Configuring Multicast VPN Extranet Support

The Multicast VPN Extranet Support feature (sometimes referred to as the MVPN Extranet Support feature) enables service providers to distribute IP multicast content originated from one enterprise site to other enterprise sites. This feature enables service providers to offer the next generation of flexible extranet services, helping to enable business partnerships between different enterprise VPN customers.

This module describes the concepts and the tasks related to configuring Multicast VPN Extranet Support.

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 Configuring Multicast VPN Extranet Support

- You are familiar with IP multicast concepts and configuration tasks.
- You are familiar with Multicast VPN (MVPN) concepts and configuration tasks.
- You are familiar with Multiprotocol Label Switching (MPLS) Layer 3 Virtual Private Network (VPN) concepts and configuration tasks.

Restrictions for Configuring Multicast VPN Extranet Support

- The Multicast VPN Extranet Support feature supports only Protocol Independent Multicast (PIM) sparse mode (PIM-SM) and Source Specific Multicast (SSM) traffic; PIM dense mode (PIM-DM) and bidirectional PIM (bidir-PIM) traffic are not supported.
- When configuring extranet MVPNs in a PIM-SM environment, the source and the rendezvous point (RP) must reside in the same site of the MVPN behind the same provider edge (PE) router.
- It is required to configure either all the Receiver MVRF(s) in Source PE or Source MVRF in all the Receiver PE(s) to deliver the Extranet content.
- IPV6 based MVPN Extranet is *not* supported.
- Only Routed interfaces and Routed interfaces on Port channels are supported towards the core. BDI towards core is *not* supported.
- The scale data for MVPN extranet is as follows:
  - Maximum number of mVRFs supported is 20
  - Maximum number of mroutes supported (Intranet + extranet) is 1000 in case of default template and 2000 in case of Video template.
- PIM-SM and PIM-SSM are supported.
- PIM-DM and bidir-PIM are *not* supported.
- RP must be configured behind the PE router and the source is in the same intranet-MVPN and behind the CE router.
- Static mroute with fallback-lookup option is supported for RPF lookup².
- Configuring the Receiver mVRF on the Source PE only to implement MVPN Extranet support is *not* supported.

Information About Multicast VPN Extranet Support

Overview of MVPN Extranet Support

An extranet can be viewed as part of a company's intranet that is extended to users outside the company. It has also been described as a "state of mind" in which a VPN is used as a way to do business with other companies as well as to sell products and content to customers and companies. An extranet is a VPN connecting the corporate site or sites to external business partners or suppliers to securely share part of a business's information or operations among them.

MPLS VPNs inherently provide security, ensuring that users access only appropriate information. MPLS VPN extranet services offer extranet users unicast connectivity without compromising the integrity of their corporate data. The Multicast VPN Extranet Support feature extends this offer to include multicast connectivity to the extranet community of interest.

The Multicast VPN Extranet Support feature enables service providers to distribute IP multicast content originated from one enterprise site to other enterprise sites. This feature enables service providers to offer the next generation of flexible extranet services, helping to enable business partnerships between different enterprise VPN customers. Using this feature, service providers can offer multicast extranet contracts to meet various business partnership requirements, including short-term, annual, and rolling contracts.

Benefits of MVPN Extranet Support

The Multicast VPN Extranet Support feature can be used to solve such business problems as:

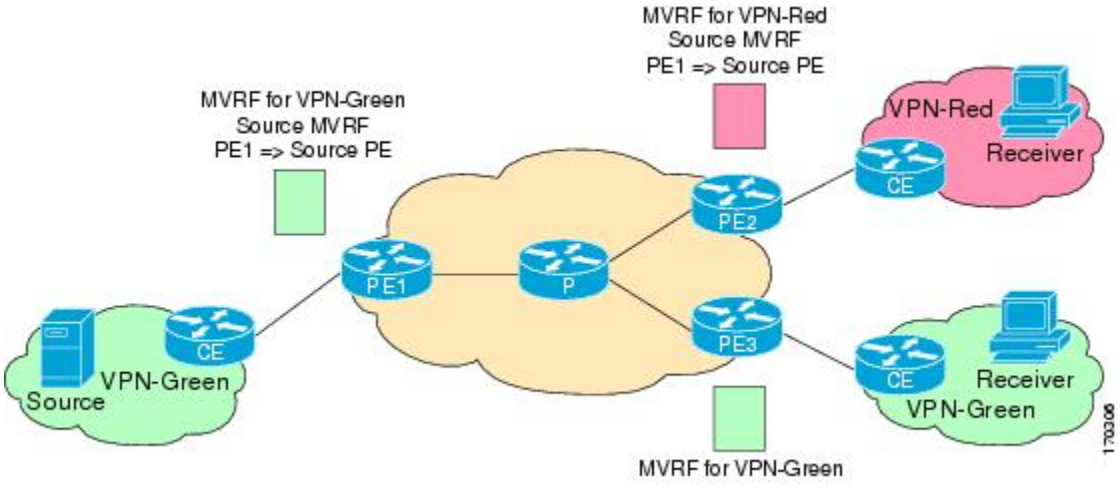
- Efficient content distribution between enterprises
- Efficient content distribution from service providers or content providers to their different enterprise VPN customers

Components of an Extranet MVPN

The figure below illustrates the components that constitute an extranet MVPN.

- **MVRF** --Multicast VPN routing and forwarding (VRF) instance. An MVRF is a multicast-enabled VRF. A VRF consists of an IP routing table, a derived forwarding table, a set of interfaces that use the forwarding table, and a set of rules and routing protocols that determine what goes into the forwarding table. In general, a VRF includes the routing information that defines a customer VPN site that is attached to a provider edge (PE) router.
- **Source MVRF** --An MVRF that can reach the source through a directly connected customer edge (CE) router.
- **Receiver MVRF** --An MVRF to which receivers are connected through one or more CE devices.
- **Source PE** --A PE router that has a multicast source behind a directly connected CE router.
- **Receiver PE** --A PE router that has one or more interested receivers behind a directly connected CE router.

Figure 1: Components of an Extranet MVPN



Solution for MVPN Extranet Support

For unicast, there is no difference between an intranet or extranet from a routing perspective; that is, when a VRF imports a prefix, that prefix is reachable through a label-switched path (LSP). If the enterprise owns the prefix, the prefix is considered a part of the corporate intranet; otherwise, the prefix is considered a part of an extranet. For multicast, however, the reachability of a prefix (especially through an LSP) is not sufficient to build a multicast distribution tree (MDT).

In order to provide support for extranet MVPN services, the same default MDT group must be configured in the source and receiver MVRF. Prior to the introduction of the Multicast VPN Extranet Support feature, there were challenges that prevented service providers from providing extranet MVPN services:

- The source MVRF may not have been configured with a default MDT group, or it may have been configured with a different MDT group as compared to the receiver MVRF. In the former case there was no way for the source MVRF to forward multicast streams to extranet sites, and in the latter case, there was no way for the separate MVRFs to be linked.
- It was not possible to maintain a forwarding table in cases where the RPF interface and outgoing interfaces belong to different VRFs.

The Multicast VPN Extranet Support feature solves these challenges as follows:

- The receiver and source MVRF multicast route (mroute) entries are linked.
- The Reverse Path Forwarding (RPF) check relies on unicast routing information to determine the interface through which the source is reachable. This interface is used as the RPF interface.

Configuration Guidelines for MVPN Extranet Support

Two configuration options are available to provide extranet MVPN services:

- Option 1: Source Side Chaining (SSC)--Configure the receiver MVRF on the source PE router.
- Option 2: Receiver Side Chaining (RSC)--Configure the source MVRF on the receiver PE router.

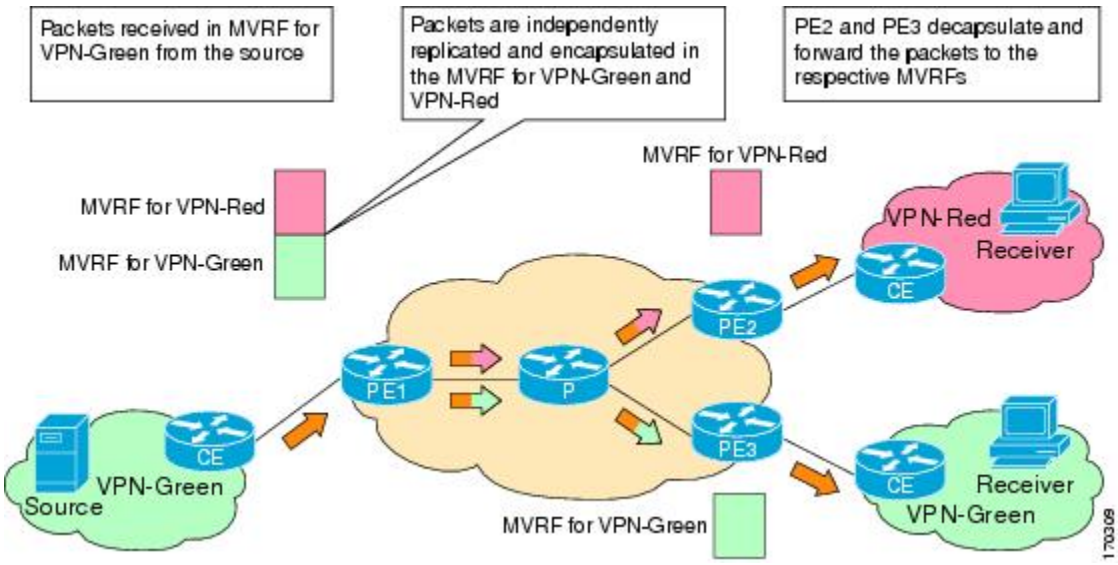
MVPN Extranet Support Configuration Guidelines for Option 1

To provide extranet MVPN services to enterprise VPN customers by configuring the receiver MVRF on the source PE router (Option 1), you would complete the following procedure:

- For each extranet site, you would configure an additional MVRF on the source PE router, that has the same default MDT group as the receiver MVRF, if the MVRF is not configured on the source PE.
- In the receiver MVRF configuration, you would configure the same unicast routing policy on the source and receiver PE routers to import routes from the source MVRF to the receiver MVRF.

The figure illustrates the flow of multicast traffic in an extranet MVPN topology where a receiver MVRF is configured on the source PE router (Option 1). In the topology, an MVRF is configured for VPN-Green and VPN-Red on PE1, the source PE router. A multicast source behind PE1 is sending out a multicast stream to the MVRF for VPN-Green, and there are interested receivers behind PE2 and PE3, the receiver PE routers for VPN-Red and VPN-Green, respectively. After PE1 receives the packets from the source in the MVRF for VPN-Green, it independently replicates and encapsulates the packets in the MVRF for VPN-Green and VPN-Red and forwards the packets. After receiving the packets from this source, PE2 and PE3 decapsulate and forward the packets to the respective MVRFs.

Figure 2: Packet Flow for MVPN Extranet Support Configuration Option 1



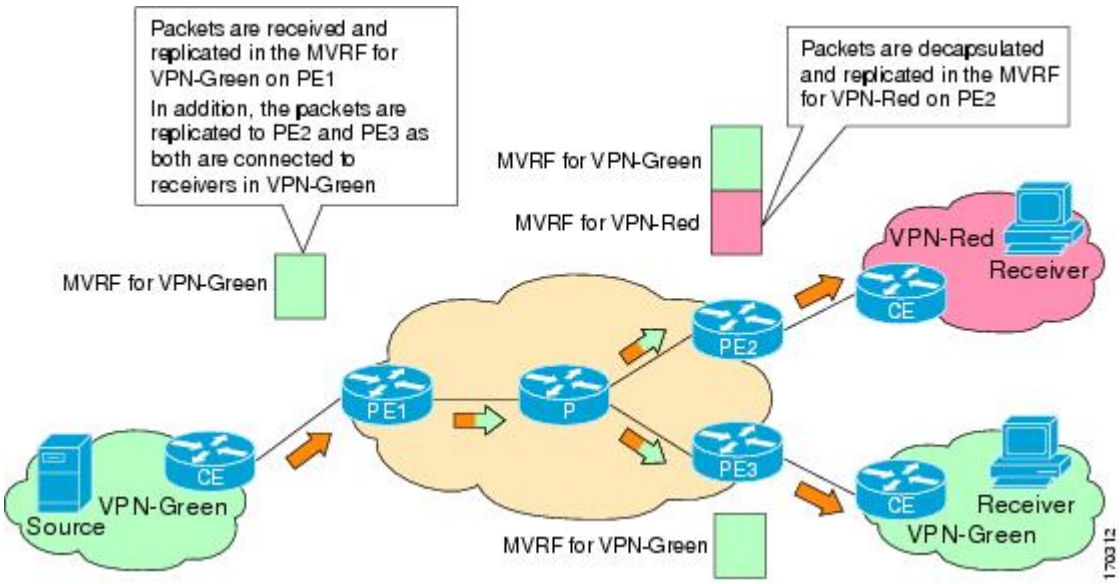
MVPN Extranet Support Configuration Guidelines for Option 2

To provide extranet MVPN services to enterprise VPN customers by configuring a source MVRF on a receiver PE router (Option 2), you would complete the following procedure:

- On a receiver PE router that has one or more interested receivers in a extranet site behind a directly connected CE router, configure an additional MVRF that has the same default MDT group as the site connected to the multicast source, if the MVRF is not configured.
- On the receiver PE router, you would configure the same unicast routing policy to import routes from the source MVRF to the receiver MVRF.

The figure illustrates the flow of multicast traffic in an extranet MVPN topology where the source MVRF is configured on a receiver PE router (Option 2). In the topology, an MVRF is configured for VPN-Green and VPN-Red on PE2, a receiver PE router. A multicast source behind PE1, the source PE router, is sending out a multicast stream to the MVRF for VPN-Green, and there are interested receivers behind PE2, the receiver PE router for VPN-Red, and behind PE3, the receiver PE router for VPN-Green. After PE1 receives the packets from the source in the MVRF for VPN-Green, it replicates and forwards the packets to PE2 and PE3, because both routers are connected to receivers in VPN-Green. The packets that originated from VPN-Green are then replicated on PE2 and forwarded to the interested receivers in VPN-Red and are replicated on PE3 and forwarded to the interested receivers in VPN-Green.

Figure 3: Packet Flow for MVPN Extranet Support Configuration Option 2



RPF for MVPN Extranet Support Using Imported Routes

You must configure either the receiver MVRF on the source PE router (Option 1) or the source MVRF on the receiver PE router (Option 2) for extranet links to be created. Once configured, RPF relies on unicast routing information to determine the interface through which the source is reachable. This interface is used as the RPF interface. No additional configuration is required for RPF resolution. The Multicast VPN Extranet Support feature supports RPF from one VRF to another VRF, from a VRF to the global routing table, and from the global routing table to a VRF.

RPF for MVPN Extranet Support Using Static Mroutes

Note This capability is not supported for MVPNv6 extranet.

By default, an extranet MVPN relies on unicast routing policies to determine the RPF interface. When the RPF lookup originates in a receiver MVRF, and it finds that the RPF interface does not lie in the same MVRF, the router uses the information in the Border Gateway Protocol (BGP) imported route to determine the source MVRF. The RPF lookup then continues and resolves in the source MVRF. In cases where the multicast and unicast topologies are incongruent, you can override the default behavior by configuring a static mroute in the receiver MVRF to explicitly specify the source MVRF using the **ip mroute** command with the **fallback-lookup** keyword and **vrf** *vrf-name* keyword and argument.

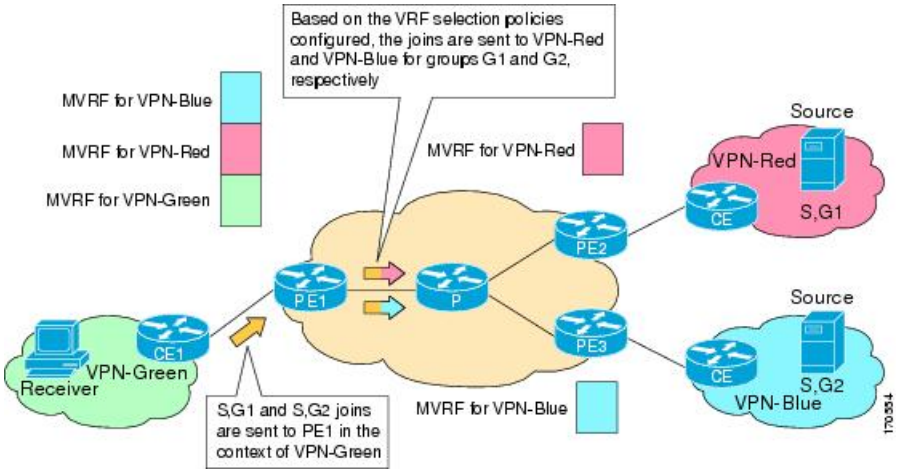
Static mroutes can also be configured to support RPF for extranet MVPN in the case where the source is present in an MVRF and the receiver is in the global table. In this case, because BGP does not allow VPNv4 routes to be imported into the IPv4 routing table, unicast cannot obtain the source MVRF information needed to resolve the RPF lookup. To enable the RPF lookup to be resolved in this case, a static mroute can be configured to explicitly specify the source MVRF using the **ip mroute** command with the **fallback-lookup** keyword and the **global** keyword.

Multicast VPN Extranet VRF Select

The Multicast VPN VRF Select feature is configured by creating group-based VRF selection policies. Group-based VRF selection policies are configured using the **ip multicast rpf select** command. The **ip multicast rpf select**command is used to configure RPF lookups originating in a receiver MVRF or in the global routing table to be resolved in a source MVRF or in the global routing table based on group address. Access Control Lists (ACLs) are used to define the groups to be applied to group-based VRF selection policies.

The figure illustrates an extranet MVPN topology with the Multicast VPN VRF Select feature configured. In this topology, (S, G1) and (S, G2) PIM joins originating from VPN-Green, the receiver VRF, are forwarded to PE1, the receiver PE. Based on the group-based VRF selection policies configured, PE1 sends the PIM joins to VPN-Red and VPN-Blue for groups G1 and G2, respectively.

Figure 4: RPF Lookups Using Group-Based VRF Selection Policies



How to Configure Multicast VPN Extranet Support

Configuring MVPN Support

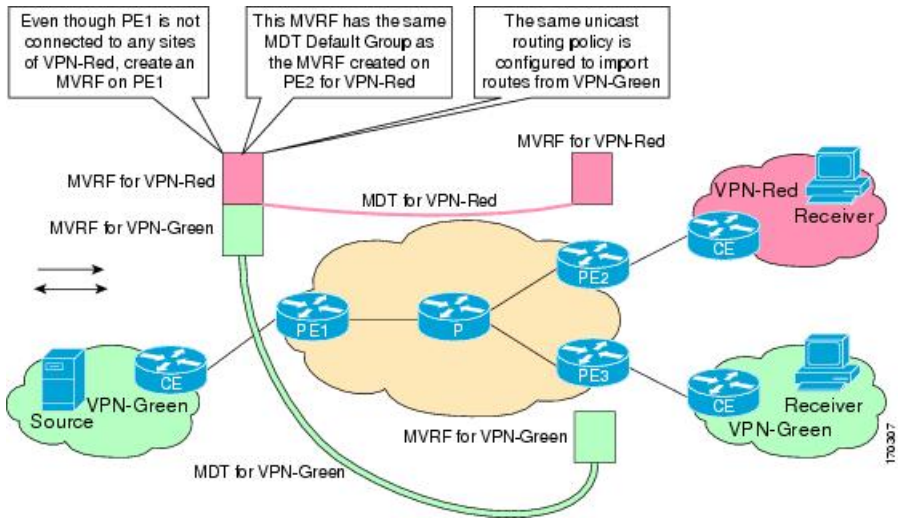
Perform one of the following tasks to provide extranet MVPN capabilities in an IPv4 core network:

Configuring the Receiver MVRF on the Source PE - Option 1 (SSC)

Perform this task to configure the receiver MVRF on the source PE router (Option 1) and provide support for extranet MVPN services.

In the following figure, the source PE router is PE1. To provide extranet MVPN services from one enterprise VPN site (VPN-Green) to another enterprise VPN site (VPN-Red) using Option 1, configure the receiver MVRF on the source PE router. In the receiver MVRF configuration, the default MDT group must be the same on both the source and receiver PE routers. In addition, you must configure the same unicast routing policy to import routes from the source MVRF (he MVRF for VPN-Green) to the receiver MVRF (the MVRF for VPN-Red).

Figure 5: Topology for MVPN Extranet Support Configuration Option 1



Before you begin

Intranet VPN in the source and receiver VPNs must be already configured.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **rd** *route-distinguisher*
5. **vpn id** *oui:vpn-index*
6. **route-target** { **export** | **import** | **both** } *route-target-ext-community*
7. **mdt default mpls mldp** *PE/P router_loopback-ip*
8. **mdt data mpls mldp** *number of data mdt*
9. **mdt data threshold** *threshold value*
10. **end**
11. **show ip mroute** [**vrf** *vrf-name*] *group-address*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**ip vrf** *vrf-name* **Example:** `Router(config)# ip vrf VPN-Red`	Defines the VPN routing instance by assigning a VRF name and enters VRF configuration mode. • The *vrf-name* argument is the name assigned to a VRF.

Step 4	**rd** *route-distinguisher*
	Example:
	`Router(config-vrf)# rd 55:2222`
		Creates routing and forwarding tables.
		• Specify the *route-distinguisher* argument to add an 8-byte value to an IPv4 prefix to create a VPN IPv4 prefix. You can enter an RD in either of these formats:
		  • 16-bit autonomous system number: your 32-bit number, for example, 101:3
		  • 32-bit IP address: your 16-bit number, for example, 192.168.122.15:1

Step 5	**vpn id** *oui:vpn-index* **Example:** `Router(config-vrf)# vpn id 1:2`	Assigns the VPN ID to the VRF oui. An organizationally unique identifier. The OUI is restricted to three octets. The vpn-index—This value identifies the VPN within the company. This VPN index is restricted to four octets.
Step 6	**route-target** { **export** | **import** | **both** } *route-target-ext-community* **Example:** `Router(config-vrf)# route-target import 55:1111`	Creates a list of import, export, or import and export route target communities for the specified VRF. Enter either an autonomous system number and an arbitrary number (xxx:y), or an IP address and an arbitrary number (A.B.C.D:y). **Note** This command works only if BGP is running.
Step 7	**mdt default mpls mldp** *PE/P router_loopback-ip* **Example:** `Router(config-vrf)# mdt default mpls mldp 20.100.0.4`	The default MDT defines the path used by PE routers to send multicast data and control messages to every other PE router in the multicast domain. Loop-back address of any PE routers can be configured.
Step 8	**mdt data mpls mldp** *number of data mdt* **Example:** `Router(config-vrf)# mdt default mpls mldp 10.1.1.10`	Creating data mdt by mentioning the number of data mdts to be created. The range is from 1 to 5000.
Step 9	**mdt data threshold** *threshold value* **Example:** `Router(config-vrf)# mdt default threshold 1`	The threshold is in kbps. The range is from 1 through 4294967.
Step 10	**end** **Example:**	Exits VRF configuration mode and returns to privileged EXEC mode.

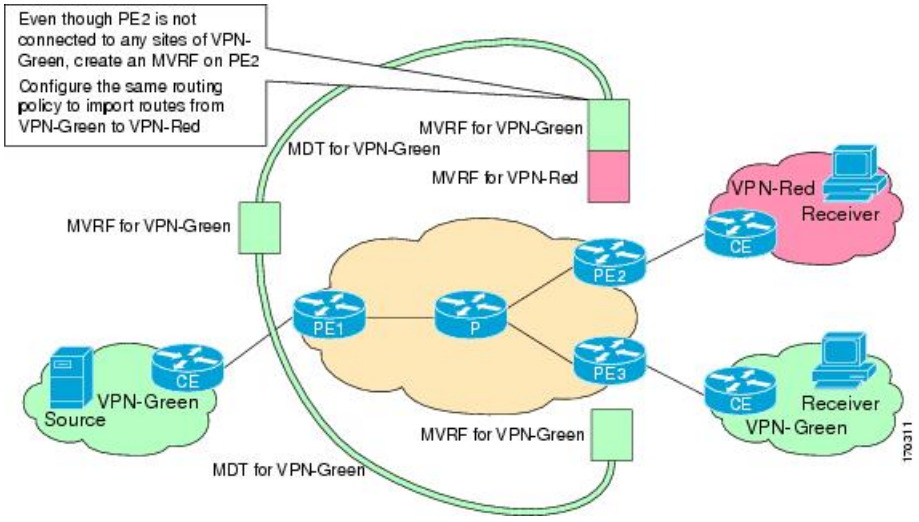
	Command or Action	Purpose
	`Router(config-vrf)# end`	
Step 11	**show ip mroute** [**vrf** *vrf-name*] *group-address* **Example:** `Router# show ip mroute 232.3.3.3`	(Optional) Displays the contents of the IP multicast mroute table for a specific group address.

Configuring the Source MVRF on the Receiver PE - Option 2 (RSC)

Perform this task to configure the source MVRF on the receiver PE router (Option 2) and provide support for extranet MVPN services.

In the following figure, the receiver PE router is PE2. To provide support for extranet MVPN services from one enterprise VPN site (VPN-Green) to another enterprise VPN site (VPN-Red) using Option 2, configure the source MVRF on the receiver PE router. The MDT group configuration of the source MVRF must be the same on both the source and receiver PE routers. In addition, you must configure the same unicast routing policy to import routes from the source MVRF (the MVRF for VPN-Green) to the receiver MVRF (the MVRF for VPN-Red).

Figure 6: Topology for MVPN Extranet Support Configuration Option 2



Before you begin

Intranet VPN in the source and receiver VPNs must be already configured.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **rd** *route-distinguisher*
5. **vpn id** *oui:vpn-index*

6. **route-target** { **export** | **import** | **both** } *route-target-ext-community*
7. **mdt default mpls mldp** *PE/P router_loopback-ip*
8. **mdt data mpls mldp** *number of data mdt*
9. **mdt data threshold** *threshold value*
10. **end**
11. **show ip mroute** [**vrf** *vrf-name*] [*group-address*] verbose
12. **show mls ip multicast group** *group-address*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip vrf** *vrf-name* **Example:** `Router(config)# ip vrf VPN-Red`	Defines the VPN routing instance by assigning a VRF name and enters VRF configuration mode. • The *vrf-name* argument is the name assigned to a VRF.

Step 4	**rd** *route-distinguisher*
	Example:
	`Router(config-vrf)# rd 55:1111`
		Creates routing and forwarding tables.
		• The *route-distinguisher* argument adds an 8-byte value to an IPv4 prefix to create a VPN IPv4 prefix. You can enter an RD in either of these formats:
		  • 16-bit autonomous system number: your 32-bit number, for example, 101:3
		  • 32-bit IP address: your 16-bit number, for example, 192.168.122.15:1

Step 5	**vpn id** *oui:vpn-index* **Example:** `Router(config-vrf)# vpn id 1:2`	Assigns the VPN ID to the VRF oui. An organizationally unique identifier. The OUI is restricted to three octets. The vpn-index—This value identifies the VPN within the company. This VPN index is restricted to four octets.
Step 6	**route-target** { **export**	**import**	**both** } *route-target-ext-community* **Example:** `Router(config-vrf)# route-target import 55:1111`	Creates a list of import, export, or import and export route target communities for the specified VRF. Enter either an autonomous system number and an arbitrary number (xxx:y), or an IP address and an arbitrary number (A.B.C.D:y). **Note** This command works only if BGP is running.

	Command or Action	Purpose
Step 7	**mdt default mpls mldp** *PE/P router_loopback-ip* **Example:** `Router(config-vrf)# mdt default mpls mldp 20.100.0.4`	The default MDT defines the path used by PE routers to send multicast data and control messages to every other PE router in the multicast domain. Loop-back address of any PE routers can be configured.
Step 8	**mdt data mpls mldp** *number of data mdt* **Example:** `Router(config-vrf)# mdt default mpls mldp 10.1.1.10`	Creating data mdt by mentioning the number of data mdts to be created. The range is from 1 to 5000.
Step 9	**mdt data threshold** *threshold value* **Example:** `Router(config-vrf)# mdt default threshold 1`	The threshold is in kbps. The range is from 1 through 4294967.
Step 10	**end** **Example:** `Router(config-vrf)# end`	Exits VRF configuration mode and returns to privileged EXEC mode.
Step 11	**show ip mroute** [**vrf** *vrf-name*] [*group-address*] verbose **Example:** `Router# show ip mroute vrf vpn_a 224.1.1.1 verbose`	To display the detailed contents of the multicast routing (mroute) table for the multicast-group address, use the show ip mroute command in user EXEC or privileged EXEC mode.
Step 12	**show mls ip multicast group** *group-address* **Example:** `Router# show mls ip multicast group 232.3.3.3`	(Optional) Displays MLS information related to a specific multicast group.

Configuring RPF for MVPN Extranet Support Using Static Mroutes

Note This task is not supported for MVPNv6 extranet.

Before you begin

You must configure support for extranet MVPN services prior to performing this task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**

3. **ip mroute vrf** *vrf-name source-address mask* **fallback-lookup** {**global** | **vrf** *vrf-name*} [*distance*]
4. **end**
5. **show ip mroute** [**vrf** *vrf-name*] *group-address*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip mroute vrf** *vrf-name source-address mask* **fallback-lookup** {**global** | **vrf** *vrf-name*} [*distance*] **Example:** `Router(config)# ip mroute vrf VPN-Red 224.100.0.5 255.255.255.255 fallback-lookup vrf VPN-Green`	(For IPv4 only) Configures the RPF lookup originating in a receiver MVRF to continue and be resolved in a source MVRF or in the global routing table using a static mroute. • The **global** keyword is used to specify that the source MVRF is in the global routing table. • The **vrf** keywordand *vrf-name* argument are used to explicitly specify a VRF as the source MVRF.
Step 4	**end** **Example:** `Router(config)# end`	Exits global configuration mode and enters privileged EXEC mode.
Step 5	**show ip mroute** [**vrf** *vrf-name*] *group-address* **Example:** `Router# show ip mroute 224.100.0.5`	(Optional) Displays the contents of the IP multicast mroute table for a specific group address.

Configuring Group-Based VRF Selection Policies with MVPN

Perform this task to configure group-based VRF selection policies with MVPN .

This task enables RPF lookups to be performed to the same source address in different VRFs using the group address as the VRF selector. This feature enhances extranet MVPNs by enabling service providers to distribute content streams coming in from different MVPNs and redistributing them from there.

Before you begin

- You must configure support for extranet MVPN services prior to performing this task.

- ACLs are used to define the groups to be applied to group-based VRF selection policies. This task assumes that you have configured the ACLs to be applied to group-based VRF selection policies.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Use the following commands:
   - **ip multicast** [**vrf** *receiver-vrf-name*] **rpf select** {**global** | **vrf** *source-vrf-name*} **group-list** *access-list*
4. Repeat step 3 to create additional group-based VRF selection policies.
5. **end**
6. Use the following commands:
   - **show ip**} **rpf** [**vrf** *vrf-name*] **select**
7. Use one of the following commands:
   - **show ip rpf** [**vrf** *vrf-name*] *source-address* [*group-address*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	Use the following commands: • **ip multicast** [**vrf** *receiver-vrf-name*] **rpf select** {**global** | **vrf** *source-vrf-name*} **group-list** *access-list* **Example:** `Router(config)# ip multicast vrf VPN-Green rpf select vrf VPN-Red group-list 1`	• (For IPv4 only) Configures RPF lookups originating in a receiver MVRF or in the global routing table to be resolved in a source MVRF or in the global routing table based on group address.
Step 4	Repeat step 3 to create additional group-based VRF selection policies.	--
Step 5	**end** **Example:** `Router(config)# end`	Exits global configuration mode and enters privileged EXEC mode.

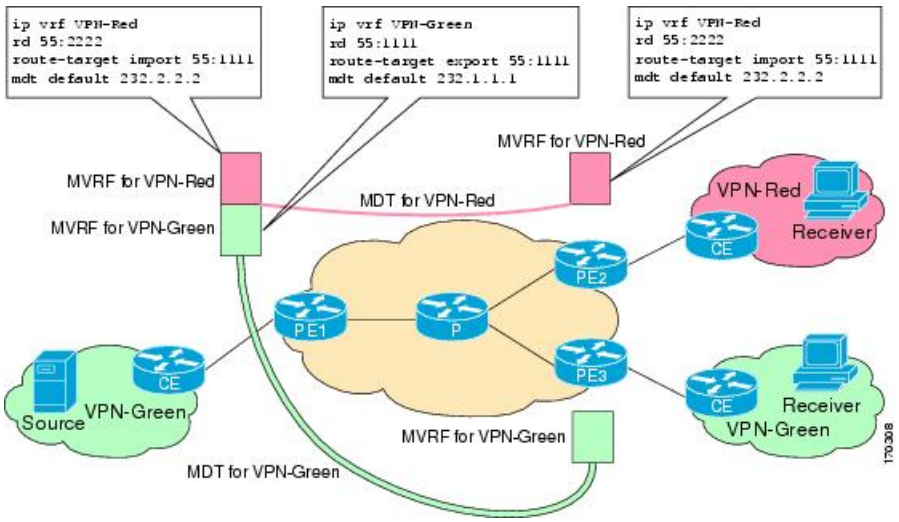
	Command or Action	Purpose
Step 6	Use the following commands: • **show ip} rpf** [**vrf** *vrf-name*] **select** **Example:** `Router# show ip rpf select`	Displays group-to-VRF mapping information.
Step 7	Use one of the following commands: • **show ip rpf** [**vrf** *vrf-name*] *source-address* [*group-address*] **Example:** `Router# show ip rpf 172.16.10.13`	Displays information about how IP multicast routing does RPF. • Use this command after configuring group-based VRF selection policies to confirm that RPF lookups are being performed based on the group address, and to display the VRF where the RPF lookup is being performed.

Configuration Examples for Multicast VPN Extranet Support

Example Configuring the Receiver VRF on the Source PE Router - Option 1 (SSC)

The following example shows the configurations for PE1, the source PE router, and PE2, the receiver PE router, in the figure. In this example, extranet MVPN services are supported between VPN-Green and VPN-Red by configuring the receiver MVRF for VPN-Red on PE1, the source PE router. The MVRF configuration for VPN-Red is configured to import routes from the MVRF for VPN-Green to the MVRF for VPN-Red.

Figure 7: Topology for MVPN Extranet Support Option 1 Configuration Example



PE1 Configuration

```
ip cef
!ip vrf VPN-Green
rd 55:1111
route-target export 55:1111
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
ip vrf VPN-Red
rd 55:2222
route-target export 55:2222
route-target import 55:2222
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
!
ip multicast-routing
ip multicast-routing vrf VPN-Green
ip multicast-routing vrf VPN-Red
!
interface Loopback0
ip address 10.1.0.1 255.255.255.0
ip pim sparse-dense-mode
!
.
.
.
!
router bgp 55
no synchronization
bgp log-neighbor-changes
neighbor 10.2.0.2 remote-as 55
neighbor 10.2.0.2 update-source Loopback0

!
address-family ipv4 mdt
neighbor 10.2.0.2 activate
neighbor 10.2.0.2 send-community extended
!
address-family vpnv4
neighbor 10.2.0.2 activate
neighbor 10.2.0.2 send-community extended
!
 address-family ipv4
  neighbor 10.2.0.2 activate
  neighbor 10.2.0.2 send-community both
 exit-address-family
 !
 address-family ipv4 vrf VPN-Green
  redistribute connected
  redistribute static
  neighbor 10.2.0.2 remote-as 100
  neighbor 10.2.0.2 activate
 exit-address-family
!
 address-family ipv4 vrf VPN-Red
  redistribute connected
  redistribute static
  neighbor 10.2.0.2 remote-as 100
  neighbor 10.2.0.2 activate
 exit-address-family
!
```

PE2 Configuration

```
!
ip vrf VPN-Red
rd 55:2222
route-target export 55:2222
route-target import 55:2222
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
ip multicast-routing
ip multicast-routing vrf VPN-Red
!
interface Loopback0
ip address 10.2.0.2 255.255.255.0
ip pim sparse-dense-mode
!
.
.
.
!
router bgp 55
no synchronization
bgp log-neighbor-changes
neighbor 10.1.0.1 remote-as 55
neighbor 10.1.0.1 update-source Loopback0
!
address-family ipv4 mdt
neighbor 10.1.0.1 activate
neighbor 10.1.0.1 send-community extended
!
address-family vpnv4
neighbor 10.1.0.1 activate
neighbor 10.1.0.1 send-community extended
!
!
 address-family ipv4
  neighbor 10.1.0.1 activate
  neighbor 10.1.0.1 send-community both
 exit-address-family
 !
 address-family ipv4 vrf VPN-Red
  redistribute connected
  redistribute static
  neighbor 10.1.0.1 remote-as 100
  neighbor 10.1.0.1 activate
 exit-address-family
!
ip pim vrf blue1 rp-address 55.55.55.55
ip pim vrf red1 rp-address 55.55.55.55
ip mroute vrf red1 40.0.0.0 255.255.255.0 fallback-lookup vrf blue1
ip mroute vrf red1 55.55.55.55 255.255.255.255 fallback-lookup vrf blue1
```

States in the Global Table on PE1 and PE2 for the MDT Default Group 232.3.3.3

The following are sample outputs from the **show ip mroute** command on PE1 and PE2. The sample outputs show the global table for the MDT default group 232.3.3.3 on PE1 and PE2.

```
PE1# show ip mroute 232.3.3.3
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
```

```
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.3.3.3), 00:46:27/00:03:27, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet0/0, Forward/Sparse-Dense, 00:45:17/00:02:44
(10.2.0.2, 232.3.3.3), 00:45:17/00:02:57, flags: sTIZ
  Incoming interface: Ethernet0/0, RPF nbr 224.0.1.4
  Outgoing interface list:
    MVRF VPN-Red, Forward/Sparse-Dense, 00:45:17/00:01:09
PE2# show ip mroute 232.3.3.3
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.3.3.3), 00:45:08/00:02:37, flags: sTIZ
  Incoming interface: Ethernet1/0, RPF nbr 224.0.2.4
  Outgoing interface list:
    MVRF VPN-Red, Forward/Sparse-Dense, 00:45:08/00:01:27
(10.2.0.2, 232.3.3.3), 00:46:19/00:03:07, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet1/0, Forward/Sparse-Dense, 00:45:08/00:02:49
```

States in the Global Table on PE1 and PE2 for the MDT Default Group 232.3.3.3 When PE1 and PE2 Are Catalyst 6500 Series Switches Configured for MVPN Extranet Support

The following are sample outputs from the **show ip mroute** on PE1 and PE2, when PE1 and PE2 are Catalyst 6500 series switches that have been configured to support extranet MVPN services. The sample output from the **show ip mroute** command shows the global table for the MDT default group 232.3.3.3 on PE1 and PE2. In the output, the “RPF-MFD” flag indicates that a multicast flow is completely hardware switched and “H” flag indicates that the flow is being hardware switched on an outgoing interface.

```
PE1# show ip mroute 232.3.3.3
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.3.3.3), 00:46:27/00:03:27, flags: sT
```

```
  Incoming interface: Loopback0, RPF nbr 0.0.0.0, RPF-MFD
  Outgoing interface list:
    GigabitEthernet2/16, Forward/Sparse-Dense, 00:45:17/00:02:44, H
(10.2.0.2, 232.3.3.3), 00:45:17/00:02:57, flags: sTIZ
  Incoming interface: GigabitEthernet2/16, RPF nbr 224.0.1.4, RPF-MFD
  Outgoing interface list:
    MVRF VPN-Red, Forward/Sparse-Dense, 00:45:17/00:01:09, H


PE2# show ip mroute 232.3.3.3
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.3.3.3), 00:45:08/00:02:37, flags: sTIZ
  Incoming interface: GigabitEthernet4/1, RPF nbr 224.0.2.4, RPF-MFD
  Outgoing interface list:
    MVRF VPN-Red, Forward/Sparse-Dense, 00:45:08/00:01:27, H
(10.2.0.2, 232.3.3.3), 00:46:19/00:03:07, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0, RPF-MFD
  Outgoing interface list:
    GigabitEthernet4/1, Forward/Sparse-Dense, 00:45:08/00:02:49, H
```

States in the VRF Table for VPN-Green on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE1. The sample output shows the state of the VRF table for VPN-Green on PE1 when receivers join the multicast group 228.8.8.8. The output indicates that extranet receivers in VPN-Red are receiving content from a source in VPN-Green that is sending to multicast group 228.8.8.8. The “E” flag in the output indicates that a (*, G) or (S, G) entry in the VRF routing table is a source VRF entry and has extranet receiver MVRF mroute entries linked to it.

```
PE1# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:38/stopped, RP 10.100.0.5, flags: SE
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
(*, 228.8.8.8), 00:01:38/stopped, RP 10.100.0.5, OIF count: 1, flags: S
(10.1.1.200, 228.8.8.8), 00:00:05/00:02:54, flags: TE
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
  (10.1.1.200, 228.8.8.8), 00:00:05/stopped, OIF count: 1, flags:
```

States in the VRF Table for VPN-Green on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE1 Is a Catalyst 6500 Series Switch Configured for MVPN Extranet Support

The following are sample outputs from the **show ip mroute** on PE1, when PE1 is a Catalyst 6500 series switch configured to support extranet MVPN services. The sample output from the **show ip mroute** command shows the state of the VRF table for VPN-Green on PE1 when receivers join the multicast group 228.8.8.8. The sample output indicate that extranet receivers in VPN-Red are receiving content from a source in VPN-Green that is sending to multicast group 228.8.8.8.

```
PE1# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:38/stopped, RP 10.100.0.5, flags: SE
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, RPF-MFD
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
(*, 228.8.8.8), 00:01:38/stopped, RP 10.100.0.5, OIF count: 1, flags: S
(10.1.1.200, 228.8.8.8), 00:00:05/00:02:54, flags: TE
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, RPF-MFD
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
  (10.1.1.200, 228.8.8.8), 00:00:05/stopped, OIF count: 1, flags:
```

States in the VRF Table for VPN-Red on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE1. The sample output shows the state of the VRF table for VPN-Red on PE1 when receivers join the multicast group 228.8.8.8. The “using vrf VPN-Green” field indicates that VPN-Red is using unicast routing information from VPN-Green to determine the RPF interface through which the source is reachable.

```
PE1# show ip mroute vrf VPN-Red 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:45/stopped, RP 10.100.0.5, flags: S
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5, using vrf VPN-Green
  Outgoing interface list:
    Tunnel2, Forward/Sparse-Dense, 00:01:45/00:02:49
(10.1.1.200, 228.8.8.8), 00:00:12/00:03:27, flags:
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5, using vrf VPN-Green
```

```
  Outgoing interface list:
    Tunnel2, Forward/Sparse-Dense, 00:00:12/00:03:18
```

States in the VRF Table for VPN-Red on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE1 Is a Catalyst 6500 Series Switches Configured for MVPN Extranet Support

```
PE1# show ip mroute vrf VPN-Red 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:45/stopped, RP 10.100.0.5, flags: S
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, using vrf VPN-Green, RPF-MFD
  Outgoing interface list:
    Tunnel2, Forward/Sparse-Dense, 00:01:45/00:02:49, H
(10.1.1.200, 228.8.8.8), 00:00:12/00:03:27, flags:
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, using vrf VPN-Green, RPF-MFD
  Outgoing interface list:
    Tunnel2, Forward/Sparse-Dense, 00:00:12/00:03:18, H
```

States in the VRF Table for VPN-Red on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE2. The sample output shows the VRF table for VPN-Red on PE2 when receivers join the multicast group 228.8.8.8.

```
PE2# show ip mroute vrf VPN-Red 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:00:28/stopped, RP 10.100.0.5, flags: S
  Incoming interface: Tunnel1, RPF nbr 10.1.0.1
  Outgoing interface list:
    Ethernet9/0, Forward/Sparse-Dense, 00:00:28/00:03:02
(10.1.1.200, 228.8.8.8), 00:00:00/00:03:29, flags:
  Incoming interface: Tunnel1, RPF nbr 10.1.0.1
  Outgoing interface list:
    Ethernet9/0, Forward/Sparse-Dense, 00:00:00/00:03:29
```

States in the VRF Table for VPN-Red on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE2 Is a Catalyst 6500 Series Switch Configured for MVPN Extranet Support

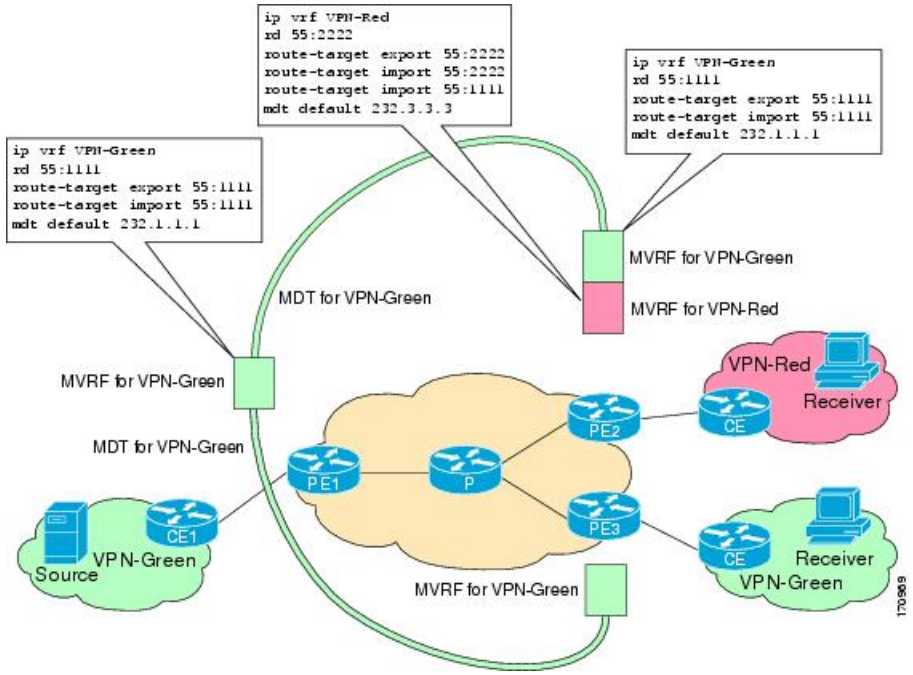
```
PE2# show ip mroute vrf VPN-Red 228.8.8.8
```

```
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:00:28/stopped, RP 10.100.0.5, flags: S
  Incoming interface: Tunnel1, RPF nbr 10.1.0.1, RPF-MFD
  Outgoing interface list:
    GigabitEthernet9/1, Forward/Sparse-Dense, 00:00:28/00:03:02, H
(10.1.1.200, 228.8.8.8), 00:00:00/00:03:29, flags:
  Incoming interface: Tunnel1, RPF nbr 10.1.0.1, RPF-MFD
  Outgoing interface list:
    GigabitEthernet9/1, Forward/Sparse-Dense, 00:00:00/00:03:29, H
```

Example Configuring the Source VRF on the Receiver PE - Option 2 (RSC)

The following configuration example is based on the extranet MVPN topology illustrated in the figure. This example shows the configurations for PE2, the receiver PE router, and PE1, the source PE router. In this example, extranet MVPN services are supported between VPN-Green and VPN-Red by configuring the source MVRF for VPN-Green on PE2. The same unicast routing policy is configured to import routes from VPN-Green to VPN-Red.

Figure 8: Topology for MVPN Extranet Support Option 2 Configuration Example



PE2 Configuration

```
!
ip vrf VPN-Green
rd 55:1111
route-target export 55:1111
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
ip vrf VPN-Red
rd 55:2222
route-target export 55:2222
route-target import 55:2222
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
!
ip multicast-routing
ip multicast-routing vrf VPN-Green
ip multicast-routing vrf VPN-Red
!
interface Loopback0
ip address 10.1.0.1 255.255.255.0
ip pim sparse-dense-mode
!
.
.
.
!
router bgp 55
no synchronization
bgp log-neighbor-changes
neighbor 10.2.0.2 remote-as 55
neighbor 10.2.0.2 update-source Loopback0

!
address-family ipv4 mdt
neighbor 10.2.0.2 activate
neighbor 10.2.0.2 send-community extended
!
address-family vpnv4
neighbor 10.2.0.2 activate
neighbor 10.2.0.2 send-community extended
!
 address-family ipv4
  neighbor 10.2.0.2 activate
  neighbor 10.2.0.2 send-community both
 exit-address-family
 !
 address-family ipv4 vrf VPN-Green
  redistribute connected
  redistribute static
  neighbor 10.2.0.2 remote-as 100
  neighbor 10.2.0.2 activate
 exit-address-family
!
 address-family ipv4 vrf VPN-Red
  redistribute connected
  redistribute static
  neighbor 10.2.0.2 remote-as 100
  neighbor 10.2.0.2 activate
 exit-address-family
!
```

```
ip mroute vrf red1 40.0.0.0 255.255.255.0 fallback-lookup vrf VPN-Green
ip mroute vrf red1 55.55.55.55 255.255.255.255 fallback-lookup vrf VPN-Green
```

PE1 Configuration

```
!
ip vrf VPN-Red
rd 55:2222
route-target export 55:2222
route-target import 55:2222
route-target import 55:1111
mdt default mpls mldp 20.100.0.4
!
ip multicast-routing
ip multicast-routing vrf VPN-Red
!
interface Loopback0
ip address 10.2.0.2 255.255.255.0
ip pim sparse-dense-mode
!
.
.
.
!
router bgp 55
no synchronization
bgp log-neighbor-changes
neighbor 10.1.0.1 remote-as 55
neighbor 10.1.0.1 update-source Loopback0
!
address-family ipv4 mdt
neighbor 10.1.0.1 activate
neighbor 10.1.0.1 send-community extended
!
address-family vpnv4
neighbor 10.1.0.1 activate
neighbor 10.1.0.1 send-community extended
!
!
 address-family ipv4
  neighbor 10.1.0.1 activate
  neighbor 10.1.0.1 send-community both
 exit-address-family
 !
 address-family ipv4 vrf VPN-Red
  redistribute connected
  redistribute static
  neighbor 10.1.0.1 remote-as 100
  neighbor 10.1.0.1 activate
 exit-address-family
!
ip pim vrf red1 rp-address 55.55.55.55
```

States in the Global Table on PE1 and PE2 for the MDT Default Group 232.1.1.1

The following are sample outputs from the **show ip mroute** command on PE1 and PE2. The sample outputs show the global table for the MDT default group 232.1.1.1 on PE1 and PE2.

```
PE1# show ip mroute 232.1.1.1
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
```

```
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.2.0.2, 232.1.1.1), 00:01:19/00:02:42, flags: sTIZ
  Incoming interface: Ethernet0/0, RPF nbr 10.0.1.4
  Outgoing interface list:
    MVRF VPN-Green, Forward/Sparse-Dense, 00:01:19/00:02:07
(10.1.0.1, 232.1.1.1), 00:02:19/00:03:11, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet0/0, Forward/Sparse-Dense, 00:02:00/00:02:36
PE2# show ip mroute 232.1.1.1
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.1.1.1), 00:02:04/00:02:38, flags: sTIZ
  Incoming interface: Ethernet1/0, RPF nbr 10.0.2.4
  Outgoing interface list:
    MVRF VPN-Green, Forward/Sparse-Dense, 00:02:04/00:02:09
(10.2.0.2, 232.1.1.1), 00:02:04/00:03:09, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet1/0, Forward/Sparse-Dense, 00:01:22/00:03:09
```

States in the Global Table on PE1 and PE2 for the MDT Default Group 232.1.1.1 When PE1 and PE2 Are Catalyst 6500 Series Switches Configured for MVPN Extranet Support

```
PE1# show ip mroute 232.1.1.1
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.2.0.2, 232.1.1.1), 00:01:19/00:02:42, flags: sTIZ
  Incoming interface: GigabitEthernet2/16, RPF nbr 10.0.1.4, RPF-MFD
  Outgoing interface list:
    MVRF VPN-Green, Forward/Sparse-Dense, 00:01:19/00:02:07, H
(10.1.0.1, 232.1.1.1), 00:02:19/00:03:11, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0, RPF-MFD
  Outgoing interface list:
```

```
    GigabitEthernet2/16, Forward/Sparse-Dense, 00:02:00/00:02:36, H
PE2# show ip mroute 232.1.1.1
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(10.1.0.1, 232.1.1.1), 00:02:04/00:02:38, flags: sTIZ
  Incoming interface: GigabitEthernet4/1, RPF nbr 10.0.2.4, RPF-MFD
  Outgoing interface list:
    MVRF VPN-Green, Forward/Sparse-Dense, 00:02:04/00:02:09, H
(10.2.0.2, 232.1.1.1), 00:02:04/00:03:09, flags: sT
  Incoming interface: Loopback0, RPF nbr 0.0.0.0, RPF-MFD
  Outgoing interface list:
    GigabitEthernet4/1, Forward/Sparse-Dense, 00:01:22/00:03:09, H
```

States in the VRF Table for VPN-Green on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE1. The sample output shows the state of the VRF table for VPN-Green on PE1 when receivers join the multicast group 228.8.8.8.

```
PE1# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:43/00:02:52, RP 10.100.0.5, flags: S
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:01:43/00:02:52
(10.1.1.200, 228.8.8.8), 00:01:15/00:03:26, flags: T
  Incoming interface: Ethernet3/0, RPF nbr 10.1.1.5
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:01:15/00:03:19
```

States in the VRF Table for VPN-Green on PE1 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE1 Is a Catalyst 6500 Series Switch Configured for MVPN Extranet Support

```
PE1# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
```

```
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:43/00:02:52, RP 10.100.0.5, flags: S
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, RPF-MFD
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:01:43/00:02:52, H
(10.1.1.200, 228.8.8.8), 00:01:15/00:03:26, flags: T
  Incoming interface: GigabitEthernet3/1, RPF nbr 10.1.1.5, RPF-MFD
  Outgoing interface list:
    Tunnel0, Forward/Sparse-Dense, 00:01:15/00:03:19, H
```

States in the VRF Table for VPN-Green on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE2. The output shows the state of the VRF table for VPN-Green on PE1 when receivers join the multicast group 228.8.8.8. The output indicates that extranet receivers in VPN-Red are receiving content from the source in VPN-Green that is sending to multicast group 228.8.8.8. The “E” flag indicates that a (*, G) or (S, G) entry in the VRF routing table is a source VRF entry and has extranet receiver MVRF mroute entries linked to it.

```
PE2# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:59/stopped, RP 10.100.0.5, flags: SE
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
(*, 228.8.8.8), 00:01:59/stopped, RP 10.100.0.5, OIF count: 1, flags: S
(10.1.1.200, 228.8.8.8), 00:01:31/00:02:59, flags: TE
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
  (10.1.1.200, 228.8.8.8), 00:01:31/00:03:29, OIF count: 1, flags:
```

States in the VRF Table for VPN-Green on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE2 Is a Catalyst 6500 Series Switch Configured for MVPN Extranet Support

```
PE2# show ip mroute vrf VPN-Green 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
```

```
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:01:59/stopped, RP 10.100.0.5, flags: SE
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, RPF-MFD
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
(*, 228.8.8.8), 00:01:59/stopped, RP 10.100.0.5, OIF count: 1, flags: S
(10.1.1.200, 228.8.8.8), 00:01:31/00:02:59, flags: TE
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, RPF-MFD
  Outgoing interface list: Null
  Extranet receivers in vrf VPN-Red:
  (10.1.1.200, 228.8.8.8), 00:01:31/00:03:29, OIF count: 1, flags:
```

States in the VRF Table for VPN-Red on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8

The following is sample output from the **show ip mroute** command on PE2. The sample output shows the state of the VRF table for VPN-Red on PE2 when receivers join the multicast group 228.8.8.8. The "using vrf VPN-Green" field indicates that VPN-Red is using unicast routing information from VPN-Green to determine the RPF interface through which the source is reachable.

```
PE2# show ip mroute vrf VPN-Red 228.8.8.8

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:02:00/stopped, RP 10.100.0.5, flags: S
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, using vrf VPN-Green
  Outgoing interface list:
    Ethernet9/0, Forward/Sparse-Dense, 00:02:00/00:02:34
(10.1.1.200, 228.8.8.8), 00:01:32/00:03:28, flags:
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, using vrf VPN-Green
  Outgoing interface list:
    Ethernet9/0, Forward/Sparse-Dense, 00:01:32/00:03:01
```

States in the VRF Table for VPN-Red on PE2 After Receivers in VPN-Red Join Multicast Group 228.8.8.8 When PE2 Is a Catalyst 6500 Series Switch Configured for MVPN Extranet Support

```
PE2# show ip mroute vrf VPN-Red 228.8.8.8
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.8.8.8), 00:02:00/stopped, RP 10.100.0.5, flags: S
```

```
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, using vrf VPN-Green, RPF-MFD
  Outgoing interface list:
    GigabitEthernet9/1, Forward/Sparse-Dense, 00:02:00/00:02:34, H
(10.1.1.200, 228.8.8.8), 00:01:32/00:03:28, flags:
  Incoming interface: Tunnel0, RPF nbr 10.1.0.1, using vrf VPN-Green, RPF-MFD
  Outgoing interface list:
    GigabitEthernet9/1, Forward/Sparse-Dense, 00:01:32/00:03:01, H
```

Example: Displaying Statistics for MVPN Extranet Support

This example is a stand alone example and does not refer to any other technologies.

The MFIB-based implementation of IP multicast updates counters in source MVRF mroute entries for extranet MVPN. Counters in the source MVRF can be displayed using Cisco IOS commands. Counters in the receiver MVRF mroute entries will remain zero.

Use the **show ip mroute** command to determine the source and receiver MVRFs. The following sample output shows that VRF blue is the source MVRF and VRF red is the receiver MVRF:

```
PE1# show ip mroute vrf blue 228.1.1.1

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.1.1.1), 00:05:48/stopped, RP 202.100.0.5, flags: SE
  Incoming interface: Ethernet3/0, RPF nbr 200.1.1.5
  Outgoing interface list: Null
  Extranet receivers in vrf red:
(*, 228.1.1.1), 00:05:48/stopped, RP 202.100.0.5, OIF count: 1, flags: S
(220.1.1.200, 228.1.1.1), 00:02:42/00:02:09, flags: TE
  Incoming interface: Ethernet3/0, RPF nbr 200.1.1.5
  Outgoing interface list: Null
  Extranet receivers in vrf red:
  (220.1.1.200, 228.1.1.1), 00:02:42/stopped, OIF count: 1, flags: T


PE1# show ip mroute vrf red 228.1.1.1

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
 Timers: Uptime/Expires
 Interface state: Interface, Next-Hop or VCD, State/Mode
(*, 228.1.1.1), 00:05:55/stopped, RP 202.100.0.5, flags: S
  Incoming interface: Ethernet3/0, RPF nbr 200.1.1.5, using vrf blue
  Outgoing interface list:
```

```
    Tunnel16, Forward/Sparse-Dense, 00:05:55/00:03:26
(220.1.1.200, 228.1.1.1), 00:02:49/stopped, flags: T
  Incoming interface: Ethernet3/0, RPF nbr 200.1.1.5, using vrf blue
  Outgoing interface list:
    Tunnel16, Forward/Sparse-Dense, 00:02:49/00:03:26
```

Use the **show ip mfib vrf** *vrf-name* command, with the source MVRF for the *vrf-name* argument, to display statistics.

The following example shows statistics for the source MVRF blue. Inspect the output to ensure that the forwarding statistics in the source MVRF MFIB are correct and that the A and F flags are set in the source MVRF. Notice that there is no indication of extranet forwarding in the MFIB.

```
PE1# show ip mfib vrf blue 228.1.1.1

Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A
flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB
Forward,
                MA - MFIB Accept
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per
second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   FS Pkt Count/PS Pkt Count
VRF blue
(*,228.1.1.1) Flags: C
  SW Forwarding: 1/0/100/0, Other: 0/0/0
  Ethernet3/0 Flags: A
  Tunnel16, MDT/239.3.3.3 Flags: F
    Pkts: 1/0
(220.1.1.200,228.1.1.1) Flags:
  SW Forwarding: 37/0/100/0, Other: 0/0/0
  Ethernet3/0 Flags: A NS
  Tunnel16, MDT/239.3.3.3 Flags: F
    Pkts: 37/0
```

The following example shows the following information for the receiver MVRF red:

- There are no forwarding statistics in the receiver MVRF MFIB because these statistics are collected in the source MVRF.
- The A and F flags are not set because these flags are only set in the source MVRF for MVPN extranet.
- There is no indication of extranet forwarding in the MFIB.

Note The NS flag in the output is present for the purpose of receiving PIM control traffic in the receiver MVRF.

```
PE1# show ip mfib vrf red 228.1.1.1

Entry Flags:    C - Directly Connected, S - Signal, IA - Inherit A
flag,
                ET - Data Rate Exceeds Threshold, K - Keepalive
                DDE - Data Driven Event, HW - Hardware Installed
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
```

```
               NS - Negate Signalling, SP - Signal Present,
               A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB
Forward,
               MA - MFIB Accept
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per
second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   FS Pkt Count/PS Pkt Count
VRF red
(*,228.1.1.1) Flags: C
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  Tunnel16, MDT/239.3.3.3 Flags: NS
(220.1.1.200,228.1.1.1) Flags:
  SW Forwarding: 0/0/0/0, Other: 0/0/0
Tunnel16, MDT/239.3.3.3 Flags: NS
```

You can also use the **show ip mroute count** command to display the extranet MVPN statistics. However, we recommend that you use the **show ip mfib** command instead. If you use the **show ip mroute count**command to display statistics, inspect the output to ensure that the forwarding statistics in the source MVRF are correct and that there are no forwarding statistics in the receiver MVRF.

The following sample output from the **show ip mroute count** command shows statistics for the source MVRF blue:

```
PE1# show ip mroute vrf blue 228.1.1.1 count

Use "show ip mfib count" to get better response time for a large number of
mroutes.

IP Multicast Statistics
3 routes using 1354 bytes of memory
2 groups, 0.50 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)
Group: 228.1.1.1, Source count: 1, Packets forwarded: 38, Packets received: 38
  RP-tree: Forwarding: 1/0/100/0, Other: 1/0/0
  Source: 220.1.1.200/32, Forwarding: 37/0/100/0, Other: 37/0/0
```

The following sample output from the **show ip mroute count** command is for the receiver MVRF red:

```
PE1# show ip mroute vrf red 228.1.1.1 count

Use "show ip mfib count" to get better response time for a large number of
mroutes.

IP Multicast Statistics
3 routes using 1672 bytes of memory
2 groups, 0.50 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)
Group: 228.1.1.1, Source count: 1, Packets forwarded: 0, Packets received: 0
  RP-tree: Forwarding: 0/0/0/0, Other: 0/0/0
  Source: 220.1.1.200/32, Forwarding: 0/0/0/0, Other: 0/0/0
```

Example Configuring RPF for MVPN Extranet Support Using Static Mroutes

The following example shows how to configure the RPF lookup originating in VPN-Red to be resolved in VPN-Green using the static mroute 192.168.1.1:

```
ip mroute vrf VPN-Red 192.168.1.1 255.255.255.255 fallback-lookup vrf VPN-Green
```

Example Configuring Group-Based VRF Selection Policies with MVPN Extranet Support

The following example shows how to use group-based VRF selection policies to configure RPF lookups originating in VPN-Green to be performed in VPN-Red for group addresses that match ACL 1 and to be performed in VPN-Blue for group addresses that match ACL 2.

```
ip multicast vrf VPN-Green rpf select vrf VPN-Red group-list 1
ip multicast vrf VPN-Green rpf select vrf VPN-Blue group-list 2
!
.
.
.
!
access-list 1 permit 239.0.0.0 0.255.255.255
access-list 2 permit 238.0.0.0 0.255.255.255
!
```