



# MPLS VPN Half-Duplex VRF

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The MPLS VPN Half-Duplex VRF feature provides scalable hub-and-spoke connectivity for subscribers of an Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) service. This feature addresses the limitations previously imposed on hub-and-spoke topologies by removing the requirement of one Virtual Routing and Forwarding (VRF) per spoke. This feature also ensures that subscriber traffic always traverses the central link between the wholesale service provider and the Internet service provider (ISP), whether the subscriber traffic is being routed to a remote network by way of the upstream ISP or to another locally or remotely connected subscriber.

## Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. 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 VPN Half-Duplex VRF](#)” section on page 18.

## 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.

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# Prerequisites for Configuring MPLS VPN Half-Duplex VRF

You must have a working MPLS core network.

## Restrictions for MPLS VPN Half-Duplex VRF

The following features are not supported on interfaces configured with the MPLS VPN Half-Duplex VRF feature:

- Multicast
- MPLS VPN Carrier Supporting Carrier
- MPLS VPN Interautonomous Systems

## Information About Configuring MPLS VPN Half-Duplex VRF

To configure this feature, you need to understand the following concepts:

- [MPLS VPN Half-Duplex VRF Overview, page 2](#)
- [Upstream and Downstream VRFs, page 3](#)
- [Reverse Path Forwarding Check, page 4](#)

For information about this feature on the Cisco 10000 series routers, see the “Half-Duplex VRF” section of the “Configuring Multiprotocol Label Switching” chapter in the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*.

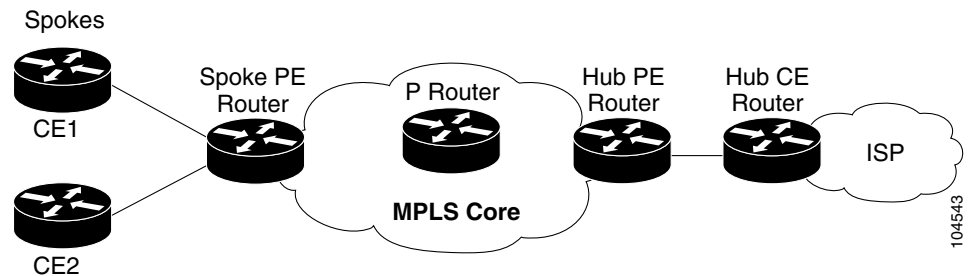
## MPLS VPN Half-Duplex VRF Overview

The MPLS VPN Half-Duplex VRF feature provides the following benefits:

- The MPLS VPN Half-Duplex VRF feature prevents local connectivity between subscribers at the spoke provider edge (PE) router and ensures that a hub site provides subscriber connectivity. Any sites that connect to the same PE router must forward intersite traffic using the hub site. This ensures that the routing done at the spoke site moves from the access-side interface to the network-side interface or from the network-side interface to the access-side interface, but never from the access-side interface to the access-side interface.
- The MPLS VPN Half-Duplex VRF feature prevents situations where the PE router locally switches the spokes without passing the traffic through the upstream ISP. This prevents subscribers from directly connecting to each other, which causes the wholesale service provider to lose revenue.
- The MPLS VPN Half-Duplex VRF feature improves scalability by removing the requirement of one VRF per spoke. When the feature is not configured, when spokes are connected to the same PE router each spoke is configured in a separate VRF to ensure that the traffic between the spokes traverses the central link between the wholesale service provider and the ISP. However, this configuration is not scalable. When many spokes connected to the same PE router, configuration of VRFs for each spoke becomes quite complex and greatly increases memory usage. This is especially true in large-scale wholesale service provider environments that support high-density remote access to Layer 3 VPNs.

[Figure 1](#) shows a sample hub-and-spoke topology.

**Figure 1**      **Hub-and-Spoke Topology**



## Upstream and Downstream VRFs

The MPLS VPN Half-Duplex VRF feature uses two unidirectional VRFs to forward IP traffic between the spokes and the hub PE router:

- The upstream VRF forwards IP traffic from the spokes toward the hub PE router. This VRF typically contains only a default route but might also contain summary routes and several default routes. The default route points to the interface on the hub PE router that connects to the upstream ISP. The router dynamically learns about the default route from the routing updates that the hub PE router or home gateway sends.



**Note** Although the upstream VRF is typically populated from the hub, it is possible also to have a separate local upstream interface on the spoke PE for a different local service that would not be required to go through the hub: for example, a local Domain Name System (DNS) or game server service.

- The downstream VRF forwards traffic from the hub PE router back to the spokes. This VRF can contain:
  - PPP peer routes for the spokes and per-user static routes received from the authentication, authorization, and accounting (AAA) server or from the Dynamic Host Control Protocol (DHCP) server
  - Routes imported from the hub PE router
  - Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), Routing Information Protocol (RIP), or Enhanced Interior Gateway Routing Protocol (EIGRP) dynamic routes for the spokes

The spoke PE router redistributes routes from the downstream VRF into Multiprotocol Border Gateway Protocol (MP-BGP). That router typically advertises a summary route across the MPLS core for the connected spokes. The VRF configured on the hub PE router imports the advertised summary route.

## Reverse Path Forwarding Check

The Reverse Path Forwarding (RPF) check ensures that an IP packet that enters a router uses the correct inbound interface. The MPLS VPN Half-Duplex VRF feature supports unicast RPF check on the spoke-side interfaces. Because different VRFs are used for downstream and upstream forwarding, the RPF mechanism ensures that source address checks occur in the downstream VRF.

Unicast RPF is not on by default. You need to enable it, as described in [Configuring Unicast Reverse Path Forwarding](#).

## How to Configure MPLS VPN Half-Duplex VRF

This section contains the following procedures:

- [Configuring the Upstream and Downstream VRFs on the Spoke PE Router](#), page 4 (required)
- [Associating a VRF with an Interface](#), page 6 (required)
- [Configuring the Downstream VRF for an AAA Server](#), page 7 (optional)
- [Verifying MPLS VPN Half-Duplex VRF Configuration](#), page 7 (optional)

To configure this feature on the Cisco 10000 series routers, see the “Half-Duplex VRF” section of the “Configuring Multiprotocol Label Switching” chapter in the [Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide](#).

## Configuring the Upstream and Downstream VRFs on the Spoke PE Router

To configure the upstream and downstream VRFs on the PE router or on the spoke PE router, use the following procedure.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vrf definition** *vrf-name*
4. **rd** *route-distinguisher*
5. **address-family** {**ipv4** | **ipv6**}
6. **route-target** {**import** | **export** | **both**} *route-target-ext-community*
7. **exit-address-family**
8. **end**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>enable</b></p> <p><b>Example:</b> Router&gt; enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
Step 2	<p><b>configure terminal</b></p> <p><b>Example:</b> Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p><b>vrf definition</b> <i>vrf-name</i></p> <p><b>Example:</b> Router(config)# vrf definition vrf1</p>	<p>Configures a VRF routing table and enters VRF configuration mode.</p> <ul style="list-style-type: none"> <li>The <i>vrf-name</i> argument is the name of the VRF.</li> </ul>
Step 4	<p><b>rd</b> <i>route-distinguisher</i></p> <p><b>Example:</b> Router(config-vrf)# rd 100:1</p>	<p>Creates routing and forwarding tables for a VRF.</p> <ul style="list-style-type: none"> <li>The <i>route-distinguisher</i> argument specifies to add an 8-byte value to an IPv4 prefix to create a VPN IPv4 prefix. You can enter a route distinguisher in either of these formats: <ul style="list-style-type: none"> <li>16-bit autonomous system number (ASN): your 32-bit number For example, 101:3.</li> <li>32-bit IP address: your 16-bit number For example, 192.168.122.15:1.</li> </ul> </li> </ul>
Step 5	<p><b>address-family</b> {<b>ipv4</b>   <b>ipv6</b>}</p> <p><b>Example:</b> Router(config-vrf) address-family ipv4</p>	<p>Enters VRF address family configuration mode to specify an address family for a VRF.</p> <ul style="list-style-type: none"> <li>The <b>ipv4</b> keyword specifies an IPv4 address family for a VRF.</li> <li>The <b>ipv6</b> keyword specifies an IPv6 address family for a VRF.</li> </ul> <p><b>Note</b> The MPLS VPN Half Duplex VRF feature supports only IPv4 address family.</p>
Step 6	<p><b>route-target</b> {<b>import</b>   <b>export</b>   <b>both</b>} <i>route-target-ext-community</i></p> <p><b>Example:</b> Router(config-vrf-af)# route-target both 100:2</p>	<p>Creates a route-target extended community for a VRF.</p> <ul style="list-style-type: none"> <li>The <b>import</b> keyword specifies to import routing information from the target VPN extended community.</li> <li>The <b>export</b> keyword specifies to export routing information to the target VPN extended community.</li> <li>The <b>both</b> keyword specifies to import both import and export routing information to the target VPN extended community.</li> <li>The <i>route-target-ext-community</i> argument adds the route-target extended community attributes to the VRF's list of import, export, or both (import and export) route-target extended communities.</li> </ul>

	Command or Action	Purpose
Step 7	<b>exit-address-family</b>  <b>Example:</b> Router(config-vrf-af)# exit-address-family	Exits from VRF address family configuration mode.
Step 8	<b>end</b>  <b>Example:</b> Router(config-vrf-af)# end	Exits to privileged EXEC mode.

## Associating a VRF with an Interface

Perform the following task to associate a VRF with an interface, which activates the VRF.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **vrf forwarding** *vrf-name*
5. **ip address** *ip-address mask* [**secondary**]
6. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>interface</b> <i>type number</i>  <b>Example:</b> Router(config)# interface Ethernet 0/1	Configures an interface type and enters interface configuration mode. <ul style="list-style-type: none"> <li>• The <b>type</b> argument identifies the type of interface to be configured.</li> <li>• The <b>number</b> argument identifies the port, connector, or interface card number.</li> </ul>
Step 4	<b>vrf forwarding</b> <i>vrf-name</i> [ <b>downstream</b> <i>vrf2</i> ]  <b>Example:</b> Router(config-if)# vrf forwarding vrf1	Associates a VRF with an interface or subinterface. <ul style="list-style-type: none"> <li>• The <i>vrf-name</i> argument is the name of the VRF.</li> <li>• The <b>downstream</b> <i>vrf2</i> is the name of the downstream VRF into which peer and per-user routes are installed.</li> </ul>

	Command or Action	Purpose
Step 5	<p><b>ip address</b> <i>ip-address mask</i> [<b>secondary</b>]</p> <p><b>Example:</b>  Router(config-if)# ip address 10.24.24.24  255.255.255.255</p>	<p>Sets a primary or secondary IP address for an interface.</p> <ul style="list-style-type: none"> <li>The <i>ip-address</i> argument is the IP address.</li> <li>The <i>mask</i> argument is the mask of the associated IP subnet.</li> <li>The <b>secondary</b> keyword specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.</li> </ul>
Step 6	<p><b>end</b></p> <p><b>Example:</b>  Router(config-if) end</p>	<p>Exits to privileged EXEC mode.</p>

## Configuring the Downstream VRF for an AAA Server

To configure the downstream VRF for an AAA (RADIUS) server in broadband or remote access situations, enter the following Cisco attribute value:

**lcp:interface-config=ip vrf forwarding U downstream D**

In standard VPN situations, enter instead the following Cisco attribute value:

**ip:vrf-id=U downstream D**

## Verifying MPLS VPN Half-Duplex VRF Configuration

To verify the Downstream VRF for an AAA Server configuration, perform the following steps.

### SUMMARY STEPS

- show vrf** [**brief** | **detail** | **id** | **interfaces** | **lock** | **select** ] [*vrf-name*]
- show ip route vrf** *vrf-name*
- show running-config** [**interface** *type number*]

### DETAILED STEPS

**Step 1** **show vrf** [**brief** | **detail** | **id** | **interfaces** | **lock** | **select** ] [*vrf-name*]

Use this command to display information about all of the VRFs configured on the router, including the downstream VRF for each associated interface or VAI:

```
Router# show vrf
```

```
Name      Default RD      Interfaces
Down     100:1           POS3/0/3 [D]
                   POS3/0/1 [D]
                   100:3          Loopback2
                   Virtual-Access3 [D]
```

```

Up      100:2      Virtual-Access4 [D]
        POS3/0/3
        POS3/0/1
        100:4      Virtual-Access3

```

### show vrf detail vrf-name

Use this command to display detailed information about the VRF you specify, including all interfaces, subinterfaces, and VAIs associated with the VRF.

If you do not specify a value for the *vrf-name* argument, detailed information about all of the VRFs configured on the router appears.

The following example shows how to display detailed information for the VRF called vrf1, in a broadband or remote access case:

```

Router# show vrf detail vrf1

VRF D; default RD 2:0; default VPNID <not set>
  Interfaces:
    Loopback2          Virtual-Access3 [D]  Virtual-Access4 [D]
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:2:0
  Import VPN route-target communities
    RT:2:1
  No import route-map
  No export route-map
VRF U; default RD 2:1; default VPNID <not set>
  Interfaces:
    Virtual-Access3    Virtual-Access4
  Connected addresses are not in global routing table
  No Export VPN route-target communities
  Import VPN route-target communities
    RT:2:1
  No import route-map
  No export route-map

```

The following example shows the VRF detail in a standard VPN situation:

```

Router# show vrf detail

VRF Down; default RD 100:1; default VPNID <not set> VRF Table ID = 1
  Description: import only from hub-pe
  Interfaces:
    Pos3/0/3 [D]      Pos3/0/1:0.1 [D]
  Connected addresses are not in global routing table
  Export VPN route-target communities
    RT:100:0
  Import VPN route-target communities
    RT:100:1
  No import route-map
  No export route-map
  VRF label distribution protocol: not configured
  VRF Up; default RD 100:2; default VPNID <not set> VRF Table ID = 2
  Interfaces:
    Pos3/0/1          Pos3/0/3
  Connected addresses are not in global routing table
  No Export VPN route-target communities
  Import VPN route-target communities
    RT:100:1
  No import route-map
  No export route-map
  VRF label distribution protocol: not configured

```



**Step 2** `show ip route vrf vrf-name`

Use this command to display the IP routing table for the VRF you specify, and information about the per-user routes installed in the downstream VRF.

The following example shows how to display the routing table for the downstream VRF named D, in a broadband or remote access situation:

```
Router# show ip route vrf D

Routing Table: D
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS interarea
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

    10.0.0.0/8 is variably subnetted, 5 subnets, 2 masks
U       10.0.0.2/32 [1/0] via 10.0.0.1
S       10.0.0.0/8 is directly connected, Null0
U       10.0.0.5/32 [1/0] via 10.0.0.2
C       10.8.1.2/32 is directly connected, Virtual-Access4
C       10.8.1.1/32 is directly connected, Virtual-Access3
```

The following example shows how to display the routing table for the downstream VRF named Down, in a standard VPN situation:

```
Router# show ip route vrf Down

Routing Table: Down
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.13.13.13 to network 0.0.0.0

C       10.2.0.0/8 is directly connected, Pos3/0/3
       10.3.0.0/32 is subnetted, 1 subnets
B       10.4.16.16 [200/0] via 10.13.13.13, 1w3d
B       10.6.0.0/8 [200/0] via 10.13.13.13, 1w3d
C       10.0.0.0/8 is directly connected, Pos3/0/1
       10.7.0.0/16 is subnetted, 1 subnets
B       10.7.0.0 [20/0] via 10.0.0.2, 1w3d
       10.0.6.0/32 is subnetted, 1 subnets
B       10.0.6.14 [20/0] via 10.0.0.2, 1w3d
       10.8.0.0/32 is subnetted, 1 subnets
B       10.8.15.15 [20/0] via 10.0.0.2, 1w3d
B*      0.0.0.0/0 [200/0] via 10.0.0.13, 1w3d
```

The following example shows how to display the routing table for the upstream VRF named U in a broadband or remote access situation:

```
Router# show ip route vrf U

Routing Table: U
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
```

```

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS interarea
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

```

```
Gateway of last resort is 192.168.0.20 to network 0.0.0.0
```

```

10.0.0.0/32 is subnetted, 1 subnets
C    10.0.0.8 is directly connected, Loopback2
B*  0.0.0.0/0 [200/0] via 192.168.0.20, 1w5d

```

The following example shows how to display the routing table for the upstream VRF named Up in a standard VPN situation:

```
Router# show ip route vrf Up
```

```

Routing Table: Up
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

```

```
Gateway of last resort is 10.13.13.13 to network 0.0.0.0
```

```

10.2.0.0/32 is subnetted, 1 subnets
C    10.2.0.1 is directly connected, Pos3/0/3
10.3.0.0/32 is subnetted, 1 subnets
B    10.3.16.16 [200/0] via 10.13.13.13, 1w3d
B    10.6.0.0/8 [200/0] via 10.13.13.13, 1w3d
10.0.0.0/32 is subnetted, 1 subnets
C    10.0.0.1 is directly connected, Pos3/0/1
B*  0.0.0.0/0 [200/0] via 10.13.13.13, 1w3d

```

### Step 3 show running-config [interface type number]

Use this command to display information about the interface you specify, including information about the associated upstream and downstream VRFs.

The following example shows how to display information about the subinterface named POS3/0/1:

```
Router# show running-config interface POS3/0/1
```

```
Building configuration...
```

```

Current configuration : 4261 bytes
!
interface POS3/0/1
  ip vrf forwarding Up downstream Down
  ip address 10.0.0.1 255.0.0.0
end

```

## Configuration Examples for MPLS VPN Half-Duplex VRF

This section provides the following configuration examples:

- [Configuring the Upstream and Downstream VRFs on the Spoke PE Router: Example, page 11](#)
- [Associating a VRF with an Interface: Example, page 11](#)
- [Configuring MPLS VPN Half-Duplex VRF: Example Using Static CE-PE Routing, page 11](#)
- [Configuring MPLS VPN Half-Duplex VRF: Example Using RADIUS Server and Static CE-PE Routing, page 13](#)
- [Configuring MPLS VPN Half-Duplex VRF: Example Using Dynamic CE-PE Routing, page 14](#)

## Configuring the Upstream and Downstream VRFs on the Spoke PE Router: Example

The following example configures an upstream VRF named Up:

```
Router> enable
Router# configure terminal
Router(config)# vrf definition Up
Router(config-vrf)# rd 1:0
Router(config-vrf)# address-family ipv4
Router(config-vrf-af)# route-target import 1:0
Router(config-vrf-af)# exit-address-family
```

The following example configures a downstream VRF named Down:

```
Router> enable
Router# configure terminal
Router(config)# vrf definition Down
Router(config-vrf)# rd 1:8
Router(config-vrf)# address-family ipv4
Router(config-vrf-af)# route-target import 1:8
Router(config-vrf-af)# exit-address-family
```

## Associating a VRF with an Interface: Example

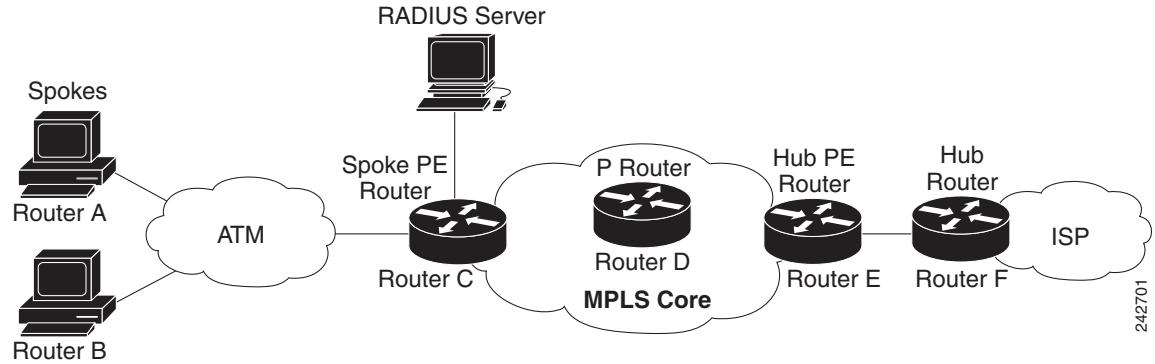
The following example associates the VRF named Up with the POS3/0/1 subinterface and specifies the downstream VRF named Down:

```
Router> enable
Router# configure terminal
Router(config)# interface POS 3/0/1
Router(config-if)# vrf forwarding Up downstream Down
Router(config-if)# ip address 10.0.0.1 255.0.0.0
```

## Configuring MPLS VPN Half-Duplex VRF: Example Using Static CE-PE Routing

This example uses the hub-and-spoke topology shown in [Figure 2](#) with local authentication (that is, the RADIUS server is not used).

Figure 2 Sample Topology



```

vrf definition D
 rd 1:8
 address-family ipv4
 route-target export 1:100
 exit-address-family
!
vrf definition U
 rd 1:0
 address-family ipv4
 route-target import 1:0
 exit-address-family
!
ip cef
vpdn enable
!
vpdn-group U
 accept-dialin
 protocol pppoe
 virtual-template 1
!
interface Loopback2
 vrf forwarding U
 ip address 10.0.0.8 255.255.255.255
!
interface ATM2/0
 description Mze ATM3/1/2
 no ip address
 no atm ilmi-keepalive
 pvc 0/16 ilmi
!
 pvc 3/100
 protocol pppoe
!
 pvc 3/101
 protocol pppoe
!

```

## Configuring MPLS VPN Half-Duplex VRF: Example Using RADIUS Server and Static CE-PE Routing

The following example shows how to connect two Point-to-Point Protocol over Ethernet (PPPoE) clients to a single VRF pair on the spoke PE router named Router C. Although both PPPoE clients are configured in the same VRF, all communication occurs using the hub PE router. Half-duplex VRFs are configured on the spoke PE. The client configuration is downloaded to the spoke PE from the RADIUS server.

This example uses the hub-and-spoke topology shown in [Figure 2](#).



### Note

The wholesale provider can forward the user authentication request to the corresponding ISP. If the ISP authenticates the user, the wholesale provider appends the VRF information to the request that goes back to the PE router.

```

aaa new-model
!
aaa group server radius R
  server 10.0.20.26 auth-port 1812 acct-port 1813
!
aaa authentication ppp default group radius
aaa authorization network default group radius
!
vrf definition D
  description Downstream VRF - to spokes
  rd 1:8
  address-family ipv4
    route-target export 1:100
  exit-address-family
!
vrf definition U
  description Upstream VRF - to hub
  rd 1:0
  address-family ipv4
    route-target import 1:0
  exit-address-family
!
ip cef
vpdn enable
!
vpdn-group U
  accept-dialin
  protocol pppoe
  virtual-template 1
!
interface Loopback2
  vrf forwarding U
  ip address 10.0.0.8 255.255.255.255
!
interface ATM2/0
  pvc 3/100
    protocol pppoe
  !
  pvc 3/101
    protocol pppoe
  !
interface virtual-template 1
  no ip address
  ppp authentication chap

```

```

!
router bgp 1
  no synchronization
  neighbor 172.16.0.34 remote-as 1
  neighbor 172.16.0.34 update-source Loopback0
  no auto-summary
!
address-family vpnv4
  neighbor 172.16.0.34 activate
  neighbor 172.16.0.34 send-community extended
  auto-summary
  exit-address-family
!
address-family ipv4 vrf U
  no auto-summary
  no synchronization
  exit-address-family
!
address-family ipv4 vrf D
  redistribute static
  no auto-summary
  no synchronization
  exit-address-family
!
ip local pool U-pool 10.8.1.1 2.8.1.100
ip route vrf D 10.0.0.0 255.0.0.0 Null0
!
radius-server host 10.0.20.26 auth-port 1812 acct-port 1813
radius-server key cisco

```

## Configuring MPLS VPN Half-Duplex VRF: Example Using Dynamic CE-PE Routing

The following example shows how to use OSPF to dynamically advertise the routes on the spoke sites. This example uses the hub-and-spoke topology shown in [Figure 2](#).

### Creating the VRFs

```

vrf definition Down
  rd 100:1
  address-family ipv4
  route-target export 100:0
  exit-address-family
!
vrf definition Up
  rd 100:2
  address-family ipv4
  route-target import 100:1
  exit-address-family

```

### Enabling MPLS

```

mpls ldp graceful-restart
mpls ldp router-id Loopback0 force
mpls label protocol ldp

```

### Configuring BGP Toward Core

```

router bgp 100
  no bgp default ipv4-unicast

```

```

    bgp log-neighbor-changes
    bgp graceful-restart restart-time 120
    bgp graceful-restart stalepath-time 360
    bgp graceful-restart
    neighbor 10.13.13.13 remote-as 100
    neighbor 10.13.13.13 update-source Loopback0
    !
    address-family vpnv4
    neighbor 10.13.13.13 activate
    neighbor 10.13.13.13 send-community extended
    bgp scan-time import 5
    exit-address-family

```

### Configuring BGP Toward Edge

```

    address-family ipv4 vrf Up
    no auto-summary
    no synchronization
    exit-address-family
    !
    address-family ipv4 vrf Down
    redistribute ospf 1000 vrf Down
    no auto-summary
    no synchronization
    exit-address-family

```

### Spoke PE's Core-Facing Interfaces and Processes

```

interface Loopback0
    ip address 10.11.11.11 255.255.255.255
!
interface POS3/0/2
    ip address 10.0.1.1 255.0.0.0
    mpls label protocol ldp
    mpls ip
!
router ospf 100
    log-adjacency-changes
    auto-cost reference-bandwidth 1000
    nsf enforce global
    redistribute connected subnets
    network 10.11.11.11 0.0.0.0 area 100
    network 10.0.1.0 0.255.255.255 area 100

```

### Spoke PE's Edge-Facing Interfaces and Processes

```

interface Loopback100
    vrf forwarding Down
    ip address 10.22.22.22 255.255.255.255
!
interface POS3/0/1
    vrf forwarding Up downstream Down
    ip address 10.0.0.1 255.0.0.0
!
interface POS3/0/3
    vrf forwarding Up downstream Down
    ip address 10.2.0.1 255.0.0.0
!
router ospf 1000 vrf Down
    router-id 10.22.22.22
    log-adjacency-changes
    auto-cost reference-bandwidth 1000
    nsf enforce global
    redistribute connected subnets

```

```

redistribute bgp 100 metric-type 1 subnets
network 10.22.22.22 0.0.0.0 area 300
network 10.0.0.0 0.255.255.255 area 300
network 10.2.0.0 0.255.255.255 area 300
default-information originate

```

## Additional References

The following sections provide references related to the MPLS VPN Half-Duplex VRFs feature.

## Related Documents

Related Topic	Document Title
MPLS VPNs	<i>Configuring MPLS Layer 3 VPNs</i>
MPLS commands	<i>Cisco IOS Multiprotocol Label Switching Command Reference</i>
Configuring IPv4 and IPv6 VRFs	<i>MPLS VPN—VRF CLI for IPv4 and IPv6 VPNs</i>
Unicast Reverse Path Forwarding	<i>Configuring Unicast Reverse Path Forwarding</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 IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>



## RFCs

RFC	Title
RFC 2547	<a href="#">BGP/MPLS VPNs</a>

## Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

# Feature Information for MPLS VPN Half-Duplex VRF

Table 1 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.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS 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 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 1** Feature Information for MPLS VPN Half-Duplex VRF

Feature Name	Releases	Feature Information
MPLS VPN - Half Duplex VRF (HDVRF) Support with Static Routing	12.3(6) 12.3(11)T 12.2(28)SB	This feature ensures that VPN clients that connect to the same PE router at the edge of the MPLS VPN use the hub site to communicate.  In 12.3(6), this feature was introduced.  In 12.4(20)T, this feature was integrated.  In 12.2(28)SB, this feature was integrated
MPLS VPN Half-Duplex VRF	12.2(28)SB2 12.4(20)T 12.2(33)SRC	In 12.2(28)SB2, support for dynamic routing protocols was added.  For the Cisco 10000 series routers, see the “Half-Duplex VRF” section of the “Configuring Multiprotocol Label Switching” chapter in the <i>Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide</i> at the following URL:  <a href="http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/dffsrv.htm#wp1065648">http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/dffsrv.htm#wp1065648</a>  In 12.4(20)T, this feature, with support for dynamic routing protocols, was integrated.  In Cisco IOS Release 12.2(33)SRC this feature, with support for dynamic routing protocols, was integrated into the SR train.  The following commands were introduced or modified: <b>show ip interface, show vrf</b>

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