls traffic-eng lsd-client**
- **show mpls ip iprm counters**
- **show mpls ip iprm ldm**

# clear mpls counters

To clear the Multiprotocol Label Switching (MPLS) forwarding table disposition counters and the Any Transport over MPLS (AToM) imposition and disposition virtual circuit (VC) counters, use the **clear mpls counters** command in privileged EXEC mode.

**clear mpls counters**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Checkpoint information resides on the active and standby Route Processor.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. This command was updated to clear AToM VC counters. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Examples

In the following example, the first **show mpls forwarding-table** command shows that 590 label-switched bytes exist in the forwarding table. The **clear mpls counters** command clears the counters. The second **show mpls forwarding-table** command shows that the number of label-switched bytes is 0.

```
Router# show mpls forwarding-table

Local  Outgoing      Prefix           Bytes Label   Outgoing   Next Hop
Label  Label or VC   or Tunnel Id     Switched      interface
20     30            10.10.17.17      590           Et3/0      172.16.0.2

Router# clear mpls counters

Clear "show mpls forwarding-table" counters [confirm]
mpls forward counters cleared

Router# show mpls forwarding-table

Local  Outgoing      Prefix           Bytes Label   Outgoing   Next Hop
Label  Label or VC   or Tunnel Id     Switched      interface
20     30            10.10.17.17      0             Et3/0       172.16.0.2
```

In the following example, the first **show mpls l2 vc detail** command shows that 15 packets were received and sent, 1656 bytes were received, and 1986 bytes were sent. The **clear mpls counters** command clears the counters. The second **show mpls l2 transport vc detail** command shows that no bytes or packets were received or sent.

```
Router# show mpls l2 vc detail

Local interface: Et0/0.10 up, line protocol up, Eth VLAN 10 up
    MPLS VC type is Eth VLAN, interworking type is Ethernet
    Destination address: 10.0.0.2, VC ID: 10, VC status: up
        Output interface: Et1/0, imposed label stack {16}
        Preferred path: not configured
        Default path: active
        Next hop: 10.0.0.2
    Create time: 00:19:35, last status change time: 00:19:09
    Signaling protocol: LDP, peer 10.0.0.2:0 up
        MPLS VC labels: local 16, remote 16
        Group ID: local 0, remote 0
        MTU: local 1500, remote 1500
        Remote interface description:
    Sequencing: receive enabled, send enabled
    VC statistics:
        packet totals: receive 15, send 15 <---- packet totals
        byte totals:   receive 1656, send 1986 <---- byte totals
        packet drops:  receive 0, seq error 0, send 0

Router# clear mpls counters

Clear "show mpls forwarding-table" counters [confirm] mpls forward
counters cleared

Router# show mpls l2 vc detail

Local interface: Et0/0.10 up, line protocol up, Eth VLAN 10 up
    MPLS VC type is Eth VLAN, interworking type is Ethernet
    Destination address: 10.0.0.2, VC ID: 10, VC status: up
        Output interface: Et1/0, imposed label stack {16}
        Preferred path: not configured
        Default path: active
        Next hop: 10.0.0.2
    Create time: 00:22:55, last status change time: 00:22:29
    Signaling protocol: LDP, peer 10.0.0.2:0 up
        MPLS VC labels: local 16, remote 16
        Group ID: local 0, remote 0
        MTU: local 1500, remote 1500
        Remote interface description:
    Sequencing: receive enabled, send enabled
    VC statistics:
        packet totals: receive 0, send 0 <---- packet totals
        byte totals:   receive 0, send 0 <---- byte totals
        packet drops:  receive 0, seq error 0, send 0
```

## Related Commands

| Command | Description |
|---|---|
| **show mpls forwarding-table** | Displays the contents of the MPLS FIB. |

# clear mpls ip iprm counters

To clear the IP Rewrite Manager (IPRM) counters, use the **clear mpls ip iprm counters** command in privileged EXEC mode.

**clear mpls ip iprm counters**

## Syntax Description

This command has no arguments or keywords.

## Defaults

No default behavior or values

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

This command sets IPRM counters to zero.

## Examples

The command in the following example clears the IPRM counters:

```
Router# clear mpls ip iprm counters

Clear iprm counters [confirm]
```

## Related Commands

| Command | Description |
|---|---|
| **show mpls ip iprm counters** | Displays the IPRM counters. |

# debug mpls ip iprm

To display debugging information for the Multiprotocol Label Switching (MPLS) IP Rewrite Manager (IPRM), use the **debug mpls ip iprm** command in privileged EXEC mode. To disable the display of this information, use the **no** form of this command.

**debug mpls ip iprm**

**no debug mpls ip iprm**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Debugging is not enabled.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

This command displays all output related to IPRM.

## Examples

The command in the following examples display all IPRM debugging for the global routing table.

### Cisco 7500 Series Example

```
Router# debug mpls ip iprm

IPRM debugging is on for global routing table

  iprm: prefix deleted: 10.0.0.44/32(glbl)
  iprm: delete mfi rewrite: 10.0.0.44/32(glbl)
  ...
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38002
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: announce prefix local labels: lcatm; trans #80; 10.0.0.44/32(glbl); 0 labels;
flags 0x0
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm: omit rewrite create: 10.0.0.44/32(glbl)
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38000
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: announce prefix local labels: lcatm; trans #81; 10.0.0.44/32(glbl); 0 labels;
flags 0x0
```

```
  iprm: get path labels: 10.0.0.44/32(glbl); nh 59.0.0.55(glbl), Et4/0/1; trans #81;
recurs tree change
  iprm: ldm get path labels: 10.0.0.44/32(glbl), ldp; flags 0x8000
  iprm: announce prefix local labels: ldp; trans #81; 10.0.0.44/32(glbl); 1 label; flags
0x0
  iprm:    lab 21, ltbl 0
  iprm: announce path labels: ldp; trans #81; 10.0.0.44/32(glbl); 0 labels; flags 0x0
  iprm:    path: nh 59.0.0.55(glbl), Et4/0/1
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm:    lcl lab 21, ltbl 0, ldp
  iprm:    path lab -, nh 59.0.0.55(glbl), Et4/0/1; ldp
  iprm: create mfi rewrite 10.0.0.44/32(glbl) passed: 2 fpis/1 mois
  iprm:    fpi[0] IV4, owner IPRM; 10.0.0.44/32; glbl
  iprm:    fpi[1] LBL, owner LDP; 21, ltbl 0
  iprm:    moi[0] PKT, flags 0x8; lab label-no-label; nh 59.0.0.55; nh if Et4/0/1 (nsf)
```

### Cisco 10000 Series Example

```
Router# debug mpls ip iprm

IPRM debugging is on for global routing table

  iprm: prefix deleted: 10.0.0.44/32(glbl)
  iprm: delete mfi rewrite: 10.0.0.44/32(glbl)
  ...
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38002
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois

  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm: omit rewrite create: 10.0.0.44/32(glbl)
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38000
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois

  iprm: get path labels: 10.0.0.44/32(glbl); nh 59.0.0.55(glbl), GigabitEthernet4/0/0;
trans #81; recurs tree change
  iprm: ldm get path labels: 10.0.0.44/32(glbl), ldp; flags 0x8000
  iprm: announce prefix local labels: ldp; trans #81; 10.0.0.44/32(glbl); 1 label; flags
0x0
  iprm:    lab 21, ltbl 0
  iprm: announce path labels: ldp; trans #81; 10.0.0.44/32(glbl); 0 labels; flags 0x0
  iprm:    path: nh 59.0.0.55(glbl), GigabitEthernet4/0/0

  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm:    lcl lab 21, ltbl 0, ldp
  iprm:    path lab -, nh 59.0.0.55(glbl), GigabitEthernet4/0/0; ldp
  iprm: create mfi rewrite 10.0.0.44/32(glbl) passed: 2 fpis/1 mois
  iprm:    fpi[0] IV4, owner IPRM; 10.0.0.44/32; glbl
  iprm:    fpi[1] LBL, owner LDP; 21, ltbl 0
  iprm:    moi[0] PKT, flags 0x8; lab label-no-label; nh 59.0.0.55; nh if
GigabitEthernet4/0/0 (nsf)
```

Table 3 describes the significant fields shown in the display. The field descriptions also apply to the output of following debug commands:

- **debug mpls ip iprm cef**
- **debug mpls ip iprm events**
- **debug mpls ip iprm ldm**
- **debug mpls ip iprm mfi**

*Table 3 debug mpls ip iprm Field Descriptions*

| Field | Description |
|---|---|
| discover prefix labels | The prefix labels that the IP LDM discovered. |
| announce prefix local labels<br>announce path labels | IP LDMs pass prefix incoming (local) and outgoing (path) labels to IPRM by announcing the labels. |
| mfi rewrite | The information required by MPLS Forwarding Infrastructure (MFI) to create forwarding data structures for an MPLS forwarding equivalence class (FEC). For IP over MPLS a prefix is an MPLS FEC. An MFI rewrite includes a set of forwarding path identifier (FPI) and MPLS output information (MOI) elements. |
| fpi | Forwarding path identifier, which is required to locate MPLS forwarding information for a FEC. IP over MPLS deals with several types of FPIs, including IPv4 (IV4), IPv6 (IV6), and label (LBL) FPIs.<br>  <br>**Note** The Cisco 10000 series router does not support IPv6. |
| moi | MPLS output information. For IP over MPLS, there is a MOI for each prefix path. The MOI includes the next hop (nh), outgoing interface (nh if), and outgoing label. IP over MPLS handles several types of MOIs, including packet (PKT) and ATM (ATM). |
| get/create/update MFI rewrite | The process IPRM uses to read (get) or update (create/update) an MFI rewrite. |
| recurs tree change | Recursion tree change. Cisco Express Forwarding notifies IPRM when the recursion tree (see below) for a prefix changes. IPRM responds by performing label discovery (see above). |
| recursion tree | A prefix known to Cisco Express Forwarding can have one or more paths (routes). Each is either a terminal path with a next hop and an outgoing interface or a recursive path with a next hop and no outgoing interface. The next hop for a recursive path typically matches a prefix known to Cisco Express Forwarding. That prefix also has one or more paths. The IP recursion tree for prefix P is a tree rooted at P's Cisco Express Forwarding entry with one of more path descendants. Terminal paths are leaf nodes in P's recursion tree and recursive paths are nonleaf nodes, each of which points to the Cisco Express Forwarding entry for its next hop. |
| glbl | The global (default) routing table. |
| ctxt | Context. Information used by IPRM when it performs label discovery. |
| flags | Information passed between IPRM and other components. |
| trans # | Transaction number used to identify an ongoing label discovery. |
| ltbl | Label table. |
| nsf | Nonstop forwarding. |

**Related Commands**

| Command | Description |
|---|---|
| **debug mpls ip iprm cef** | Displays debugging information for interactions between Cisco Express Forwarding and the IPRM. |
| **debug mpls ip iprm events** | Displays events related to the MPLS IPRM. |
| **debug mpls ip iprm ldm** | Displays debugging information for interactions between the LDMs and the MPLS IPRM. |
| **debug mpls ip iprm mfi** | Displays debugging information for interactions between the MFI and the MPLS IPRM. |

# debug mpls ip iprm cef

To display debugging information for interactions between Cisco Express Forwarding and the Multiprotocol Label Switching (MPLS) IP Rewrite Manager (IPRM), use the **debug mpls ip iprm cef** command in privileged EXEC mode. To disable the display of these events, use the **no** form of this command.

**debug mpls ip iprm cef** [**table** {**all** | *table-id*} | **vrf** *vrf-name* | **acl** *acl-name* | **prefix-list** *prefix-list-name*]

**no debug mpls ip iprm cef**

## Syntax Description

| | |
|---|---|
| **table** | (Optional) Displays the debugging information for one or more routing tables. |
| **all** | Displays debugging information for all routing tables. |
| *table-id* | The ID of the routing table for which you want to display debugging information. Table 0 is the default or global routing table. |
| **vrf** | (Optional) Displays debugging information for the VPN routing and forwarding (VRF) instance you specify. |
| *vrf-name* | The name of the VRF instance. You can find VRF names with the **show ip vrf** command. |
| **acl** | (Optional) Displays debugging information for the access control list (ACL) you specify. |
| *acl-name* | The name of the ACL. You can find ACL names with the **show ip access-list** command. |
| **prefix-list** | (Optional) Displays debugging information for the prefix list you specify. |
| *prefix-list-name* | The name of the prefix list. You can find prefix list names with the **show ip prefix-list** command. |

## Defaults

Debugging is not enabled. If you do not supply an optional keyword, all the debugging events are displayed.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

This command limits the debug output to the IPRM interactions with Cisco Express Forwarding.

## Examples

In the following example, IPRM events related to Cisco Express Forwarding are displayed.

### Cisco 7500 Series Example

```
Router# debug mpls ip iprm cef

IPRM CEF interaction debugging is on for global routing table
iprm: prefix deleted: 10.0.0.44/32(glbl)
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38002
  iprm: announce prefix local labels: lcatm; trans #94; 10.0.0.44/32(glbl); 0 labels;
flags 0x0
  ...
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38000
  iprm: announce prefix local labels: lcatm; trans #97; 10.0.0.44/32(glbl); 0 labels;
flags 0x0
  iprm: get path labels: 10.0.0.44/32(glbl); nh 59.0.0.55(glbl), Et4/0/1; trans #97;
recurs tree change
  iprm: announce prefix local labels: ldp; trans #97; 10.0.0.44/32(glbl); 1 label; flags
0x0
  iprm:    lab 21, ltbl 0
  iprm: announce path labels: ldp; trans #97; 10.0.0.44/32(glbl); 0 labels; flags 0x0
  iprm:    path: nh 59.0.0.55(glbl), Et4/0/1
```

### Cisco 10000 Series Example

```
Router# debug mpls ip iprm cef

IPRM CEF interaction debugging is on for global routing table
iprm: prefix deleted: 10.0.0.44/32(glbl)
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38002

  ...
  iprm: discover prefix labels: 10.0.0.44/32(glbl); recurs tree change; ctxt 0x38000

  iprm: get path labels: 10.0.0.44/32(glbl); nh 59.0.0.55(glbl), GigabitEthernet4/0/0;
trans #97; recurs tree change
  iprm: announce prefix local labels: ldp; trans #97; 10.0.0.44/32(glbl); 1 label; flags
0x0
  iprm:    lab 21, ltbl 0
  iprm: announce path labels: ldp; trans #97; 10.0.0.44/32(glbl); 0 labels; flags 0x0
  iprm:    path: nh 59.0.0.55(glbl), GigabitEthernet4/0/0
```

See the field descriptions for the **debug mpls ip iprm** command for an explanation of the fields displayed in the output.

## Related Commands

| Command | Description |
|---|---|
| **debug mpls ip iprm events** | Displays events related to the MPLS IPRM. |
| **debug mpls ip iprm ldm** | Displays debugging information for interactions between the IP LDMs and the MPLS IPRM. |
| **debug mpls ip iprm mfi** | Displays debugging information for interactions between the MFI and the MPLS IPRM. |

# debug mpls ip iprm events

To display events related to the Multiprotocol Label Switching (MPLS) IP Rewrite Manager (IPRM), use the **debug mpls ip iprm events** command in privileged EXEC mode. To disable the display of these events, use the **no** form of this command.

**debug mpls ip iprm events**

**no debug mpls ip iprm events**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Debugging is not enabled.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Examples

See the command page for **debug mpls ip iprm** for sample command output. See the command page for **debug mpls ip iprm** for an explanation of the fields displayed in the output.

## Related Commands

| Command | Description |
|---|---|
| **debug mpls ip iprm cef** | Displays debugging information for interactions between Cisco Express Forwarding and the IPRM. |
| **debug mpls ip iprm ldm** | Displays debugging information for interactions between the LDMs and the MPLS IPRM. |
| **debug mpls ip iprm mfi** | Displays debugging information for interactions between the MFI and the MPLS IPRM. |

# debug mpls ip iprm ldm

To display debugging information for interactions between the IP Label Distribution Modules (LDMs) and the Multiprotocol Label Switching (MPLS) IP Rewrite Manager (IPRM), use the **debug mpls ip iprm ldm** command in privileged EXEC mode. To disable the display of this information, use the **no** form of this command.

**debug mpls ip iprm ldm** [**bgp** | **lcatm** | **ldp** | **vpnv4** | **6pe** | **table** {**all** | *table-id*} | **vrf** *vrf-name* | **acl** *acl-name* | **prefix-list** *prefix-list-name*]

**no debug mpls ip iprm ldm**

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**debug mpls ip iprm ldm** [**bgp** | **ldp** | **vpnv4** | **table** {**all** | *table-id*} | **vrf** *vrf-name* | **acl** *acl-name* | **prefix-list** *prefix-list-name*]

**no debug mpls ip iprm ldm**

## Syntax Description

| | |
|---|---|
| **bgp** | (Optional) Displays Border Gateway Protocol (BGP) events. |
| **lcatm** | (Optional) Displays Label Controlled ATM (LC-ATM) events.<br>**Note** Applies to Cisco 7000 series routers only. |
| **ldp** | (Optional) Displays Label Distribution Protocol (LDP) events. |
| **vpnv4** | (Optional) Displays Virtual Private Network (VPNv4) events. |
| **6pe** | (Optional) Displays IPv6 over MPLS events.<br>**Note** Applies to Cisco 7000 series routers only. |
| **table** | (Optional) Displays debugging information for one or more routing tables. |
| **all** | (Optional) Displays debugging information for all routing tables. |
| *table-id* | (Optional) Specifies the routing table for which you want to display debugging information. Table 0 is the default or global routing table. |
| **vrf** | (Optional) Displays debugging information for the VPN routing and forwarding (VRF) instance you specify. |
| *vrf-name* | (Optional) The name of the VRF instance. You can find VRF names with the **show ip vrf** command. |
| **acl** | (Optional) Displays debugging information for the access control list (ACL) you specify. |
| *acl-name* | (Optional) The name of the ACL. You can find ACL names with the **show ip access-list** command. |
| **prefix-list** | (Optional) Displays debugging information for the prefix list you specify. |
| *prefix-list-name* | (Optional) The name of the prefix list. You can find prefix list names with the **show ip prefix-list** command. |

## Defaults

Debugging is not enabled. If you do not supply an optional keyword, all the debugging events are displayed.

**Command Modes**

Privileged EXEC

**Command History**

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

**Examples**

See the **debug mpls ip iprm** command page for sample output and an explanation of the fields displayed in the output.

**Related Commands**

| Command | Description |
|---|---|
| **debug mpls ip iprm cef** | Displays debugging information for interactions between Cisco Express Forwarding and the IPRM. |
| **debug mpls ip iprm events** | Displays debugging information about events related to the MPLS IPRM. |
| **debug mpls ip iprm mfi** | Displays debugging information for interactions between the MFI and the MPLS IPRM. |

# debug mpls ip iprm mfi

To display debugging information for interactions between the Multiprotocol Label Switching (MPLS) Forwarding Infrastructure (MFI) and the MPLS IP Rewrite Manager (IPRM), use the **debug mpls ip iprm mfi** command in privileged EXEC mode. To disable the display of this information, use the **no** form of this command.

**debug mpls ip iprm mfi** [**table** {**all** | *table-id*} | **vrf** *vrf-name* | **acl** *acl-name* | **prefix-list** *prefix-list-name*]

**no debug mpls ip iprm mfi**

## Syntax Description

| | |
|---|---|
| **table** | (Optional) Displays debugging information for one or more routing tables. |
| **all** | (Optional) Displays debugging information for all routing tables. |
| *table-id* | (Optional) Displays debugging information for the routing table you specify. Table 0 is the default or global routing table. |
| **vrf** | (Optional) Displays debugging information for the VPN Routing and Forwarding (VRF) instance you specify. |
| *vrf-name* | (Optional) The name of the VRF instance. You can find VRF names with the **show ip vrf** command. |
| **acl** | (Optional) Displays debugging information for the access control list (ACL) you specify. |
| *acl-name* | (Optional) The name of the ACL. You can find ACL names with the **show ip access-list** command. |
| **prefix-list** | (Optional) Displays debugging information for the prefix list you specify. |
| *prefix-list-name* | (Optional) The name of the prefix list. You can find prefix list names with the **show ip prefix-list** command. |

## Defaults

Debugging is not enabled. If you enable debugging but do not supply an optional keyword, all the debugging events are displayed.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Examples

The command in the following example displays MFI events.

### Cisco 7500 Series Example

```
Router# debug mpls ip iprm mfi

IPRM MFI interaction debugging is on for global routing table
iprm: delete mfi rewrite: 10.0.0.44/32(glbl)
 .
 .
 .
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm: omit rewrite create: 10.0.0.44/32(glbl)
 .
 .
 .
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm:    lcl lab 21, ltbl 0, ldp
  iprm:    path lab -, nh 59.0.0.55(glbl), Et4/0/1; ldp
  iprm: create mfi rewrite 10.0.0.44/32(glbl) passed: 2 fpis/1 mois
  iprm:    fpi[0] IV4, owner IPRM; 10.0.0.44/32; glbl
  iprm:    fpi[1] LBL, owner LDP; 21, ltbl 0
  iprm:    moi[0] PKT, flags 0x8; lab label-no-label; nh 59.0.0.55; nh if Et4/0/1 (nsf)
```

### Cisco 10000 Series Example

```
Router# debug mpls ip iprm mfi

IPRM MFI interaction debugging is on for global routing table
iprm: delete mfi rewrite: 10.0.0.44/32(glbl)
 .
 .
 .
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm: omit rewrite create: 10.0.0.44/32(glbl)
 .
 .
 .
  iprm: get mfi rewrite 10.0.0.44/32(glbl) obtained: 0 fpis/0 mois
  iprm: update mfi rewrite: 10.0.0.44/32(glbl); prefix label info
  iprm:    lcl lab 21, ltbl 0, ldp
  iprm:    path lab -, nh 59.0.0.55(glbl), GigabitEthernet4/0/0; ldp
  iprm: create mfi rewrite 10.0.0.44/32(glbl) passed: 2 fpis/1 mois
  iprm:    fpi[0] IV4, owner IPRM; 10.0.0.44/32; glbl
  iprm:    fpi[1] LBL, owner LDP; 21, ltbl 0
  iprm:    moi[0] PKT, flags 0x8; lab label-no-label; nh 59.0.0.55; nh if
  GigabitEthernet4/0/0 (nsf)
```

See the **debug mpls ip iprm** command page for an explanation of the fields displayed in the output.

## Related Commands

| Command | Description |
|---|---|
| **debug mpls ip iprm cef** | Displays debugging information for interactions between Cisco Express Forwarding and the MPLS IPRM . |

| Command | Description |
|---|---|
| **debug mpls ip iprm events** | Displays events related to the MPLS IPRM. |
| **debug mpls ip iprm ldm** | Displays debugging information for interactions between the IP LDMs and the MPLS IPRM. |

# debug mpls traffic-eng lsd-client

To display the Application Programming Interface (API) messages sent to the Label Switching Database (LSD) from the Traffic Engineering (TE) client, use the **debug mpls traffic-eng lsd-client** command in privileged EXEC mode. To disable the display of these messages, use the **no** form of this command.

**debug mpls traffic-eng lsd-client**

**no debug mpls traffic-eng lsd-client**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Debugging is not enabled.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(28)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(28)SXH. |

## Examples

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and enable TE globally:

```
00:10:23: TE-LSD-CLIENT: register with LSD OK; conn_id = 23, recov time = 60000 s
00:10:23: TE-LSD-CLIENT: LSD is now up
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and disable TE globally:

```
00:09:50: TE-LSD-CLIENT: unregister LSD client; result = OK; conn_id 23
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and enable TE on specific interfaces on Cisco 7500 series routers:

```
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on Ethernet1/0; status = OK
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on Serial2/0; status = OK
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on Serial3/0; status = OK
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and disable TE on specific interfaces on Cisco 7500 series routers:

```
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on Ethernet1/0; status = OK
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on Serial2/0; status = OK
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on Serial3/0; status = OK
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and enable TE on specific interfaces on Cisco 10000 series routers:

```
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on GigabitEthernet1/0/0; status = OK
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on Serial2/0/0; status = OK
00:10:23: TE-LSD-CLIENT: enabled TE LSD client on Serial3/0/0; status = OK
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and disable TE on specific interfaces on Cisco 10000 series routers:

```
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on GigabitEthernet1/0/0; status = OK
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on Serial2/0/0; status = OK
00:09:50: TE-LSD-CLIENT: disabled TE LSD client on Serial3/0/0; status = OK
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command, allocate labels on tunnel midpoints, and create tunnel midpoint rewrites on Cisco 7500 series routers:

```
00:14:04: TE-LSD-CLIENT: label alloc OK; label = 16, conn_id = 23
00:14:04: TE-LSD-CLIENT: Create TE mid rewrite for 10.100.100.100 1 [5], Result: OK
00:14:04:          In: Serial3/0, 16 Out: Serial2/0, 3
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command, allocate labels on tunnel midpoints, and create tunnel midpoint rewrites on a Cisco 10000 series router:

```
00:14:04: TE-LSD-CLIENT: label alloc OK; label = 16, conn_id = 23
00:14:04: TE-LSD-CLIENT: Create TE mid rewrite for 10.100.100.100 1 [5], Result: OK
00:14:04:          In: Serial3/0/0, 16 Out: Serial2/0/0, 3
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command, free labels on tunnel midpoints, and delete tunnel midpoints on a Cisco 7500 series router:

```
00:13:13: TE-LSD-CLIENT: Delete TE mid rewrite for iou-100_t1, Result: OK
00:13:13: In: Serial3/0, 16 Out: Serial2/0, 1
00:13:13: TE-LSD-CLIENT: free label 16 result =  OK; conn_id = 23
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command, free labels on tunnel midpoints, and delete tunnel midpoints on a Cisco 10000 series router:

```
00:13:13: TE-LSD-CLIENT: Delete TE mid rewrite for iou-100_t1, Result: OK
00:13:13: In: Serial3/0/0, 16 Out: Serial2/0/0, 1
00:13:13: TE-LSD-CLIENT: free label 16 result =  OK; conn_id = 23
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and create tunnel headend rewrites on a Cisco 7500 series router:

```
00:09:10: TE-LSD-CLIENT: Create TE he rewrite for iou-100_t1, Result = OK
00:09:10: tun_inst: 7  Out: Serial3/0, 16  Dest: 10.0.0.2
ps_flags: 0x60003
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and create tunnel headend rewrites on a Cisco 10000 series router:

```
00:09:10: TE-LSD-CLIENT: Create TE he rewrite for iou-100_t1, Result = OK
00:09:10: tun_inst: 7  Out: Serial3/0/0, 16  Dest: 10.0.0.2
ps_flags: 0x60003
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and delete tunnel headend rewrites on a Cisco 7500 series router:

```
00:09:15: TE-LSD-CLIENT: Delete TE he rewrite for iou-100_t1, Result: OK
00:09:15: tun_inst: 7  Out: Serial3/0, 16  ps_flags: 0x60003
```

The following messages are displayed when you issue the **debug mpls traffic-eng lsd-client** command and delete tunnel headend rewrites on a Cisco 10000 series router:

```
00:09:15: TE-LSD-CLIENT: Delete TE he rewrite for iou-100_t1, Result: OK
00:09:15: tun_inst: 7  Out: Serial3/0/0, 16  ps_flags: 0x60003
```

## Related Commands

| Command | Description |
|---|---|
| **debug mpls ip iprm events** | Displays events related to the MPLS IPRM. |
| **debug mpls ip iprm ldm** | Displays debugging information for interactions between the IP LDMs and the MPLS IPRM. |
| **debug mpls ip iprm mfi** | Displays debugging information for interactions between the MFI and the MPLS IPRM. |

# show mpls ip iprm counters

To display the number of occurrences of various Multiprotocol Label Switching (MPLS) IP Rewrite Manager (IPRM) events, use the **show mpls ip iprm counters** command in privileged EXEC mode.

**show mpls ip iprm counters**

## Syntax Description

This command has no arguments or keywords.

## Defaults

No default behaviors or values.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SXH. |

## Usage Guidelines

This command reports the occurrences of IPRM events.

## Examples

The command in the following example displays the events that the IPRM logs:

```
Router# show mpls ip iprm counters

  CEF Tree Changes Processed/Ignored:           91/12
  CEF Deletes Processed/Ignored:                12/2
  Label Discoveries:                            74
  Rewrite Create Successes/Failures:            60/0
  Rewrite Gets/Deletes:                         82/0
  Label Announcements: Info/Local/Path:         6/119/80
  Walks: Recursion Tree/CEF Full/CEF interface: 78/2/0
```

Table 4 describes the significant fields shown in the display.

***Table 4 show mpls ip iprm counters Command Field Descriptions***

| Field | Description |
|---|---|
| CEF Tree Changes Processed/Ignored | Processed—The number of Cisco Express Forwarding tree change announcements that IPRM processed.<br>Ignored—The number of Cisco Express Forwarding tree change announcements that IPRM ignored.<br>Typically, IPRM processes tree change announcements only for prefixes in a routing table. |
| CEF Deletes Processed/Ignored | Processed—The number of Cisco Express Forwarding delete entry announcements that IPRM processed.<br>Ignored—The number of Cisco Express Forwarding delete entry announcements that IPRM ignored.<br>Typically, IPRM processes delete entry announcements only for prefixes in a routing table. |
| Label Discoveries | The number of label discoveries performed by IPRM. Label discovery is the process by which IPRM obtains prefix labels from the IP Label Distribution Modules (LDMs). |
| Rewrite Create Successes/Failures | Successes—The number of times IPRM successfully updated the MPLS forwarding information.<br>Failures—The number of times IPRM attempted to update the MPLS forwarding information and failed. |
| Rewrite Gets/Deletes | Gets—The number of times IPRM retrieved forwarding information from the MPLS forwarding infrastructure.<br>Deletes—The number of times IPRM removed prefix forwarding information from the MPLS forwarding infrastructure. |

*Table 4 show mpls ip iprm counters Command Field Descriptions (continued)*

| Field | Description |
|---|---|
| CEF Tree Changes Processed/Ignored | Processed—The number of Cisco Express Forwarding tree change announcements that IPRM processed.<br>Ignored—The number of Cisco Express Forwarding tree change announcements that IPRM ignored.<br>Typically, IPRM processes tree change announcements only for prefixes in a routing table. |
| Label Announcements: Info/Local/Path | Info—The number of times an IP label distribution module informed IPRM that label information for a prefix changed.<br>Local—The number of times an IP label distribution module specified local labels for a prefix.<br>Path—The number of times an IP LDM specified outgoing labels for a prefix route. |
| Walks: Recursion Tree/CEF Full/CEF interface | Recursion Tree—The number of times IPRM requested Cisco Express Forwarding to walk the recursion (path) tree for a prefix.<br>CEF Full—The number of times IPRM requested Cisco Express Forwarding to walk a Cisco Express Forwarding table and notify IPRM about each prefix.<br>CEF interface—The number of times IPRM requested Cisco Express Forwarding to walk a Cisco Express Forwarding table and notify IPRM about each prefix with a path that uses a specific interface. |

## Related Commands

| Command | Description |
|---|---|
| **clear mpls ip iprm counters** | Clears the IPRM counters. |
| **show mpls ip iprm ldm** | Displays information about the IP LDMs that have registered with the IPRM. |

# show mpls ip iprm ldm

To display information about the IP Label Distribution Modules (LDMs) that have registered with the IP Rewrite Manager (IPRM), use the **show mpls ip iprm ldm** command in privileged EXEC mode.

**show mpls ip iprm ldm** [**table** {**all** | *table-id*} | **vrf** *vrf-name*] [**ipv4** | **ipv6**]

**Cisco 10000 Series Routers**

**show mpls ip iprm ldm** [**table** {**all** | *table-id*} | **vrf** *vrf-name*] [**ipv4**]

## Syntax Description

| | |
|---|---|
| **table** | (Optional) Displays the LDMs for one or more routing tables. |
| **all** | Displays the LDMs for all routing tables. |
| *table-id* | Displays the LDMs for the routing table you specify. Table 0 is the default or global routing table. |
| **vrf** | (Optional) Displays the LDMs for the VPN routing and forwarding (VRF) instance you specify. |
| *vrf-name* | (Optional) The name of the VRF instance. You can find VRF names with the **show ip vrf** command. |
| **ipv4** | (Optional) Displays IPv4 LDMs. |
| **ipv6** | (Optional) Displays IPv6 LDMs.<br>**Note** Applies to Cisco 7500 series routers only. |

## Defaults

If you do not specify any keywords or parameters, the command displays the LDMs for the global routing table (the default).

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 12.2(25)S | This command was introduced. |
| 12.2(28)SB | This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series routers. |
| 12.2(33)SRA | This command was integrated into Cisco IOS Release 12.2(33)SRA. |
| 12.2(33)SXH | This command was integrated into Cisco IOS Release 12.2(33)SSH. |

## Usage Guidelines

This command displays the IP LDMs registered with IPRM.

## Examples

The command in the following example displays the LDMs for the global routing tables. It shows that two LDMs (lcatm and ldp) are registered for the ipv4 global routing table, and that one LDM (bgp ipv6) is registered for the ipv6 global routing table.

```
Router# show mpls ip iprm ldm

  table (glbl;ipv4); ldms: 2
    lcatm, ldp
  table (glbl;ipv6); ldms: 1
    bgp ipv6
```

The command in the following example displays all of the LDMs registered with IPRM. The output shows the following:

- The LDMs called lcatm and ldp have registered with IPRM for the ipv4 global table.
- The LDM called bgp ipv6 is registered for the IPv6 global table.
- The LDM called bgp vpnv4 is registered for all IPv4 vrf routing tables.

```
Router# show mpls ip iprm ldm table all

  table (glbl;ipv4); ldms: 2
    lcatm, ldp
  table (glbl;ipv6); ldms: 1
    bgp ipv6
  table (all-tbls;ipv4); ldms: 1
    bgp vpnv4
```

The command in the following example displays the LDMs registered for the IPv6 routing tables.

```
Router# show mpls ip iprm ldm ipv6

  table (glbl;ipv6); ldms: 1
    bgp ipv6
```

### Cisco 10000 Series Examples Only

The command in the following example displays the LDMs for the global routing tables. It shows that one LDM (ldp) is registered for the ipv4 global routing table.

```
Router# show mpls ip iprm ldm

  table (glbl;ipv4); ldms: 1
    ldp
```

The command in the following example displays all of the LDMs registered with IPRM. The output shows the following:

- The LDM called ldp has registered with IPRM for the ipv4 global table.
- The LDM called bgp vpnv4 is registered for all IPv4 vrf routing tables.

```
Router# show mpls ip iprm ldm table all

  table (glbl;ipv4); ldms: 1
    ldp
  table (all-tbls;ipv4); ldms: 1
    bgp vpnv4
```

**Related Commands**

| Command | Description |
|---|---|
| **show mpls ip iprm counters** | Displays the number of occurrences of various IPRM events. |

# Feature Information for MPLS High Availability: Overview

Table 5 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Cisco IOS software images are specific to a Cisco IOS software release, a feature set, and a platform. Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

**Note** Table 5 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

***Table 5 Feature Information for MPLS High Availability: Overview***

| Feature Name | Releases | Feature Information |
|---|---|---|
| MPLS High Availability: Overview | 12.2(25)S<br>12.2(28)SB<br>12.2(33)SRA<br>12.2(33)SXH | This feature provides an overview of the Multiprotocol Label Switching (MPLS) high availability (HA) features.<br>In 12.2(25)S, this feature was introduced on the Cisco 7500 series router.<br>In 12.2(28)SB, support was added for the Cisco 10000.<br>In 12.2(33)SRA, support was added for the Cisco 7600 series routers.<br>In 12.2(33)SXH, this feature was integrated into Cisco IOS Release 12.2(33)SXH. |