



MPLS LDP–VRF-Aware Static Labels

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

Finding Feature Information

For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for MPLS LDP–VRF-Aware Static Labels” section on page 9](#).

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

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Information About MPLS LDP–VRF-Aware Static Labels

- [Overview of MPLS Static Labels and MPLS LDP–VRF-Aware Static Labels, page 2](#)



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

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

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

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

You can configure static labels for the following purposes:

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

Labels Reserved for Static Assignment

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

How to Configure MPLS LDP–VRF-Aware Static Labels

- [Reserving Labels to Use for MPLS Static Labels and MPLS LDP–VRF-Aware Static Labels, page 3](#) (required)
- [Configuring MPLS Static Labels in the MPLS VPN Provider Core, page 4](#) (optional)
- [Configuring MPLS LDP–VRF-Aware Static Labels at the Edge of the VPN, page 5](#) (optional)

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

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

SUMMARY STEPS

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

DETAILED STEPS

| | Command or Action | Purpose |
|--------|--|---|
| Step 1 | enable Example: Router> enable | Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted. |
| Step 2 | configure terminal Example: Router# configure terminal | Enters global configuration mode. |
| Step 3 | mpls label range <i>minimum-value maximum-value</i> [static <i>minimum-static-value maximum-static-value</i>] Example: Router(config)# mpls label range 200 100000 static 16 199 | Reserves a range of labels for static labels assignment. The default is that no labels are reserved for static assignment. Note You might need to reload the router for the range of labels you reserve to take effect. |

| | Command or Action | Purpose |
|--------|--|---|
| Step 4 | exit Example: Router(config)# exit | Exits global configuration mode. |
| Step 5 | show mpls label range Example: Router# show mpls label range | Displays information about the range of values for local labels, including those available for static assignment. |

Configuring MPLS Static Labels in the MPLS VPN Provider Core

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

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

Prerequisites

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

SUMMARY STEPS

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

DETAILED STEPS

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

| | Command | Purpose |
|--------|--|--|
| Step 3 | <pre>mpls static binding ipv4 prefix mask {label input label output nexthop {explicit-null implicit-null label}}</pre> <p>Example: Router(config)# mpls static binding ipv4 10.2.2.0 255.255.255.255 input 17</p> | <p>Specifies static binding of labels to IPv4 prefixes.</p> <p>Specified bindings are installed automatically in the MPLS forwarding table as routing demands.</p> |
| Step 4 | <pre>exit</pre> <p>Example: Router(config)# exit</p> | <p>Exits global configuration mode and enters privileged EXEC mode.</p> |
| Step 5 | <pre>show mpls static binding ipv4</pre> <p>Example: Router# show mpls static binding ipv4</p> | <p>Displays the configured static labels.</p> |
| Step 6 | <pre>show mpls forwarding-table</pre> <p>Example: Router# show mpls forwarding-table</p> | <p>Displays the static labels used for MPLS forwarding.</p> |

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

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

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

Restrictions

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

Prerequisites

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

SUMMARY STEPS

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

4. **exit**
5. **show mpls static binding ipv4 vrf *vpn-name***

DETAILED STEPS

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

Troubleshooting Tips

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

Configuration Examples for MPLS LDP–VRF-Aware Static Labels

- [Example: Reserving Labels to Use for MPLS Static Labels and MPLS LDP–VRF-Aware Static Labels, page 7](#)
- [Example: Configuring MPLS Static Labels in the MPLS VPN Provider Core, page 7](#)
- [Example: Configuring MPLS LDP–VRF-Aware Static Labels at the VPN Edge, page 7](#)

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

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

```
Router(config)# mpls label range 200 100000 static 16 199

% Label range changes take effect at the next reload.
```

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

```
Router# show mpls label range

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

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

```
Router# show mpls label range

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

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

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

```
Router(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 55
Router(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 output 10.0.0.66 167
Router(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 input 17
Router(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 output 10.13.0.8
explicit-null
```

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

```
Router# show mpls static binding ipv4

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

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

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

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

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

```
Router# show mpls static binding ipv4 vrf vpn100

10.0.0.0/8: (vrf: vpn100) Incoming label: 55
           Outgoing labels: None
10.66.0.0/16: (vrf: vpn100) Incoming label: 17
            Outgoing labels: None
```

Additional References

Related Documents

| Related Topic | Document Title |
|------------------------------------|---|
| Cisco IOS commands | Cisco IOS Master Commands List, All Releases |
| MPLS commands | Cisco IOS Multiprotocol Label Switching Command Reference |
| MPLS VPN configuration information | Configuring MPLS Layer 3 VPNs |

Standards

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

MIBs

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

RFCs

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

Technical Assistance

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

Feature Information for MPLS LDP–VRF-Aware Static Labels

[Table 1](#) lists the features in this module and provides links to specific configuration information.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS XE software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

**Note**

[Table 1](#) lists only the Cisco IOS XE software release that introduced support for a given feature in a given Cisco IOS XE software release train. Unless noted otherwise, subsequent releases of that Cisco IOS XE software release train also support that feature.

Table 1 Feature Information for MPLS LDP-VRF-Aware Static Labels

| Feature Name | Releases | Feature Information |
|----------------------------------|--------------------------|--|
| MPLS LDP-VRF-Aware Static Labels | Cisco IOS XE Release 2.1 | <p>The MPLS LDP-VRF-Aware Static Labels feature explains how to configure the MPLS LDP-VRF-Aware Static Labels feature and MPLS static labels. VRF-aware static labels can be used at the edge of an MPLS VPN, whereas MPLS static labels can be used only in the MPLS VPN provider core.</p> <p>In Cisco IOS XE Release 2.2, this feature was implemented on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> • Overview of MPLS Static Labels and MPLS LDP-VRF-Aware Static Labels, page 2 • Labels Reserved for Static Assignment, page 2 • Reserving Labels to Use for MPLS Static Labels and MPLS LDP-VRF-Aware Static Labels, page 3 • Configuring MPLS Static Labels in the MPLS VPN Provider Core, page 4 • Configuring MPLS LDP-VRF-Aware Static Labels at the Edge of the VPN, page 5 <p>The following commands were introduced or modified: debug mpls static binding, mpls label range, mpls static binding ipv4, mpls static binding ipv4 vrf, show mpls label range, show mpls static binding ipv4, and show mpls static binding ipv4 vrf.</p> |

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