MPLS VPN per Customer Edge (CE) Label

The MPLS VPN per Customer Edge (CE) Label feature allows you to configure a single VPN label at the provider edge (PE) for every immediate next hop or set of next hops.

You can enable (or disable) the MPLS VPN per CE Label feature in global configuration mode.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

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

Prerequisites for MPLS VPN per CE Label

- If your virtual routing and forwarding (VRF) domain has any of the following features enabled, disable them before you configure the MPLS VPN per CE Label feature:
    - External Border Gateway Protocol (EBGP) multipath feature
    - Internal Border Gateway Protocol (IBGP) multipath feature
    - Carrier Supporting Carrier (CSC) feature

- Before configuring Multiprotocol Label Switching (MPLS) Layer 3 VPNs, you must install MPLS, Label Distribution Protocol (LDP), and Cisco Express Forwarding in your network. All devices in the core,

including the provider edge (PE) devices, must be able to support Cisco Express Forwarding and MPLS forwarding.

Restrictions for MPLS VPN per CE Label

- Enabling the MPLS VPN per CE Label feature causes Border Gateway Protocol (BGP) reconvergence, which can result in data loss for traffic coming from the Multiprotocol Label Switching (MPLS) VPN core.

> **Note** You can minimize network disruption by enabling this feature during a scheduled MPLS maintenance window. Also, if possible, avoid enabling this feature on a live device.

- IPv6 Provider Edge devices (6PE) are not supported.

- Prefix-Independent Convergence (PIC) is not supported. Per CE Label with only multipath is supported. You cannot use this feature with:

  - Internal Border Gateway Protocol (IBGP) multipath feature

  - Carrier Supporting Carrier (CSC) feature

- When per CE label is configured, MPLS Forwarding Infrastructure (MFI) has to back up key and label information to a standby device. This will impact software downgrades.

- The BGP Best External feature provides the network with a backup external route to avoid loss of connectivity of the primary external route. This feature is not supported.

- Importing routes from protocols other than BGP on a PE device is not supported.

- Any network with a zero next hop is assigned one label per network, because the next hop cannot be reliably determined.

- Do not use per CE labels if there are multiple neighbors with the same address in a VRF domain.

- Only single hop EBGP is supported. Multihop EBGP is not supported.

- In high availability configurations, labels will be preserved after switchover from standby only if BGP Graceful Restart is configured before establishing BGP sessions.

Information About MPLS VPN per CE Label

MPLS VPN per CE Label Functionality

The provider edge (PE) devices store both local and remote routes and include a label entry for each route. For distributed platforms, the per-prefix labels consume memory. When there are many virtual routing and forwarding (VRF) domains and routes, the amount of memory that the per-prefix labels consume can become

an issue. The purpose of using per CE label allocation is to avoid an additional lookup on the PE device's routing table and to conserve label space.

The MPLS VPN per CE Label feature allows the same label to be used for all the routes advertised from a unique customer edge (CE) peer device. The PE device allocates one label for every immediate next hop (in most cases, the next hop is a CE router). The label is directly mapped to the next hop so there is no VRF route lookup performed during data forwarding. However, the number of labels allocated is one for each CE rather than one for each prefix. As BGP is aware of all the next hops, it assigns a label for each next hop (not for each PE-CE interface).

How to Configure MPLS VPN per CE Label

Configuring the per CE Label Feature

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enters privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mpls label mode** {**vrf** *vrf-name*	**all-vrfs**} **protocol** {**bgp-vpnv4**	**bgp-vpnv6**	**all-afs**} {**per-ce**} **Example:** `Device(config)# mpls label mode all-vrfs protocol bgp-vpnv6 per-ce`	Configures the MPLS VPN per CE Label feature.
Step 4	**end** **Example:** `Device(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.
Step 5	**show ip vrf detail** **Example:** `Device# show ip vrf detail`	Displays the VRF label mode.

	Command or Action	Purpose
Step 6	show mpls forwarding-table Example: `Device# show mpls forwarding-table`	Displays the contents of the Multiprotocol Label Switching (MPLS) Label Forwarding Information Base (LFIB).

Configuration Examples for MPLS VPN per CE Label

Examples: MPLS VPN per CE Label

```
Device> enable
Device# configure terminal
Device(config)# mpls label mode all-vrfs protocol bgp-vpnv6 per-ce
Device(config)# end
```

You can use **show** commands to view information about a per CE label configuration.

The following example shows how to display detailed information about the defined VPN routing and forwarding (VRF) instances and associated interfaces:

```
PE1# show ip vrf detail

VRF red (VRF Id = 1); default RD 1:1; default VPNID <not set="">
  New CLI format, supports multiple address-families
  Flags: 0x180C
  Interfaces:
    Et1/0                    Et2/0
VRF Table ID = 1
  Flags: 0x0
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1
  No import route-map
  No global export route-map
  No export route-map
  VRF label distribution protocol: not configured
  VRF label allocation mode: per-ce
```

The following example shows how to display the contents of the MPLS Label Forwarding Information Base (LFIB):

```
PE1# show mpls forwarding-table

Local     Outgoing   Prefix         Bytes Label   Outgoing   Next Hop
Label     Label      or Tunnel Id   Switched      interface
16        Pop Label  1.1.1.1/32     0             Et0/0      10.0.0.1
18        No Label   nh-id(1)       0             Et2/0      10.0.2.2
19        No Label   nh-id(2)       0             Et1/0      10.0.1.2
20        No Label   nh-id(3)       0             Et1/0      10.0.1.2
22        No Label   nh-id(5)       0             Et1/0      10.0.1.2
          No Label   nh-id(5)       0             Et2/0      10.0.2.2
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
MPLS commands	Cisco IOS Multiprotocol Label Switching Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 2547	*BGP/MPLS*

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 VPN per CE Label

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

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

Table 1: Feature Information for MPLS VPN per CE Label

Feature Name	Releases	Feature Information
MPLS VPN per CE Label		The MPLS VPN per CE Label feature allows you to configure a single VPN label at the provider edge (PE) for every immediate next hop or set of next hops. The following commands were introduced or modified: **show mpls forwarding-table**, **mpls label mode**.