MPLS VPN 6VPE per VRF Label

The MPLS VPN 6VPE per VRF Label feature allows you to configure a single Virtual Private Network (VPN) label for all local routes in the entire IPv6 VPN routing and forwarding (VRF) domain. This MPLS VPN 6VPE per VRF Label feature incorporates a single (per VRF) VPN label for *all* local IPv6 routes in the VRF table.

You can enable (or disable) the MPLS VPN 6VPE per VRF 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 at the end of this module.

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 MPLS VPN 6VPE per VRF Label Feature

- If your virtual routing and forwarding (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 MPLS VPN 6VPE 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 installed 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.
- Before configuring a 6VPE per VRF label, be sure that the IPv6 address family is configured on that VRF.

Restrictions for the MPLS VPN 6VPE per VRF Label Feature

- Enabling the MPLS VPN 6VPE per VRF Label feature causes Border Gateway Protocol (BGP) reconvergence, which can result in data loss for traffic coming from the Multiprotocol Label Switching (MPLS) Virtual Private Network (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

- Per-prefix MPLS counters for VPN prefixes are lost when you enable the MPLS VPN 6VPE per VRF Label feature.
- You cannot use this feature with Carrier Supporting Carrier (CSC) and external/internal BGP (EIBGP) multipath features.

Information About the MPLS VPN 6VPE per VRF Label Feature

MPLS VPN 6VPE per VRF Label Functionality

The provider edge (PE) device stores both local and remote routes and includes a label entry for each route. For distributed platforms, the multiplicity of 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 cause performance degradation on some platform devices. To avoid this issue, the MPLS VPN 6VPE per VRF Label feature allows the advertisement of a single Virtual Private Network (VPN) label for local routes throughout the entire VRF. The device 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 MPLS VPN 6VPE per VRF Label feature:

- The VRF uses one label for all local routes.
- When you enable the MPLS VPN 6VPE 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 6VPE per VRF label.
- When you enable the MPLS VPN 6VPE per VRF Label feature, the CE device's learned local routes will experience some data loss.

The CE does not lose data when you disable the MPLS VPN 6VPE per VRF Label feature because the configuration reverts to the default labeling configuration of the Cisco 7600 platform, which uses the Per VRF Aggregate label from the local nonCE-sourced routes.

- When you disable the MPLS VPN 6VPE per VRF Label feature, the configuration reverts to the default configuration.
- A 6VPE Per VRF Label forwarding entry is deleted only if the VRF, the IPv6 VRF address family, or the Border Gateway Protocol (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 Default	Label Mode: MPLS VPN 6VPE per VRF Label feature
Local to the PE (connected, static route to NULL0, BGP aggregates), redistributed to BGP	Per VRF Aggregate label	6VPE Per VRF Label
Locally learned from CE (through external BGP or other PE or CE protocols)	Per Prefix label	6VPE Per VRF Label

How to Configure the MPLS VPN 6VPE per VRF Label Feature

Configuring the MPLS VPN 6VPE per VRF Label Feature

To configure a single (per VRF) Virtual Private Network (VPN) label for all local IPv6 routes in the virtual routing and forwarding (VRF) table, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **mpls label mode** {**vrf** *vrf-name* | **all-vrfs**} **protocol** {**bgp-vpnv6** | **all-afs**} {**per-prefix** | **per-vrf**}
4. **end**
5. **show vrf detail** *vrf-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**mpls label mode** {**vrf** *vrf-name* | **all-vrfs**} **protocol** {**bgp-vpnv6** | **all-afs**} {**per-prefix** | **per-vrf**} **Example:** `Device(config)# mpls label mode all-vrfs protocol bgp-vpnv6 per-vrf`	Configures a single (per VRF) VPN label for all local IPv6 routes in the VRF table.
Step 4	**end** **Example:** `Device(config)# end`	Returns to privileged EXEC mode.
Step 5	**show vrf detail** *vrf-name* **Example:** `Device# show vrf detail vpn1`	Displays the VRF label mode for the specified VRF.

Examples

The following example shows how to verify the 6VPE per VRF label configuration.

In this example output, the **bold** text indicates the 6VPE per VRF label mode for VPN1.

```
Device# show vrf detail vpn1
VRF vpn1 (VRF Id = 1); default RD 1:1; default VPNID <not set>
  Interfaces:
    GE4/1                   Lo1
Address family ipv4 (Table ID = 1 (0x1)):
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1                  RT:2:2
  No import route-map
  No export route-map
```

```
  VRF label distribution protocol: not configured
  VRF label allocation mode: per-prefix
    vrf-conn-aggr for connected and BGP aggregates (Label 17)
Address family ipv6 (Table ID = 503316481 (0x1E000001)):
  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
  VRF label distribution protocol: not configured
  VRF label allocation mode: per-vrf (Label 18)

Device# show bgp vpnv6 unicast vrf vpn1 label
   Network          Next Hop      In label/Out label
Route Distinguisher: 1:1 (vpn1)
   2001:DB8:1:2::/96
                    2001:DB8:1:2::1 IPv6 VRF Aggr:18/nolabel
                    ::              IPv6 VRF Aggr:18/nolabel(vpn1)
   2001:DB8:4:5::/96
                    ::FFFF:127.0.0.4
                                    nolabel/17
   2001:DB8:2::1/128
                    ::              IPv6 VRF Aggr:18/nolabel(vpn1)
   2001:DB8:4::1/128
                    ::FFFF:127.0.0.4
                                    nolabel/18
   2001:DB8:CE2::1/128
                    ::FFFF:127.0.0.4
                                    nolabel/19
   2001:DB8:CE1::1/128
                    2001:DB8:1:2::1 IPv6 VRF Aggr:18/nolabel

Device# show mpls forwarding
Local  Outgoing      Prefix            Bytes Label   Outgoing   Next Hop
Label  Label or VC   or Tunnel Id      Switched      interface
16     Pop Label     127.0.0.4/32      0             AT3/0/0.1  point2point
17     Pop Label     IPv4 VRF[V]       0             aggregate/vpn1
18     Pop Label     IPv6 VRF[V]       0             aggregate/vpn1
```

Troubleshooting Tips

The **debug ip bgp vpnv6 unicast** command can help troubleshoot the 6VPE per VRF label configuration.

Configuration Examples for MPLS VPN 6VPE per VRF Label

Examples: 6VPE No Label Mode Default Configuration

The following example shows the 6VPE default label mode configuration (no label mode).

In this example output, the **bold** text indicates the default label mode for VPN1.

```
Device# show vrf detail vpn1
VRF vpn1 (VRF Id = 1); default RD 1:1; default VPNID <not set>
  Interfaces:
    GE4/1                   Lo1
Address family ipv4 (Table ID = 1 (0x1)):
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:1:1
  Import VPN route-target communities
    RT:1:1                  RT:2:2
```

```
  No import route-map
  No export route-map
  VRF label distribution protocol: not configured
  VRF label allocation mode: per-prefix
    vrf-conn-aggr for connected and BGP aggregates (Label 17)
Address family ipv6 (Table ID = 503316481 (0x1E000001)):
  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
  VRF label distribution protocol: not configured
  VRF label allocation mode: per-prefix
    vrf-conn-aggr for connected and BGP aggregates (Label 18)

Device# show bgp vpnv6 unicast vrf vpn1 label
   Network          Next Hop      In label/Out label
Route Distinguisher: 1:1 (vpn1)
   2001:DB8:1:2::/96
                    2001:DB8:1:2::1 IPv6 VRF Aggr:18/nolabel
                    ::              IPv6 VRF Aggr:18/nolabel(vpn1)
   2001:DB8:4:5::/96
                    ::FFFF:127.0.0.4
                                    nolabel/17
   2001:DB8:2::1/128
                    ::              IPv6 VRF Aggr:18/nolabel(vpn1)
   2001:DB8:4::1/128
                    ::FFFF:127.0.0.4
                                    nolabel/18
   2001:DB8:CE2::1/128
                    ::FFFF:127.0.0.4
                                    nolabel/19
   2001:DB8:CE1::1/128
                    2001:DB8:1:2::1 19/nolabel
Device# show mpls forwarding
Local  Outgoing      Prefix            Bytes Label   Outgoing   Next Hop
Label  Label or VC   or Tunnel Id      Switched      interface
16     Pop Label     127.0.0.4/32      0             AT3/0/0.1  point2point
17     Pop Label     IPv4 VRF[V]       0             aggregate/vpn1
18     Pop Label     IPv6 VRF[V]       0             aggregate/vpn1
19     No Label      2001:DB8:CE1::1/128[V]
                                       0             GE4/1      FE80::20C:CFFF:FEAD:A00A
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco Master Command List, All Releases
MPLS and MPLS applications commands	Cisco IOS Multiprotocol Label Switching Command Reference
MPLS VPNs	“MPLS Virtual Private Networks” module

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 6VPE 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 6VPE per VRF Label

Feature Name	Releases	Feature Information
MPLS VPN 6VPE per VRF Label	12.2(33)SRD	The MPLS VPN 6VPE per VRF Label feature allows a user to configure a single VPN label for all local routes in the entire IPv6 VPN routing and forwarding (VRF) domain. The feature incorporates a single (per VRF) VPN label for all local IPv6 routes in the VRF table. You can enable (or disable) the MPLS VPN 6VPE per VRF Label feature in global configuration mode. In Release 12.2(33)SRD, this feature was introduced on the Cisco 7600 router. The following commands were introduced: **debug ip bgp vpnv6 unicast** and **mpls label mode** (6VPE).