Configuring Multicast VPN Extranet Support

First Published: December 4, 2006
Last Updated: August 21, 2007

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 in This Module

Your Cisco IOS software release may not support all of the features documented in this module. 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 Configuring Multicast VPN Extranet Support" section on page 38.

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.

Contents

Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Prerequisites for Configuring Multicast VPN Extranet Support

- You are familiar with IP multicast concepts and configuration tasks.
- You are familiar with 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 only supports 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.

Information About Multicast VPN Extranet Support

Before you configure extranet MVPNs, you should understand the following concepts:

- Overview of MVPN Extranet Support, page 2
- Configuration Guidelines for MVPN Extranet Support, page 4
- Hardware Acceleration for Multicast VPN Extranet Support on Catalyst 6500 Series Switches, page 7
- Overview of Multicast VPN Extranet VRF Select, page 7

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 comprising 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

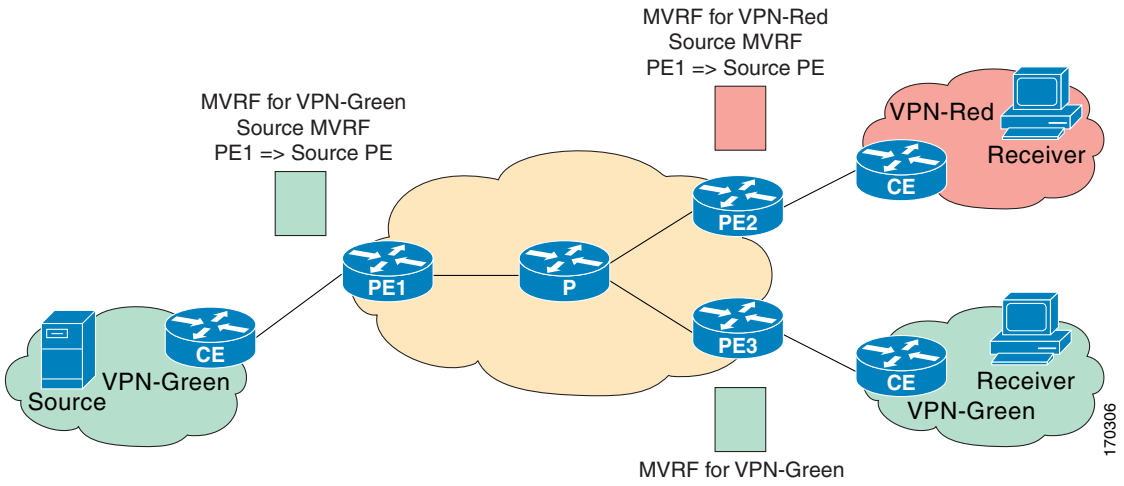
The Multicast VPN Extranet Support feature can be used to solve such business problems as:

- 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

Figure 1 illustrates the components that constitute an extranet MVPN.

Figure 1 Components of 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.

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. 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 a label-switched path) 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 in Cisco IOS Releases 12.2(31)SB2 and 12.2(33)SXH, 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

There are two configuration options available to provide extranet MVPN services:

- Option 1—Configure the receiver MVRF on the source PE router.
- Option 2—Configure the source MVRF on the receiver PE router.

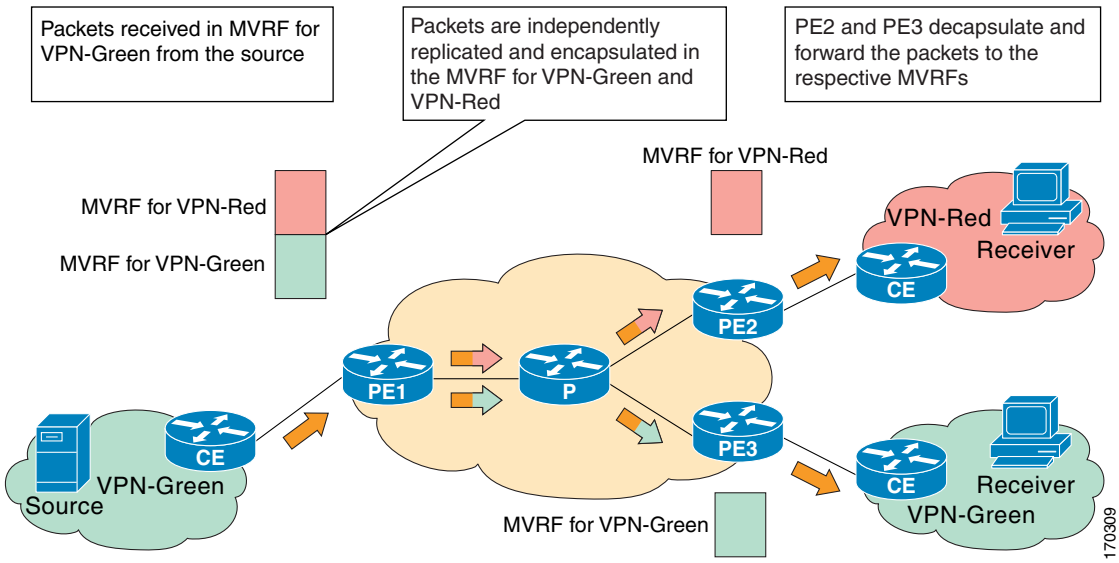
MVPN Extranet Support Configuration Guidelines for Option 1

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, which 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.

Figure 2 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



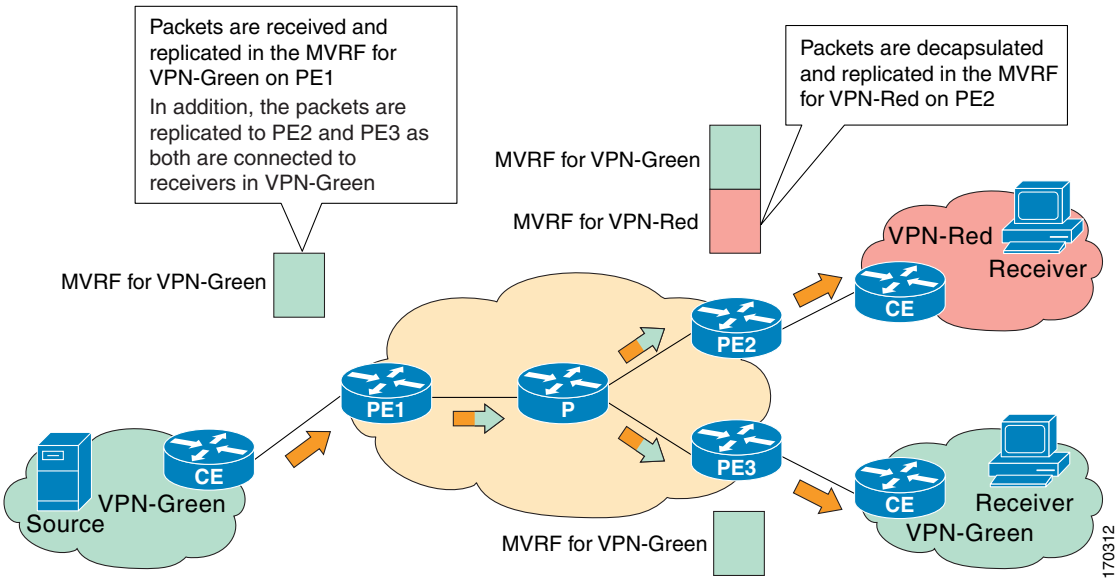
MVPN Extranet Support Configuration Guidelines for Option 2

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.

Figure 3 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, as 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

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 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.

Hardware Acceleration for Multicast VPN Extranet Support on Catalyst 6500 Series Switches

Beginning in Cisco IOS Release 12.2(33)SXH, on Catalyst 6500 series switches, forwarding entries for source and receiver MVRFs are linked in hardware (similar to how they are in linked in software for the Multicast VPN Extranet Support feature) and packets are replicated in hardware when being forwarded to extranet MVPN sites. This functionality is referred to as the Hardware Acceleration for Multicast VPN Extranet Support feature.

Overview of Multicast VPN Extranet VRF Select

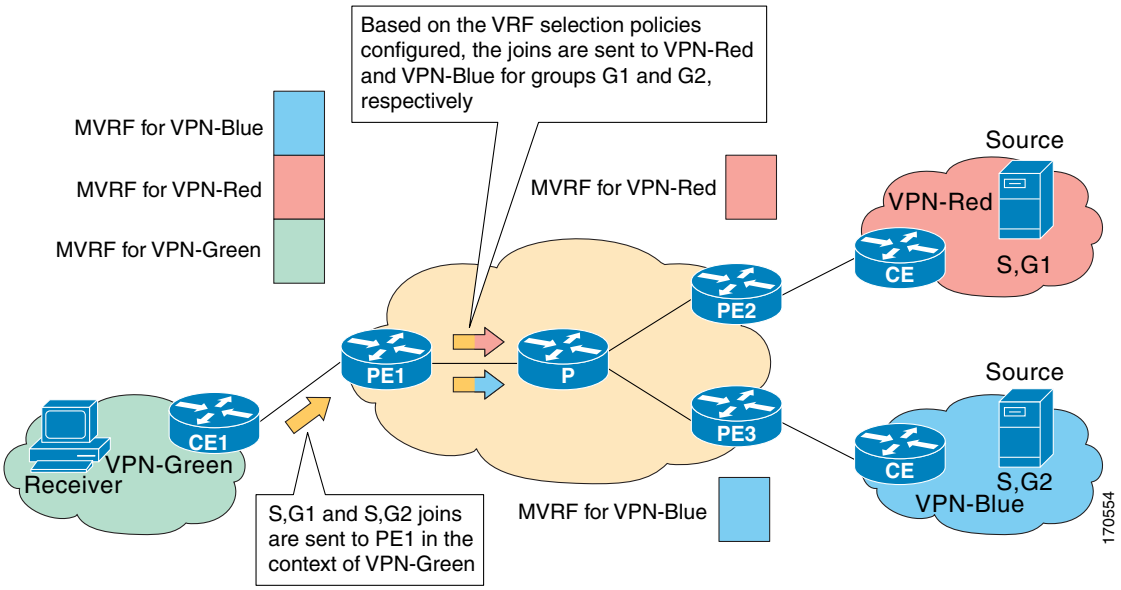
Prior to the introduction of the Multicast VPN Extranet VRF Select feature in Cisco IOS Release 12.2(31)SB2 and subsequent 12.2SB releases, RPF lookups for a source address could only be performed in a single VRF, that is, in the VRF where Internet Group Management Protocol (IGMP) or PIM joins are received, in the VRF learned from BGP imported routes, or in the VRF specified in static mroutes (when RPF for an extranet MVPN is configured using static mroutes). In those cases, the source VRF is solely determined by the source address or the way the source address was learned.

The Multicast VPN Extranet VRF Select feature provides the capability for 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.

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.

Figure 4 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

This section contains the following tasks:

- Configuring MVPN Extranet Support, page 8 (required)
- Configuring RPF for MVPN Extranet Support Using Static Mroutes, page 14 (optional)
- Configuring Group-Based VRF Selection Policies with MVPN Extranet Support, page 15 (optional)

Configuring MVPN Extranet Support

Perform this task to configure support for extranet MVPN services. Extranet MVPN services enable service providers to distribute IP multicast content originated from a corporate site to the sites of external business partners or suppliers.

Perform one of the following tasks to provide extranet MVPN capabilities:

- Configuring the Receiver MVRF on the Source PE (Option 1), page 9
- Configuring the Source MVRF on the Receiver PE (Option 2), page 11

Prerequisites

- This task assumes that you have configured intranet VPN in the source and receiver VPNs. For more information about configuring VPNs, refer to the "MPLS Virtual Private Networks" part in the *Cisco IOS Multiprotocol Label Switching Configuration Guide*, Release 12.4.

Restrictions

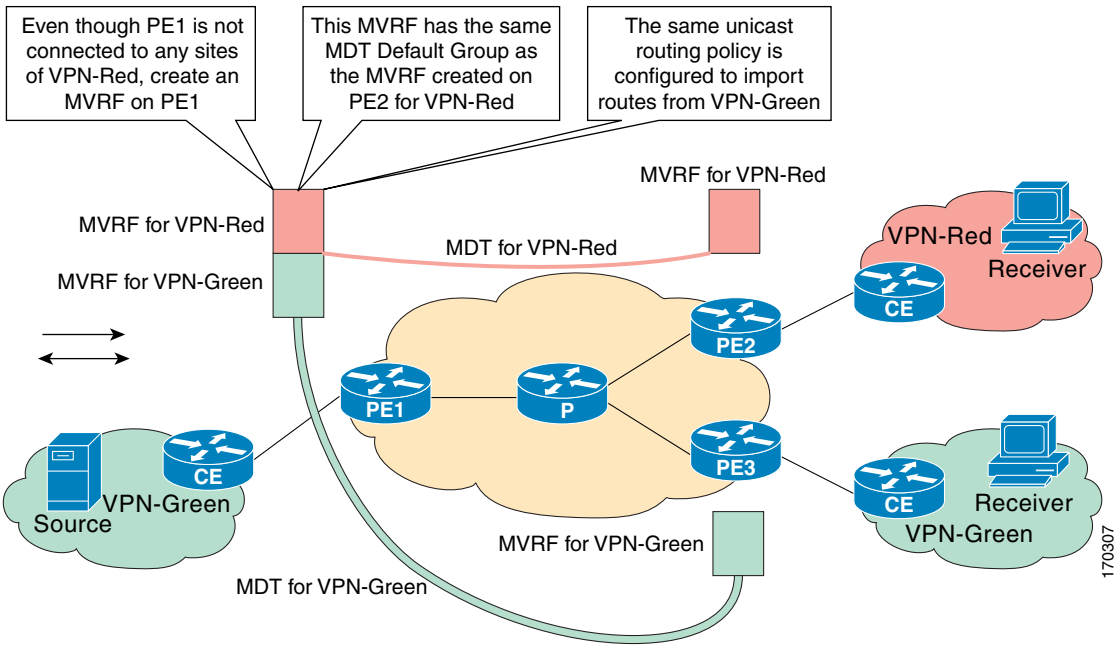
- The Multicast VPN Extranet Support feature only supports PIM-SM and SSM traffic; PIM-DM and bidir-PIM traffic are not supported.
- When configuring extranet MVPNs in a PIM-SM environment, the source and the RP must reside in the same site of the MVPN behind the same PE router.
- In Cisco IOS Release 12.2(33)SXH and subsequent 12.2SX releases, on Catalyst 6500 series switches, forwarding entries for source and receiver MVRFs are linked in hardware (similar to how they are in linked in software for the Multicast VPN Extranet Support feature) and packets are replicated in hardware when being forwarded to extranet sites.

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

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

The configuration for this task is done at PE1, the source PE router, in Figure 5. To provide extranet MVPN services from one enterprise VPN site (for example, VPN-Green) to another enterprise VPN site (for example, VPN-Red) using Option 1, you would 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 would configure the same unicast routing policy to import routes from the source MVRF (for example, the MVRF for VPN-Green) to the receiver MVRF (for example, the MVRF for VPN-Red).

Figure 5 Topology for MVPN Extranet Support Configuration Option 1



Note This task assumes that you have configured intranet VPN in the source and receiver VPNs. For more information about configuring VPNs, refer to the "MPLS Virtual Private Networks" part in the *Cisco IOS Multiprotocol Label Switching Configuration Guide*, Release 12.4.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **rd** *route-distinguisher*
5. **route-target import** *route-target-ext-community*
6. **mdt default** *group-address*
7. **end**
8. **show ip mroute** [**vrf** *vrf-name*] *group-address*
9. **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 55:2222`	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 (AS) number: your 32-bit number, for example, 101:3 – 32-bit IP address: your 16-bit number, for example, 192.168.122.15:1

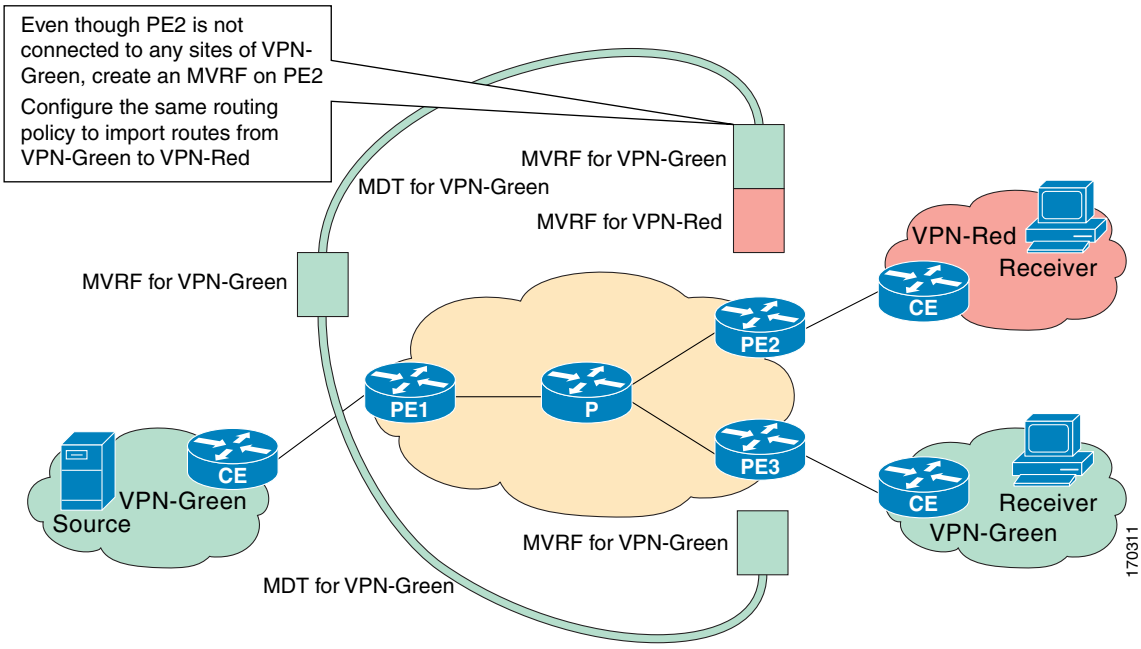
	Command or Action	Purpose
Step 5	**route-target import** *route-target-ext-community* **Example:** `Router(config-vrf)# route-target import 55:1111`	Creates a route-target extended community for a VRF. • The **import** keyword imports routing information from the target VPN extended community. • The *route-target-ext-community* 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. **Note** For content to be distributed from the source MVRF to the receiver MVRF, you must configure the same unicast routing policy on the source and receiver PE routers to import routes from the source VRF to the receiver VRF.
Step 6	**mdt default** *group-address* **Example:** `Router(config-vrf)# mdt default 232.3.3.3`	Configures the multicast group address range for data multicast distribution tree (MDT) groups for a VRF. • A tunnel interface is created as a result of this command. • By default, the destination address of the tunnel header is the *group-address* argument.
Step 7	**end** **Example:** `Router(config-vrf)# end`	Exits VRF configuration mode and returns to privileged EXEC mode.
Step 8	**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.
Step 9	**show mls ip multicast group** *group-address* **Example:** `Router# show mls ip multicast group 232.3.3.3`	(Optional) Displays multilayer switching (MLS) information related to a specific multicast group. **Note** This command only can be used to verify support for extranet MVPN services on Catalyst 6500 series switches running Cisco IOS Release 12.2(33)SXH or a subsequent 12.2SX release.

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

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

The configuration for this task is done at PE2, the receiver PE router, in Figure 6. To provide support for extranet MVPN services from one enterprise VPN site (for example, VPN-Green) to another enterprise VPN site (for example, VPN-Red) using Option 2, you would 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 would configure the same unicast routing policy to import routes from the source MVRF (for example, the MVRF for VPN-Green) to the receiver MVRF (for example, the MVRF for VPN-Red).

Figure 6 Topology for MVPN Extranet Support Configuration Option 2



Note This task assumes that you have configured intranet VPN in the source and receiver VPNs. For more information about configuring VPNs, refer to the "MPLS Virtual Private Networks" part in the *Cisco IOS Multiprotocol Label Switching Configuration Guide*, Release 12.4.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip vrf** *vrf-name*
4. **rd** *route-distinguisher*
5. **route-target import** *route-target-ext-community*
6. **mdt default** *group-address*
7. **end**
8. **show ip mroute** [**vrf** *vrf-name*] *group-address*
9. **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 (AS) 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	**route-target import** *route-target-ext-community* **Example:** `Router(config-vrf)# route-target import 55:1111`	Creates a route-target extended community for a VRF. • The **import** keyword exports routing information to the target VPN extended community. • The *route-target-ext-community* 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. **Note** For content to be distributed from the source MVRF to the receiver MVRF, you must configure the same unicast routing policy on the source and receiver PE routers to import routes from the source VRF to the receiver VRF.
Step 6	**mdt default** *group-address* **Example:** `Router(config-vrf)# mdt default 232.1.1.1`	Configures the multicast group address range for data MDT groups for a VRF. • A tunnel interface is created as a result of this command. • By default, the destination address of the tunnel header is the *group-address* argument.
Step 7	**end** **Example:** `Router(config-vrf)# end`	Exits VRF configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 8	**show ip mroute** [**vrf** *vrf-name*] *group-address* **Example:** `Router# show ip mroute 232.1.1.1`	(Optional) Displays the contents of the IP multicast mroute table for a specific group address.
Step 9	**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. **Note** This command only can be used to verify support for extranet MVPN services on Catalyst 6500 series switches running Cisco IOS Release 12.2(33)SXH or a subsequent 12.2SX release.

Configuring RPF for MVPN Extranet Support Using Static Mroutes

Perform this task to configure RPF for extranet MVPNs using static mroutes.

RPF for MVPN Extranet Support Using Static Mroutes

By default, extranet MVPN relies on the 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 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.

Prerequisites

You must configure support for extranet MVPN services prior to performing this task. For more information, see the "Configuring MVPN Extranet Support" 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*
6. **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 mroute vrf** *vrf-name source-address mask* **fallback-lookup** {**global** | **vrf** *vrf-name*} [*distance*] **Example:** `Router(config)# ip mroute vrf VPN-Red 220.100.0.5 255.255.255.255 fallback-lookup vrf VPN-Green`	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** keyword and *vrf-name* argument is 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 220.100.0.5`	(Optional) Displays the contents of the IP multicast mroute table for a specific group address.
Step 6	**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. **Note** This command only can be used to verify support for extranet MVPN services on Catalyst 6500 series switches running Cisco IOS Release 12.2(33)SXH or a subsequent 12.2SX release.

Configuring Group-Based VRF Selection Policies with MVPN Extranet Support

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.

Prerequisites

- This task requires the routers to be running Cisco IOS Release 12.2(31)SB2 or a subsequent 12.2SB release.

- You must configure support for extranet MVPN services prior to performing this task. For more information, see the "Configuring MVPN Extranet Support" 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. For information about how to configure access lists, refer to the "Configuring IP Access Lists" chapter of the *Cisco IOS Application Service Configuration Guide*, Release 12.4.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **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. **show ip rpf** [**vrf** *vrf-name*] **select**
7. **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.

	Command or Action	Purpose
Step 3	**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`	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. • The optional **vrf** keyword and *receiver-vrf-name* argument are used to apply a group-based VRF selection policy to RPF lookups originating in the VRF specified for the *receiver-vrf-name* argument. If the optional **vrf** keyword and *receiver-vrf-name* argument are not specified, the group-based VRF selection policy applies to RPF lookups originating in the global table. • The **global** keyword is used to specify that the RPF lookup for groups matching the access list specified for the **group-list** keyword and *access-list* argument be performed in the global routing table. • The **vrf** keyword and *source-vrf-name* argument are used to specify that the RPF lookups for groups matching the access list specified with the **group-list** keyword and *access-list* argument be performed in the VRF specified for the *vrf-name* argument. • The **group-list** keyword and *access-list* argument is used to specify the access list to be applied to the group-based VRF selection policy.
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.
Step 6	**show ip rpf** [**vrf** *vrf-name*] **select** **Example:** `Router# show ip rpf select`	Displays group-to-VRF mapping information. • Use the optional **vrf** keyword and *vrf-name* argument to display the group-to-VRF mappings for the VRF instance specified for the *vrf-name* argument.
Step 7	**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. • Use the optional **vrf** keyword and *vrf-name* argument to display how IP multicast routing does RPF in the VRF specified for the *vrf-name* argument.

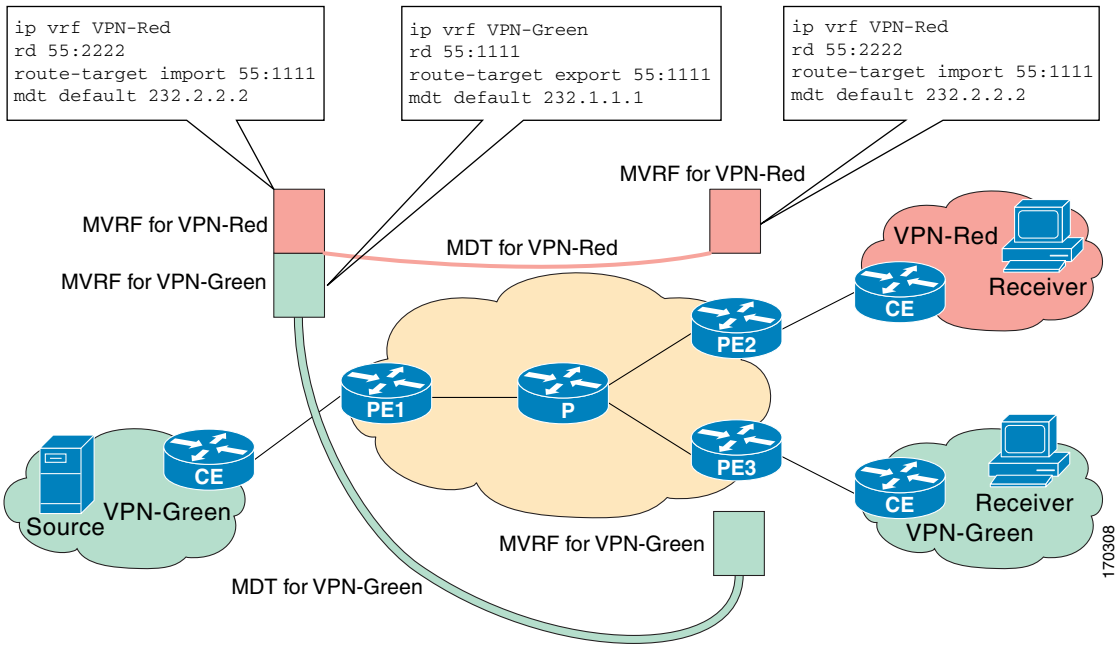
Configuration Examples for Multicast VPN Extranet Support

This section provides the following configuration examples:

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

The following example shows the configurations for PE1, the source PE router, and PE2, the receiver PE router, in Figure 7. 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 232.1.1.1
```

```
!
ip vrf VPN-Red
 rd 55:2222
 route-target export 55:2222
 route-target import 55:2222
 route-target import 55:1111
 mdt default 232.3.3.3
!
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
 !
```

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 232.3.3.3
!
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
 !
```

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 210.0.1.4
  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 210.0.2.4
  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** and **show mls ip multicast** commands on PE1 and PE2, when PE1 and PE2 are Catalyst 6500 series switches that have been configured to support extranet MVPN services. The sample outputs from the **show ip mroute** command show 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. The sample outputs from the **show mls ip multicast** command shows MLS information related to 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, 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 210.0.1.4, RPF-MFD
  Outgoing interface list:
    MVRF VPN-Red, Forward/Sparse-Dense, 00:45:17/00:01:09, H

PE1# show mls ip multicast group 232.3.3.3

Multicast hardware switched flows:
(10.1.0.1, 232.3.3.3) Incoming interface: Lo0, Packets switched: 28
Hardware switched outgoing interfaces:
        Gi2/16
RPF-MFD installed


(10.2.0.2, 232.3.3.3) Incoming interface: Gi2/16, Packets switched: 28
Hardware switched outgoing interfaces:
        MVRF VPN-Red
RPF-MFD installed

Total hardware switched flows : 2

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 210.0.2.4, 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

PE2# show mls ip multicast group 232.3.3.3

Multicast hardware switched flows:
(10.1.0.1, 232.3.3.3) Incoming interface: Gi4/1, Packets switched: 808
Hardware switched outgoing interfaces:
        MVRF VPN-Red
RPF-MFD installed


(10.2.0.2, 232.3.3.3) Incoming interface: Lo0, Packets switched: 808
Hardware switched outgoing interfaces:
        Gi4/1
RPF-MFD installed

Total hardware switched flows : 2
```

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** and **show mls ip multicast** commands 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 from the **show mls ip multicast** command shows MLS information related to group 228.8.8.8 in VPN-Green after receivers in VPN-Red join multicast group 228.8.8.8. The sample outputs from both the **show ip mroute** and **show mls ip multicast** commands 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:

PE1# show mls ip multicast vrf VPN-Green group 228.8.8.8

vrf VPN-Green tableid 1
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 4
Hardware switched outgoing interfaces:
        Extranet VPN-Red
RPF-MFD installed


Extranet receivers in vrf VPN-Red(2):
(*, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 4
Hardware switched outgoing interfaces:
        Tu2
RPF-MFD installed
```

```
(10.1.1.200, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Extranet VPN-Red
RPF-MFD installed


Extranet receivers in vrf VPN-Red(2):
(10.1.1.200, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Tu2
RPF-MFD installed

Total hardware switched flows : 4
```

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

The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands 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-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. The sample output from the **show mls ip multicast** shows MLS information related to the group 228.8.8.8 in VPN-Red.

```
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

PE1# show mls ip multicast vrf VPN-Red group 228.8.8.8

vrf VPN-Red tableid 2
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 4
Hardware switched outgoing interfaces:
        Tu2
RPF-MFD installed


(10.1.1.200, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Tu2
RPF-MFD installed

Total hardware switched flows : 2
PE1#
```

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

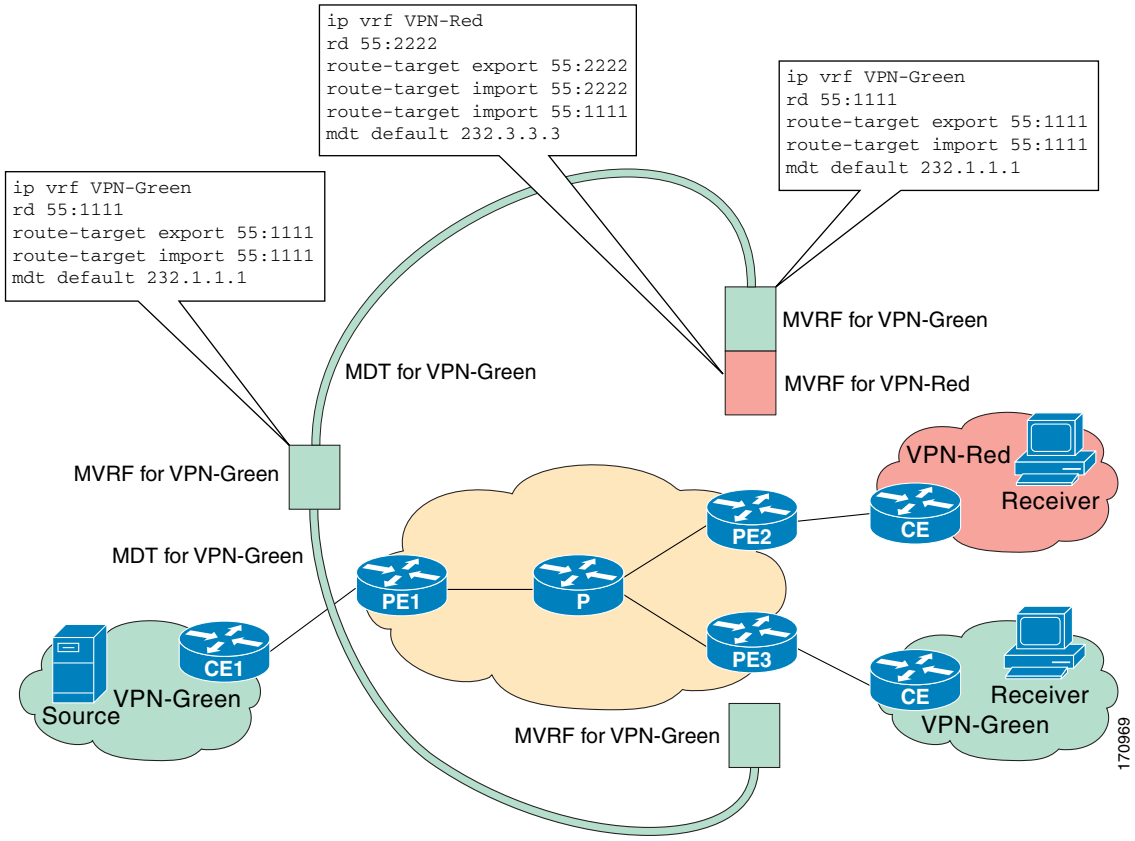
The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands on PE2, when PE2 is a Catalyst 6500 series switch configured to support extranet MVPN services. The sample output from the **show ip mroute** command shows the VRF table for VPN-Red on PE2 when receivers join the multicast group 228.8.8.8. The sample output from the **show mls ip multicast** command shows MLS information related to the group 228.8.8.8 in VPN-Red.

```
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

PE2# show mls ip multicast vrf VPN-Red group 228.8.8.8

vrf VPN-Red tableid 2
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Tu1, Packets switched: 4
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed


(10.1.1.200, 228.8.8.8) Incoming interface: Tu1, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed

Total hardware switched flows : 2
```

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

The following configuration example is based on the extranet MVPN topology illustrated in Figure 8. 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 cef
!
ip vrf VPN-Red
 rd 55:2222
 route-target export 55:2222
 route-target import 55:2222
 route-target import 55:1111
 mdt default 232.3.3.3
!
ip vrf VPN-Green
 rd 55:1111
 route-target export 55:1111
 route-target import 55:1111
```

```
 mdt default 232.1.1.1
!
ip multicast-routing
ip multicast-routing vrf VPN-Red
ip multicast-routing vrf VPN-Green
!
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
 !
```

PE1 Configuration

```
ip cef
!
ip vrf VPN-Green
 rd 55:1111
 route-target export 55:1111
 route-target import 55:1111
 mdt default 232.1.1.1
!
ip multicast-routing
ip multicast-routing vrf VPN-Green
!
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
 !
```

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

The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands on PE1 and PE2, when PE1 and PE2 are Catalyst 6500 series switches that have been configured to support extranet MVPN services. The sample outputs from the **show ip mroute** command show the global table for the MDT default group 232.1.1.1 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. The sample outputs from the **show mls ip multicast** command shows MLS information related to multicast 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: 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

PE1# show mls ip multicast group 232.1.1.1
Multicast hardware switched flows:
(10.2.0.2, 232.1.1.1) Incoming interface: Gi2/16, Packets switched: 28
Hardware switched outgoing interfaces:
        MVRF VPN-Green
RPF-MFD installed


(10.1.0.1, 232.1.1.1) Incoming interface: Lo0, Packets switched: 28
Hardware switched outgoing interfaces:
        Gi2/16
RPF-MFD installed

Total hardware switched flows : 2

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

PE2# show mls ip multicast group 232.1.1.1
Multicast hardware switched flows:
(10.1.0.1, 232.1.1.1) Incoming interface: Gi4/1, Packets switched: 28
Hardware switched outgoing interfaces:
        MVRF VPN-Green
RPF-MFD installed


(10.2.0.2, 232.1.1.1) Incoming interface: Lo0, Packets switched: 28
Hardware switched outgoing interfaces:
        Gi4/1
RPF-MFD installed

Total hardware switched flows : 2
```

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

The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands 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 from the **show mls ip multicast** command shows MLS information related to multicast group 228.8.8.8 in VPN-Red.

```
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

PE1# show mls ip multicast vrf VPN-Green group 228.8.8.8

vrf VPN-Red tableid 1
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 4
Hardware switched outgoing interfaces:
        Tu0
RPF-MFD installed


(10.1.1.200, 228.8.8.8) Incoming interface: Gi3/1, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Tu0
RPF-MFD installed

Total hardware switched flows : 2
```

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

The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands on PE2, when PE2 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 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. The sample output from the **show mls ip multicast** command shows MLS information related to multicast group 228.8.8.8 in VPN-Green.

```
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:

PE2# show mls ip multicast vrf VPN-Green group 228.8.8.8

vrf VPN-Green tableid 1
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Tu0, Packets switched: 4
Hardware switched outgoing interfaces:
        Extranet VPN-Red
RPF-MFD installed


Extranet receivers in vrf VPN-Red(2):
```

```
(*, 228.8.8.8) Incoming interface: Tu0, Packets switched: 4
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed


(10.1.1.200, 228.8.8.8) Incoming interface: Tu0, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Extranet VPN-Red
RPF-MFD installed


Extranet receivers in vrf VPN-Red(2):
(10.1.1.200, 228.8.8.8) Incoming interface: Tu0, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed

Total hardware switched flows : 4
```

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

The following are sample outputs from the **show ip mroute** and **show mls ip multicast** commands on PE2, when PE2 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-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. The sample output from the **show mls ip multicast** command shows MLS information related to multicast group 228.8.8.8 in VPN-Red.

```
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

PE2# show mls ip multicast vrf VPN-Red group 228.8.8.8

vrf VPN-Red tableid 2
Multicast hardware switched flows:
(*, 228.8.8.8) Incoming interface: Tu0, Packets switched: 4
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed


(10.1.1.200, 228.8.8.8) Incoming interface: Tu0, Packets switched: 2179579
Hardware switched outgoing interfaces:
        Gi9/1
RPF-MFD installed

Total hardware switched flows : 2
```

Configuring RPF for MVPN Extranet Support Using Static Mroutes: Example

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
```

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

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
!
```

Additional References

The following sections provide references related to configuring MVPN extranet services.

Related Documents

Related Topic	Document Title
Basic IP multicast concepts, configuration tasks, and examples	"Configuring Basic IP Multicast" chapter in the *Cisco IOS IP Multicast Configuration Guide*, Release 12.4T
IP multicast overview	"IP Multicast Technology Overview" chapter in the *Cisco IOS IP Multicast Configuration Guide*, Release 12.4
MPLS Layer 3 VPN concepts and configuration tasks	*Cisco IOS Multiprotocol Label Switching Configuration Guide*, Release 12.4
Multicast VPN concepts, configuration tasks, and examples	"Configuring Multicast VPN" module in the *Cisco IOS IP Multicast Configuration Guide*, Release 12.4T
Catalyst 6500 series Multicast VPN concepts, configuration tasks, and examples	"Configuring IPv4 Multicast VPN Support" in the *Catalyst 6500 Series Cisco IOS Software Configuration Guide*, Release 12.2SX
IP multicast commands: complete command syntax, command mode, command history, command defaults, usage guidelines, and examples	• *Cisco IOS IP Multicast Command Reference*, Release 12.2SB • *Cisco IOS IP Multicast Command Reference*, Release 12.2SX
MPLS commands: complete command syntax, command mode, command history, command defaults, usage guidelines, and examples	• *Cisco IOS Multiprotocol Label Switching Command Reference*, Release 12.2SB • *Cisco IOS Multiprotocol Label Switching Command Reference*, Release 12.2SX

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: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Configuring Multicast VPN Extranet Support

Table 1 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.2(1) or a later release appear in the table.

For information on a feature in this technology that is not documented here, see the "IP Multicast Features Roadmap."

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 Configuring Multicast VPN Extranet Support

Feature Name	Releases	Feature Information
Multicast VPN Extranet Support	12.2(31)SB2 12.2(33)SXH	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. The following sections provide information about this feature: • Overview of MVPN Extranet Support, page 2 • Configuration Guidelines for MVPN Extranet Support, page 4 • Configuring MVPN Extranet Support, page 8 • Configuring RPF for MVPN Extranet Support Using Static Mroutes, page 14 • Configuring the Receiver VRF on the Source PE Router (Option 1): Example, page 18 • Configuring the Source VRF on the Receiver PE (Option 2): Example, page 27 The following commands were introduced or modified by this feature: **ip mroute**, **show ip mroute**.

Table 1 Feature Information for Configuring Multicast VPN Extranet Support

Feature Name	Releases	Feature Information
Multicast VPN Extranet VRF Select	12.2(31)SB2	The Multicast VPN Extranet VRF Select feature provides the capability for 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. The following sections provide information about this feature: • Overview of Multicast VPN Extranet VRF Select, page 7 • Configuring Group-Based VRF Selection Policies with MVPN Extranet Support, page 15 • Configuring Group-Based VRF Selection Policies with MVPN Extranet Support: Example, page 36 The following commands were introduced or modified by this feature: **ip multicast rpf select**, **show ip rpf**, **show ip rpf select**.
Hardware Acceleration for Multicast VPN Extranet Support	12.2(33)SXH	The Hardware Acceleration for Multicast VPN Extranet Support introduces the linking of forwarding entries and the replication of packets in hardware for extranet MVPN services on Catalyst 6500 series switches. In 12.2(33)SXH, this feature was introduced on the Catalyst 6500. The following sections provide information about this feature: • Hardware Acceleration for Multicast VPN Extranet Support on Catalyst 6500 Series Switches, page 7 • Configuring MVPN Extranet Support, page 8