



MPLS VPN - Per VRF Label

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The MPLS VPN - Per VRF Label feature (hereafter, in this document, referred to as the Per VRF Label feature or the Per VRF feature) allows you to configure a single Virtual Private Network (VPN) label for all local routes in the entire VPN routing and forwarding (VRF) domain on Cisco 6500 routers. This MPLS VPN - Per VRF Label feature incorporates a single (per VRF) VPN label that for all local routes in the VRF table.

You can enable (or disable) the MPLS VPN - Per VRF Label feature in global configuration mode. This feature is available for the Cisco 6500 router only.

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Finding Feature Information

Your software release may not support all the features documented in this module. 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 Table at the end of this document.

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 the Per VRF Label Feature



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- If your VRF domain has the external/internal Border Gateway Protocol (EIBGP) multipath feature or the Carrier Supporting Carrier (CSC) feature enabled, disable those features before you configure the Per VRF Label feature.
- Before configuring Multiprotocol Label Switching (MPLS) Layer 3 VPNs, you must have MPLS, Label Distribution Protocol (LDP), and Cisco Express Forwarding (CEF) installed in your network. All routers in the core, including the Provider Edge (PE) routers, must be able to support CEF and MPLS forwarding.

Restrictions for the Per VRF Label Feature

- Enabling the Per VRF Label feature causes BGP reconvergence, which can result in data loss for traffic coming from the 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 router.

- There is no performance degradation when you configure up to 511 VRFs; however, when you add more than 511 VRFs, your network might experience some minor performance degradation (similar to the normal degradation experienced by any of the directly connected VRF prefixes present in the router).
- Per-prefix MPLS counters for VPN prefixes are lost when you enable the Per VRF Label feature.
- You cannot use this feature with CSC and EIBGP multipath features.

Information About the Per VRF Label Feature

- [MPLS VPN - Per VRF Label Functionality, page 2](#)

MPLS VPN - Per VRF Label Functionality

The PE stores both local and remote routes and includes a label entry for each route. For distributed platforms, the per-prefix labels consume memory. When there are many VRFs and routes, the amount of memory that the per-prefix labels consume can become an issue.

This new Per VRF Label feature allows the advertisement of a single VPN label for local routes throughout the entire VRF. The router uses a new VPN label for the VRF decoding and IP-based lookup to learn where to forward packets for the PE or customer edge (CE) interfaces.

The following conditions apply when you configure the Per VRF Label feature:

- The VRF uses one label for all local routes.
- When you *enable* the Per VRF Label feature, any existing Per VRF Aggregate label is used. If no Per VRF Aggregate label is present, the software creates a new Per VRF label.
- When you *enable* the Per VRF Label feature, the CE router's learned local routes will experience some data loss.

The CE does not lose data when you disable the Per VRF Label feature because when you disable the feature, the configuration reverts to the default labeling configuration of the Cisco 6500 platform, which uses the Per VRF Aggregate label from the local nonCE-sourced routes.

- When you *disable* the Per VRF Label feature, the configuration reverts to the default configuration of the Cisco 6500 routers.
- A Per VRF label forwarding entry is deleted only if the VRF or the BGP configuration is removed.

Summarization of Label Allocation Modes

The table below defines the label allocations used with various route types.

Table 1 **Label Allocation Modes**

Route Types	Label Mode: Cisco 6500 Default	Label Mode: Per VRF Label Feature
Local to the PE (connected, static route to NULL0, BGP aggregates), redistributed to BGP	Per VRF Aggregate label	Per VRF label
Locally learned from CE (through EBGP or other PE or CE protocols)	Per Prefix label	Per VRF label

How to Configure the Per VRF Label Feature

- [Configuring the Per VRF Label Feature, page 3](#)

Configuring the Per VRF Label Feature

To configure the Per VRF Label feature, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls label mode {vrf *vrf-name* | all-vrfs} protocol bgp-vpnv4 {per-prefix | per-vrf}**
4. **end**
5. **show ip vrf detail**

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 mode {vrf vrf-name all-vrfs} protocol bgp-vpnv4 {per-prefix per-vrf} Example: Router(config)# mpls label mode all-vrfs protocol bgp-vpnv4 per-vrf	Configures the Per VRF Label feature.
Step 4 end Example: Router(config)# end	Returns to privileged EXEC mode.
Step 5 show ip vrf detail Example: Router# show ip vrf detail	Displays the VRF label mode.

- [Examples, page 4](#)

Examples

The following command example shows how to verify the Per VRF Label configuration:

In this example output, the **bold** text indicates the label modes:

```
Router# show ip vrf detail
VRF vpn1; default RD 1:1; default VPNID <not set>
VRF Table ID = 1
  Interfaces:
    Ethernet0/0          Serial5/0          Loopback1
Connected addresses are not in global routing table
Export VPN route-target communities
  RT:1:1
Import VPN route-target communities
```

```

RT:1:1
No import route-map
No export route-map
CSC is not configured.
VRF label allocation mode: per-vrf (Label 19)
VRF vpn2; default RD 2:1; default VPNID <not set>
VRF Table ID = 2
Interfaces:
Ethernet2/0          Loopback2
Connected addresses are not in global routing table
Export VPN route-target communities
RT:2:1
Import VPN route-target communities
RT:2:1
No import route-map
No export route-map
CSC is not configured.
VRF label allocation mode: per-vrf (Label 20)
VRF vpn3; default RD 3:1; default VPNID <not set>
VRF Table ID = 3
Interfaces:
Ethernet3/0          Loopback3
Connected addresses are not in global routing table
Export VPN route-target communities
RT:3:1
Import VPN route-target communities
RT:3:1
No import route-map
No export route-map
CSC is not configured.
VRF label allocation mode: per-vrf (Label 23)
Router# show ip bgp vpnv4 all labels
Network      Next Hop      In label/Out label
Route Distinguisher: 1:1 (vpn1)
 127.0.0.1/32  192.168.1.1   IPv4 VRF Aggr:19/nolabel
 127.0.0.5/32  127.0.0.4    nolabel/19
 192.168.1.0/24 192.168.1.1   IPv4 VRF Aggr:19/nolabel
                  0.0.0.0      IPv4 VRF Aggr:19/aggregate(vpn1)
 192.168.4.0/24 127.0.0.4    nolabel/20
 172.16.0.0/16  0.0.0.0      IPv4 VRF Aggr:19/aggregate(vpn1)
172.16.128.0/32 192.168.1.1   IPv4 VRF Aggr:19/nolabel
Route Distinguisher: 2:1 (vpn2)
 127.0.2.2/32  0.0.0.0      IPv4 VRF Aggr:20/aggregate(vpn2)
127.0.0.6/32   192.168.5.1   IPv4 VRF Aggr:20/nolabel
 192.168.5.0/24 0.0.0.0      IPv4 VRF Aggr:20/aggregate(vpn2)
172.17.128.0/32 192.168.5.1   IPv4 VRF Aggr:20/nolabel
Route Distinguisher: 3:1 (vpn3)
 127.0.3.2/32  0.0.0.0      IPv4 VRF Aggr:23/aggregate(vpn3)
127.0.0.8/32   192.168.7.1   IPv4 VRF Aggr:23/nolabel
 192.168.7.0/24 0.0.0.0      IPv4 VRF Aggr:23/aggregate(vpn3)
172.16.128.0/32 192.168.7.1   IPv4 VRF Aggr:23/nolabel
Router# show mpls forwarding-table

Local  Outgoing  Prefix          Bytes tag  Outgoing  Next Hop
tag    tag or VC or Tunnel Id  switched   interface
16     Pop tag   192.168.3.0/24  0          Et1/0     192.168.2.3
17     Pop tag   127.0.0.3/32   0          Et1/0     192.168.2.3
18     17       127.0.0.4/32   0          Et1/0     192.168.2.3
19     Pop Label IPv4 VRF[V]    0          aggregate/vpn1
20     Pop Label IPv4 VRF[V]    0          aggregate/vpn2
23     Pop Label IPv4 VRF[V]    0          aggregate/vpn3
PE1#

```

Configuration Examples for the Per VRF Label feature

- [No Label Mode for Cisco 6500 Router Default Example, page 6](#)
- [Mixed Mode with Global Per-Prefix Example, page 7](#)
- [Mixed Mode with Global Per-VRF Example, page 8](#)

No Label Mode for Cisco 6500 Router Default Example

The following example shows the default label mode configuration (no label mode) for the Cisco 6500 router.

In this example output, the **bold** text indicates the label modes:

```
Router# show ip vrf detail
VRF vpn1; default RD 1:1; default VPNID <not set>
VRF Table ID = 1
  Interfaces:
    Ethernet0/0          Serial5/0          Loopback1
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1
  No import route-map
  No export route-map
  CSC is not configured.
VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 19)
VRF vpn2; default RD 2:1; default VPNID <not set>
VRF Table ID = 2
  Interfaces:
    Ethernet2/0          Loopback2
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:2:1
  Import VPN route-target communities
    RT:2:1
  No import route-map
  No export route-map
  CSC is not configured.

VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 20)
VRF vpn3; default RD 3:1; default VPNID <not set>
VRF Table ID = 3
  Interfaces:
    Ethernet3/0          Loopback3
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:3:1
  Import VPN route-target communities
    RT:3:1
  No import route-map
  No export route-map
  CSC is not configured.
VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 23)
Router# show ip bgp vpnv4 all labels
  Network      Next Hop      In label/Out label
Route Distinguisher: 1:1 (vpn1)
  127.0.0.1/32  192.168.1.1   27/nolabel
  127.0.0.5/32  127.0.0.4    nolabel/19
  192.168.1.0/24 192.168.1.1  IPv4 VRF Aggr:19/nolabel
  0.0.0.0       0.0.0.0      IPv4 VRF Aggr:19/aggregate(vpn1)
  192.168.4.0/24 127.0.0.4    nolabel/20
  172.16.0.0/16  0.0.0.0      IPv4 VRF Aggr:19/aggregate(vpn1)
  172.16.128.0/32 192.168.1.1  28/nolabel
Route Distinguisher: 2:1 (vpn2)
  127.0.2.2/32  0.0.0.0      IPv4 VRF Aggr:20/aggregate(vpn2)
  127.0.0.6/32  192.168.5.1  21/nolabel
  192.168.5.0/24 0.0.0.0      IPv4 VRF Aggr:20/aggregate(vpn2)
  172.17.128.0/32 192.168.5.1  22/nolabel
Route Distinguisher: 3:1 (vpn3)
  127.0.3.2/32  0.0.0.0      IPv4 VRF Aggr:23/aggregate(vpn3)
  127.0.0.8/32  192.168.7.1  24/nolabel
```

```

192.168.7.0/24 0.0.0.0 IPv4 VRF Aggr:23/aggregate(vpn3)
172.16.128.0/32 192.168.7.1 25/nolabel
Router# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes tag  Outgoing   Next Hop
tag    tag or VC  or Tunnel Id    switched  interface
16     Pop tag    192.168.3.0/24  0          Et1/0      192.168.2.3
17     Pop tag    127.0.0.3/32   0          Et1/0      192.168.2.3
18     17         127.0.0.4/32   0          Et1/0      192.168.2.3
19     Pop Label  IPv4 VRF[V]    0          aggregate/vpn1
20     Pop Label  IPv4 VRF[V]    0          aggregate/vpn2
21     Untagged  127.0.0.6/32[V] 0          Et2/0      192.168.5.1
22     Untagged  172.17.128.0/32[V]0
23     Pop Label  IPv4 VRF[V]    0          aggregate/vpn3
24     Untagged  127.0.0.8/32[V] 0          Et3/0      192.168.7.1
25     Untagged  172.16.128.0/32[V]0
27     Untagged  127.0.0.1/32[V] 0          Et0/0      192.168.1.1
28     Untagged  172.16.128.0/32[V]0          Et0/0      192.168.1.1

```

Mixed Mode with Global Per-Prefix Example

For this example, the following commands set VPN 1 for per-vrf label mode, VPN 2 for per-prefix label mode, and all remaining VPNs for per-prefix (globally).

In this example output, the **bold** text indicates the label modes:

```

Router# mpls label mode vrf vpn1 protocol bgp-vpnv4 per-vrf
Router# mpls label mode vrf vpn2 protocol bgp-vpnv4 per-prefix

```

Use the following show commands to display the label mode settings:

```

Router# show ip vrf detail
VRF vpn1; default RD 1:1; default VPNID <not set>
VRF Table ID = 1
  Interfaces:
    Ethernet0/0          Serial5/0          Loopback1
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1
  No import route-map
  No export route-map
  CSC is not configured.
VRF label allocation mode: per-vrf (Label 26)
VRF vpn2; default RD 2:1; default VPNID <not set>
VRF Table ID = 2
  Interfaces:
    Ethernet2/0          Loopback2
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:2:1
  Import VPN route-target communities
    RT:2:1
  No import route-map
  No export route-map
  CSC is not configured.
VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 27)
VRF vpn3; default RD 3:1; default VPNID <not set>
VRF Table ID = 3
  Interfaces:
    Ethernet3/0          Loopback3
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:3:1
  Import VPN route-target communities
    RT:3:1
  No import route-map
  No export route-map
  CSC is not configured.

```

```

VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 28)
Router# show ip bgp vpnv4 all label
Network          Next Hop      In label/Out label
Route Distinguisher: 1:1 (vpn1)
 127.0.0.1/32    192.168.1.1   IPv4 VRF Aggr:26/nolabel
 127.0.0.5/32    127.0.0.4    nolabel/19
 192.168.1.0/24  0.0.0.0      IPv4 VRF Aggr:26/aggregate(vpn1)
                   192.168.1.1   IPv4 VRF Aggr:26/nolabel
 192.168.4.0/24  127.0.0.4    nolabel/20
 172.16.0.0/16   0.0.0.0      IPv4 VRF Aggr:26/aggregate(vpn1)
 172.16.128.0/32 192.168.1.1   IPv4 VRF Aggr:26/nolabel
Route Distinguisher: 2:1 (vpn2)
 127.0.2.2/32    0.0.0.0      IPv4 VRF Aggr:27/aggregate(vpn2)
 127.0.0.6/32    192.168.5.1  20/nolabel
 192.168.5.0/24  0.0.0.0      IPv4 VRF Aggr:27/aggregate(vpn2)
 172.17.128.0/32 192.168.5.1  21/nolabel
Route Distinguisher: 3:1 (vpn3)
 127.0.3.2/32    0.0.0.0      IPv4 VRF Aggr:28/aggregate(vpn3)
 127.0.0.8/32    192.168.7.1  22/nolabel
 192.168.7.0/24  0.0.0.0      IPv4 VRF Aggr:28/aggregate(vpn3)
 172.16.128.0/32 192.168.7.1  23/nolabel
Router# show mpls forwarding-table

Local  Outgoing  Prefix          Bytes tag  Outgoing      Next Hop
tag    tag or VC  or Tunnel Id    switched   interface
16     Pop tag    192.168.3.0/24  0          Et1/0         192.168.2.3
17     Pop tag    127.0.0.3/32   0          Et1/0         192.168.2.3
18     17        127.0.0.4/32   0          Et1/0         192.168.2.3
20     Untagged  127.0.0.6/32[V] 0          Et2/0         192.168.5.1
21     Untagged  172.17.128.0/32[V]0 0          Et2/0         192.168.5.1
22     Untagged  127.0.0.8/32[V] 0          Et3/0         192.168.7.1
23     Untagged  172.16.128.0/32[V]0 0          Et3/0         192.168.7.1
26     Pop Label IPv4 VRF[V]    0          aggregate/vpn1
27     Pop Label IPv4 VRF[V]    0          aggregate/vpn1
28     Pop Label IPv4 VRF[V]    0          aggregate/vpn1

```

Mixed Mode with Global Per-VRF Example

For this example, the following commands set VPN 1 for per-vrf label mode, VPN 2 for per-prefix label mode, and all remaining VPNs for per-vrf (globally).

In this example output, the **bold** text indicates the label modes:

```

Router# mpls label mode vrf vpn1 protocol bgp-vpnv4 per-vrf
Router# mpls label mode vrf vpn2 protocol bgp-vpnv4 per-prefix
Router# mpls label mode all-vrfs protocol bgp-vpnv4 per-vrf
Router# show ip vrf detail
VRF vpn1; default RD 1:1; default VPNID <not set>
VRF Table ID = 1
  Interfaces:
    Ethernet0/0          Serial5/0          Loopback1
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1
  No import route-map
  No export route-map
  CSC is not configured.
  VRF label allocation mode: per-vrf (Label 26)
VRF vpn2; default RD 2:1; default VPNID <not set>
VRF Table ID = 2
  Interfaces:
    Ethernet2/0          Loopback2
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:2:1
  Import VPN route-target communities
    RT:2:1

```



```

No import route-map
No export route-map
CSC is not configured.
VRF label allocation mode: per-prefix
per-vrf-aggr for connected and BGP aggregates (Label 27)
VRF vpn3; default RD 3:1; default VPNID <not set>
VRF Table ID = 3
  Interfaces:
    Ethernet3/0          Loopback3
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:3:1
  Import VPN route-target communities
    RT:3:1
  No import route-map
  No export route-map
  CSC is not configured.
VRF label allocation mode: per-vrf (Label 28)
Router# show ip bgp vpnv4 all label

      Network          Next Hop          In label/Out label
Route Distinguisher: 1:1 (vpn1)
  127.0.0.1/32        192.168.1.1      IPv4 VRF Aggr:26/nolabel
  127.0.0.5/32        127.0.0.4        nolabel/19
  192.168.1.0/24      0.0.0.0          IPv4 VRF Aggr:26/aggregate(vpn1)
                    192.168.1.1      IPv4 VRF Aggr:26/nolabel
  192.168.4.0/24      127.0.0.4        nolabel/20
  172.16.0.0/16       0.0.0.0          IPv4 VRF Aggr:26/aggregate(vpn1)
  172.16.128.0/32    192.168.1.1      IPv4 VRF Aggr:26/nolabel
Route Distinguisher: 2:1 (vpn2)
  127.0.2.2/32        0.0.0.0          IPv4 VRF Aggr:27/aggregate(vpn2)
  127.0.0.6/32        192.168.5.1      20/nolabel
  192.168.5.0/24      0.0.0.0          IPv4 VRF Aggr:27/aggregate(vpn2)
  172.17.128.0/32    192.168.5.1      21/nolabel
Route Distinguisher: 3:1 (vpn3)
  127.0.3.2/32        0.0.0.0          IPv4 VRF Aggr:28/aggregate(vpn3)
  127.0.0.8/32        192.168.7.1      IPv4 VRF Aggr:28/nolabel
  192.168.7.0/24      0.0.0.0          IPv4 VRF Aggr:28/aggregate(vpn3)
  172.16.128.0/32    192.168.7.1      IPv4 VRF Aggr:28/nolabel
Router# show mpls forwarding-table

Local  Outgoing  Prefix          Bytes tag  Outgoing      Next Hop
tag    tag or VC or Tunnel Id  switched    interface
16     Pop tag   192.168.3.0/24  0          Et1/0         192.168.2.3
17     Pop tag   127.0.0.3/32   0          Et1/0         192.168.2.3
18     17        127.0.0.4/32   0          Et1/0         192.168.2.3
20     Untagged  127.0.0.6/32[V] 0          Et2/0         192.168.5.1
21     Untagged  172.17.128.0/32[V]0 0          Et2/0         192.168.5.1
26     Pop Label IPv4 VRF[V]    0          aggregate/vpn1
27     Pop Label IPv4 VRF[V]    0          aggregate/vpn2
28     Pop Label IPv4 VRF[V]    0          aggregate/vpn3

```

Additional References

Related Documents

Related Topic	Document Title
MPLS VPNs	<i>MPLS Layer 3 VPNs Configuration Guide</i>

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 Isoftware releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2547	<i>BGP/MPLS</i>

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. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS Multiprotocol Label Switching Command Reference* at http://www.cisco.com/en/US/docs/ios/mps/command/reference/mp_book.html . For information about all Cisco IOS commands, use the Command Lookup Tool at <http://tools.cisco.com/Support/CLILookup> or the *Cisco IOS Master Command List, All Releases* , at http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html .

- `debug ip bgp vpnv4 unicast`
- `mpls label mode`

Feature Information for MPLS VPN - Per VRF 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 2 *Feature Information for MPLS VPN - Per VRF Label*

Feature Name	Releases	Feature Information
MPLS VPN - Per VRF Label	12.2(33)SRD	<p>This feature allows a user to configure a single VPN label for all local routes in the entire VPN routing and forwarding (VRF) domain on Cisco 6500 routers. The feature incorporates a single (per VRF) VPN label for all local routes in the VRF table.</p> <p>You can enable (or disable) the MPLS VPN - Per VRF Label feature in global configuration mode using a new, hidden, command. This feature is available for the Cisco 6500 router only.</p> <p>In 12.2(33)SRD, this feature was integrated.</p>

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