IP Multicast: Multicast Services Configuration Guide, Cisco IOS XE Everest 16.6

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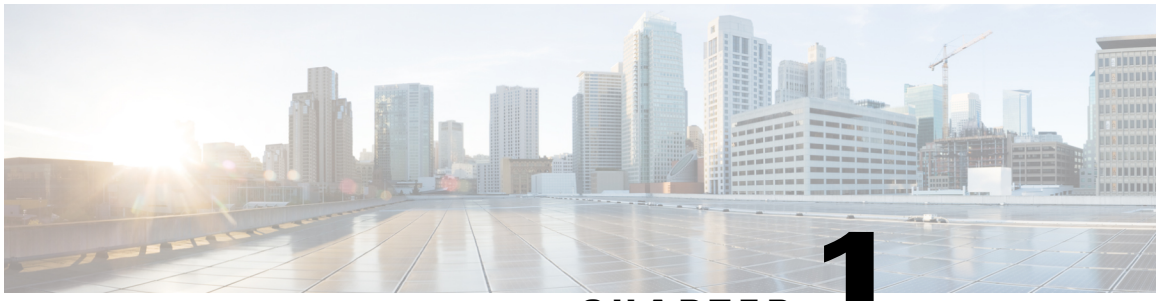


CHAPTER 1

Read Me First

Important Information about Cisco IOS XE 16

Effective Cisco IOS XE Release 3.7.0E (for Catalyst Switching) and Cisco IOS XE Release 3.17S (for Access and Edge Routing) the two releases evolve (merge) into a single version of converged release—the Cisco IOS XE 16—providing one release covering the extensive range of access and edge products in the Switching and Routing portfolio.

Feature Information

Use Cisco Feature Navigator to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

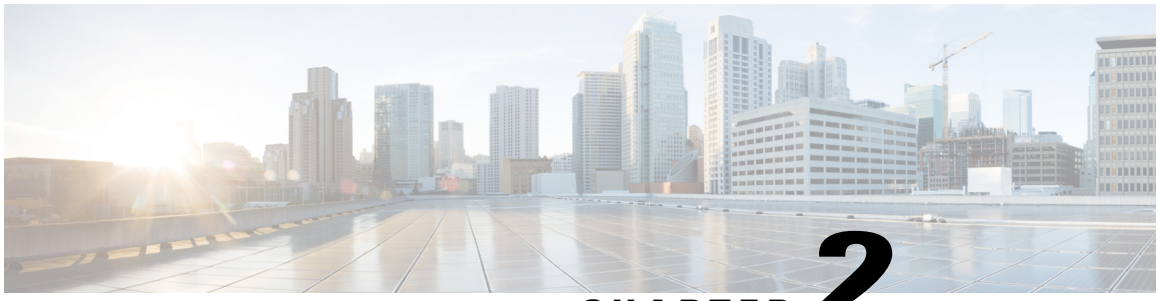
Related References

- Cisco IOS Command References, All Releases

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the What's New in Cisco Product Documentation RSS feed. RSS feeds are a free service.



CHAPTER 2

Implementing Multicast Service Reflection

The Cisco Multicast Service Reflection feature provides the capability for users to translate externally received multicast or unicast destination addresses to multicast or unicast addresses that conform to their organization's internal addressing policy. Using this feature, users do not need to redistribute unicast routes from external sources at the translation boundary into their network infrastructure for Reverse Path Forwarding (RPF) to work properly. In addition, users can receive identical feeds from two ingress points in the network and route them independently.

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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 Implementing Multicast Service Reflection

- Configure your multicast-enabled network with the necessary infrastructure to run either Protocol Independent Multicast Sparse Mode (PIM-SM), Bidirectional PIM (bidir-PIM), or PIM Source Specific

Multicast (PIM-SSM). The configuration process may include configuring RPs, interface boundaries, or SSM ranges.

For configuration information, see the " Configuring Basic IP Multicast " module.

- Confirm that the virtual interface for multicast service reflection (Vif1 interface) is installed in your border router and the Multicast Service Reflection application is installed and operational.
- Each active receiver must initiate an Internet Group Management Protocol (IGMP) join to the multicast group that is defined on the router in the PIM domain.

Restrictions for Implementing Multicast Service Reflection

- When translating groups of multicast packets that are destined for the same multicast group but are originating from different sources, as in the case when using PIM-SSM, all multicast packets destined for a particular SSM group will get mapped to a single (S, G) after translation has occurred. For example, if (10.1.1.1, 232.1.1.1) and (10.1.1.2, 232.1.1.1) need to be translated, they will appear as a single entry, for example, (92.168.1.2, 232.239.1.1), where 192.168.1.2 is an IP address that resides in the Vif1 IP subnet.
- PIM/IGMP control packets are not translated.
- The following types of translation are not supported in Cisco IOS XE software:
  - Unicast-to-Multicast Destination Translation
  - Unicast-to-Multicast Destination Splitting

Information About Implementing Multicast Service Reflection

Benefits of Implementing Multicast Service Reflection

- Allows users to translate externally received multicast or unicast destination addresses to multicast or unicast addresses that conform to their company's internal addressing policy. This allows the seperation of the private addressing scheme used by the content provider from the public addressing used by the service provider. The following types of translations are supported:
  - Multicast-to-Multicast Destination Translation
  - Multicast-to-Unicast Destination Translation
  - Multicast-to-Multicast Destination Splitting
  - Multicast-to-Unicast Destination Splitting
- Provides logical separation between private and public multicast networks.
- Provides the flexibility to forward multicast packets--translated or untranslated--out the same outgoing interface.

- Provides redundancy by allowing users to get identical feeds from two ingress points in the network and route them independently.
- Allows users to use the subnet of their choice to be the source network and scope it appropriately.

Rendezvous Points

A rendezvous point (RP) is a role that a router performs when operating in PIM-SM or bidirectional PIM. An RP is required only in networks running PIM-SM or bidirectional PIM. In PIM-SM, only network segments with active receivers that have explicitly requested multicast data will be forwarded the traffic.

An RP acts as the meeting place for sources and receivers of multicast data. In a PIM-SM network, first hop designated routers with directly connected sources initially send their traffic to the RP. This traffic is then forwarded to receivers down a shared distribution tree. By default, when the last hop router with a directly connected receiver receives traffic from the shared tree, it immediately performs a shortest path tree switchover and sends a Join message towards the source, creating a source-based distribution tree between the source and the receiver.

PIM Sparse Mode

PIM sparse mode (PIM-SM) uses a pull model to deliver multicast traffic. Only network segments with active receivers that have explicitly requested the data will receive the traffic.

Unlike dense mode interfaces, sparse mode interfaces are added to the multicast routing table only when periodic Join messages are received from downstream routers, or when a directly connected member is on the interface. When forwarding from a LAN, sparse mode operation occurs if an RP is known for the group. If so, the packets are encapsulated and sent toward the RP. When no RP is known, the packet is flooded in a dense mode fashion. If the multicast traffic from a specific source is sufficient, the first hop router of the receiver may send Join messages toward the source to build a source-based distribution tree.

PIM-SM distributes information about active sources by forwarding data packets on the shared tree. Because PIM-SM uses shared trees (at least, initially), it requires the use of a rendezvous point (RP). The RP must be administratively configured in the network.

In sparse mode, a router assumes that other routers do not want to forward multicast packets for a group, unless there is an explicit request for the traffic. When hosts join a multicast group, the directly connected routers send PIM Join messages toward the RP. The RP tracks multicast groups. Hosts that send multicast packets are registered with the RP by the first hop router of that host. The RP then sends Join messages toward the source. At this point, packets are forwarded on a shared distribution tree. If the multicast traffic from a specific source is sufficient, the first hop router of the host may send Join messages toward the source to build a source-based distribution tree.

First-hop designated routers with directly connected sources register with the RP and then data is forwarded down the shared tree to the receivers. The edge routers learn about a particular source when they receive data packets on the shared tree from that source through the RP. The edge router then sends PIM (S, G) Join messages toward that source. Each router along the reverse path compares the unicast routing metric of the RP address to the metric of the source address. If the metric for the source address is better, it will forward a PIM (S, G) Join message toward the source. If the metric for the RP is the same or better, then the PIM (S, G) Join message will be sent in the same direction as the RP. In this case, the shared tree and the source tree would be considered congruent.

If the shared tree is not an optimal path between the source and the receiver, the routers dynamically create a source tree and stop traffic from flowing down the shared tree. This behavior is the default behavior in Cisco

IOS software. Network administrators can force traffic to stay on the shared tree by using the Cisco IOS **ip pim spt-threshold infinity** command.

PIM-SM scales well to a network of any size, including those with WAN links. The explicit join mechanism prevents unwanted traffic from flooding the WAN links.

Vif1 Interface

The Vif1 interface is similar to a loopback interface--it is a logical IP interface that is always up when the router is active.

The Vif1 interface needs to reside on its own unique subnet, and that subnet should be advertised in the Interior Gateway Protocol (IGP) updates (RIP, EIGRP, OSPF, ISIS).

The Vif1 interface maintains information about the input interface, private-to-public mgroup mappings, mask length, which defines your pool range, and the source of the translated packet.

Multicast Service Reflection Application

Cisco multicast service reflection is an application running in Cisco IOS software interrupt level switching that processes packets forwarded by Cisco IOS software to the Vif1 interface. Unlike IP multicast Network Address Translation (NAT), which only translates the source IP address, the IP reflect service translates both source and destination addresses. Multicast service reflection is especially useful when users that have not yet moved to the new multicast group still need to receive the untranslated stream.

Multicast service reflection is implemented using an interface CLI statement. Each configured multicast service reflection CLI statement establishes a packet match and rewrite operation acting on packets sent by Cisco IOS unicast or multicast packet routing onto the Vif1 interface. The matched and rewritten packet is sent back into Cisco IOS unicast or multicast packet routing, where it is handled like any other packet arriving from an interface.

The Vif1 interface is a receiver for the original stream and makes it appear that the new stream is coming from a source directly connected to the Vif1 subnet. The Vif1 interface is a Designated Router (DR) for active sources and registers with the appropriate RP.

More than one multicast service reflection operation can be configured to match the same packets, which allows you to replicate the same received traffic to multiple destination addresses.

The Multicast Service Reflection feature is available in Cisco IOS Release 12.4(4)T on software-based nondistributed forwarding platforms, up to and including the Cisco 7200 series routers, as well as Cisco Catalyst 6500 series switches providing forwarding in hardware in Cisco IOS Release 12.2(33)SXI4.

How to Implement Multicast Service Reflection

Configuring Multicast Service Reflection

Perform this task to configure multicast service reflection.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **interface** *type number*
5. **ip pim sparse-mode**
6. no shutdown
7. exit
8. Repeat Steps 4 through 7 for each PIM interface.
9. **interface Vif1**
10. **ip address** *ip-address mask* [**secondary**]
11. **ip pim sparse-mode**
12. **ip service reflect** *input-interface* **destination** *destination-address* **to** *new-destination-address* **mask-len** *number* **source** *new-source-address*
13. **ip igmp static-group** {***** | *group-address* [**source** {*source-address* | **ssm-map**}]}
14. end

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 multicast-routing** [**distributed**] **Example:** `Router(config)# ip multicast-routing`	Enables IP multicast routing. • Use the **distributed** keyword to enable the Multicast Distributed Switching feature.
Step 4	**interface** *type number* **Example:** `Router(config)# interface ethernet 0`	Enters interface configuration mode for the specified interface type and number.

	Command or Action	Purpose
Step 5	**ip pim sparse-mode** **Example:** `Router(config-if)# ip pim sparse-mode`	Enables PIM sparse mode on the interface.
Step 6	no shutdown **Example:** `Router(config-if)# no shutdown`	Enables an interface.
Step 7	exit **Example:** `Router(config-if)# exit`	Exits interface configuration mode, and returns to global configuration mode.
Step 8	Repeat Steps 4 through 7 for each PIM interface.	--
Step 9	**interface Vif1** **Example:** `Router(config)# interface Vif1`	Enters interface configuration mode for the Vif1 interface.
Step 10	**ip address** *ip-address mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.1.1.1 255.255.255.0`	Sets a primary or secondary IP address for an interface.
Step 11	**ip pim sparse-mode** **Example:** `Router(config-if)# ip pim sparse-mode`	Enables PIM sparse mode on an interface.
Step 12	**ip service reflect** *input-interface* **destination** *destination-address* **to** *new-destination-address* **mask-len** *number* **source** *new-source-address* **Example:** `Router(config-if)# ip service reflect ethernet0 destination 224.1.1.0 to 239.2.2.0 mask-len 24 source 10.1.1.2`	Matches and rewrites multicast packets routed onto the Vif1 interface. • The matched and rewritten packets are sent back into Cisco multicast packet routing (or unicast routing if the destination is unicast), where they are handled like any other packets arriving from an interface.

	Command or Action	Purpose
Step 13	**ip igmp static-group** {***** | *group-address* [**source** {*source-address* | **ssm-map**}]} **Example:** `Router(config-if)# ip igmp static-group 224.1.1.1`	Configures the router to be a statically connected member of the specified group on the interface, and forwards traffic destined for the multicast group onto the interface. • This step is only applicable for multicast-to-multicast and multicast-to-unicast scenarios.
Step 14	end **Example:** `Router(config-if)# end`	Exits interface configuration mode, and returns to privileged EXEC mode.

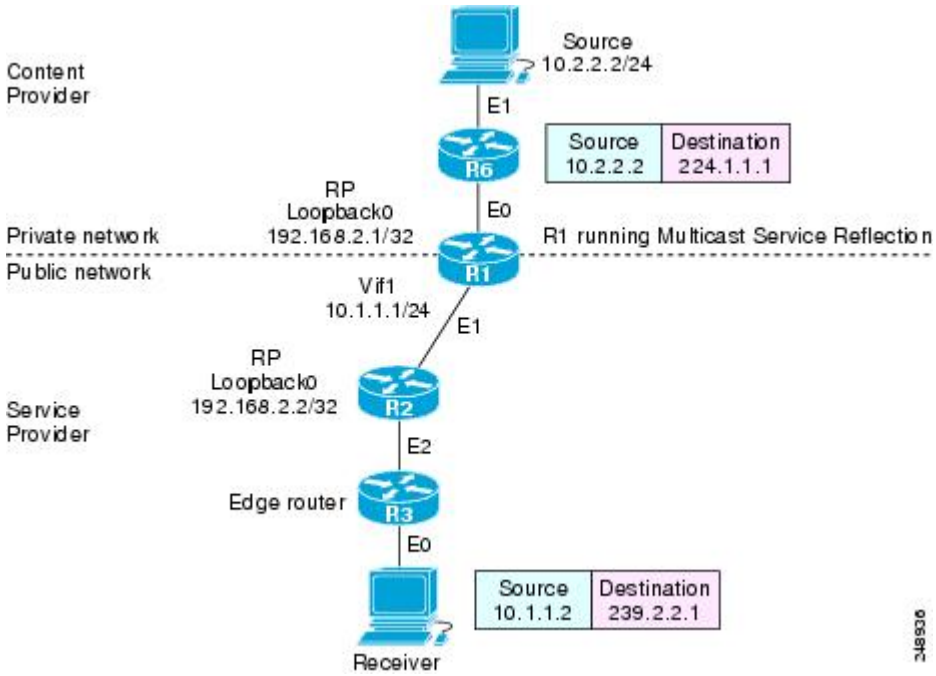
Configuration Examples for Multicast Service Reflection

Example Multicast-to-Multicast Destination Translation

The following example shows how to implement multicast service reflection (multicast-to-multicast destination translation) in a service provider network. Multicast-to-Multicast Destination Translation allows service providers to translate externally received content provider multicast destination addresses to multicast destination addresses that conform to the service provider's internal addressing policy.

This example uses the topology illustrated in the figure.

Figure 1: Multicast Service Reflection (Multicast-to-Multicast Destination Translation) in a Service Provider Network Example Topology



In this example topology, a content provider is sending financial market information to a service provider, which in turn is sending that information to active receivers (brokerage houses). The service provider may be receiving market data from multiple content providers.

Router R1 is an edge router in the service provider's PIM domain.

Router R1 has a loopback interface and is acting as the RP for the 224.1.1.0/24 address range.

Router R1 has a Vif1 interface and is running the multicast service reflection application.

Router R2 has a loopback interface and is acting as the RP for the 239.2.2.0/24 address range.

Enter these commands on the router running the multicast service reflection application (R1):

```
!
configure terminal
 ip multicast-routing
 interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
 ! Configure the loopback interface for the Service Provider RP
!
 interface loopback 0
 ip address 192.168.2.1 255.255.255.255
 ip pim sparse-mode
 !
 ip pim rp-address 192.168.2.1 mcast-content-provider-groups override
 ip pim rp-address 192.168.2.2 mcast-service-provider-groups override
 ip access-list standard mcast-content-provider-groups permit 224.1.1.0 0.0.0.255
 ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
 !
! Configure the Vif1 virtual interface for multicast service reflection
!
 interface Vif1
 ip address 10.1.1.1 255.255.255.0
 ip pim sparse-mode
 ip service reflect Ethernet 0 destination 224.1.1.0 to 239.2.2.0 mask-len 24 source 10.1.1.2
 ip igmp static-group 224.1.1.0
 ip igmp static-group 224.1.1.1
 ip igmp static-group 224.1.1.2
 ip igmp static-group 224.1.1.3
 .
 .
 .
 ip igmp static-group 224.1.1.255
```

Enter these commands on the router that is the RP in the service provider network (R2):

```
ip multicast-routing
interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
!
 interface loopback 0
 ip address 192.168.2.2 255.255.255.255
 ip pim sparse-mode
!
ip pim rp-address 192.168.2.2 mcast-service-provider-groups override
ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
!
```

Enter these commands on all the other routers in the service provider network (R3):

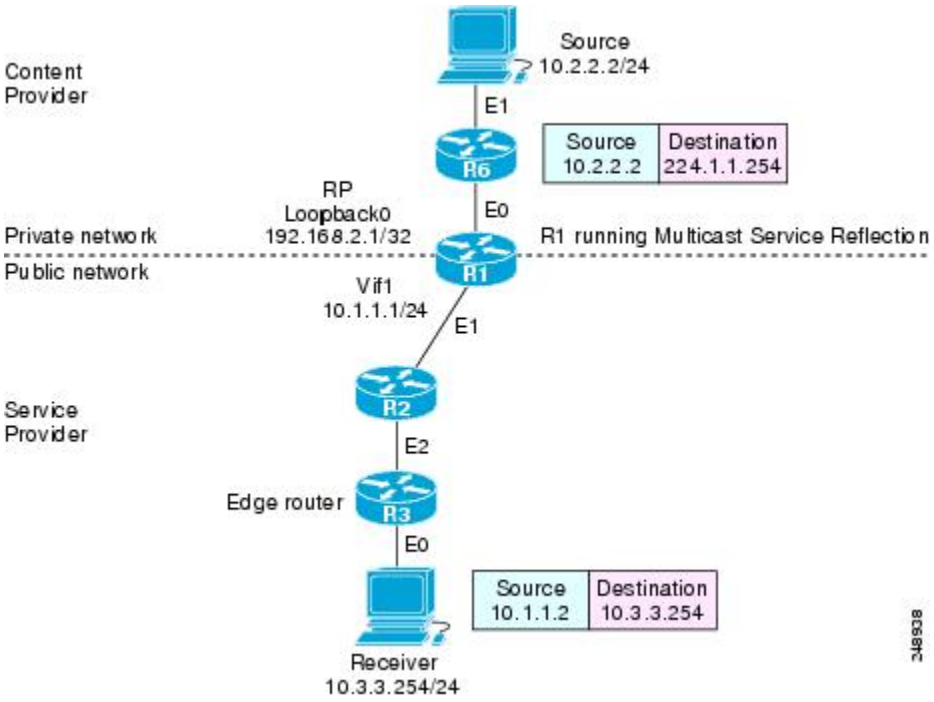
```
ip multicast-routing
 interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
!
 ip pim rp-address 192.168.2.2 mcast-service-provider-groups override
 ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
 end
```

Example Multicast-to-Unicast Destination Translation

The following example shows how to implement multicast service reflection (multicast-to-unicast destination translation) in a service provider network. Multicast-to-Unicast Destination Translation allows service providers to translate externally received content provider multicast destination addresses to unicast destination addresses that conform to the service provider's internal addressing policy.

This example uses the topology illustrated in the figure.

Figure 2: Multicast Service Reflection (Multicast-to-Unicast Destination Translation) in a Service Provider Network Example Topology



In this example topology, a content provider is sending financial market information to a service provider, which in turn is sending that information to active receivers (brokerage houses). The service provider may be receiving market data from multiple content providers.

Router R1 is an edge router in the service provider's PIM domain.

Router R1 has a loopback interface and is acting as the RP for the 224.1.1.0/24 address range.

Router R1 has a Vif1 interface and is running the multicast service reflection application.

Routers R2 and R3 are non PIM enabled routers running unicast routing only in the service provider network.

Enter these commands on the router running the multicast service reflection application (R1):

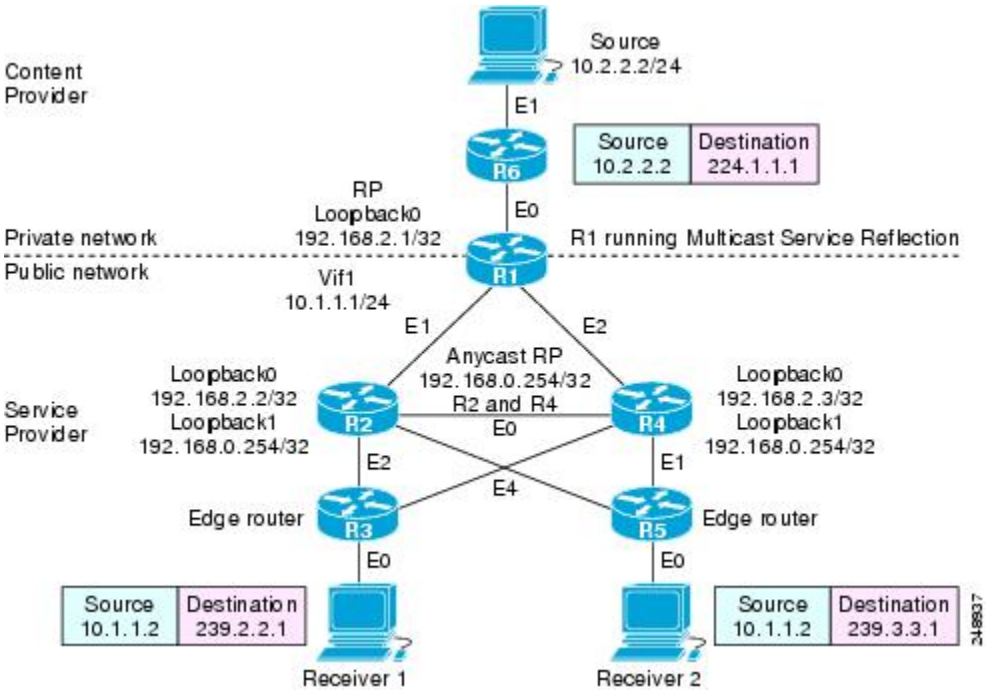
```
configure terminal
 ip multicast-routing
 interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
! Configure the loopback interface for the Service Provider RP
!
 interface loopback 0
 ip address 192.168.2.1 255.255.255.255
ip pim sparse-mode
 !
 ip pim rp-address 192.168.2.1 mcast-content-provider-groups override
 ip access-list standard mcast-content-provider-groups permit 224.1.1.10 0.0.0.255
 !
! Configure the Vif1 virtual interface for multicast service reflection
!
 interface Vif1
 ip address 10.1.1.1 255.255.255.0
 ip pim sparse-mode
 ip service reflect Ethernet 0 destination 224.1.1.0 to 10.3.3.0 mask-len 24 source 10.1.1.2
 end
```

Example Multicast-to-Multicast Destination Splitting

The following example shows how to implement multicast service reflection (multicast-to-multicast destination splitting where the multicast single stream is converted into two unique multicast streams) in a service provider network. Multicast-to-Multicast Destination Splitting allows service providers to translate externally received content provider multicast destination addresses to multiple multicast destination addresses that conform to the service provider's internal addressing policy.

This example uses the topology illustrated in the figure.

Figure 3: Multicast Service Reflection (Multicast-to-Multicast Destination Splitting) in a Service Provider Network Example Topology



In this example topology, a content provider is sending financial market information to a service provider, which in turn is sending that information to active receivers (brokerage houses). The service provider may be receiving market data from multiple content providers.

Router R1 is an edge router in the service provider's PIM domain.

Router R1 has a loopback configured and is acting as an RP for the 224.1.1.0/24 address range.

Router R1 has a Vif1 interface and is running the multicast service reflection application.

Routers R2 and R4 have multiple loopback interfaces and are acting as anycast RPs for the 239.2.2.0 and 239.3.3.0 address ranges.

Router R3 and R5 are edge routers in the service provider's PIM domain.

Enter these commands on the router running the multicast service reflection application (R1):

```
configure terminal
 ip multicast-routing
 interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
 ! Configure the loopback interface for the Service Provider RP
!
 interface loopback 0
 ip address 192.168.2.1 255.255.255.255
 ip pim sparse-mode
 !
 ip pim rp-address 192.168.2.1 mcast-content-provider-groups override
 ip pim rp-address 192.168.0.254 mcast-service-provider-groups override
 ip access-list standard mcast-content-provider-groups permit 224.1.1.0 0.0.0.255
 ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
 ip access-list standard mcast-service-provider-groups permit 239.3.3.0 0.0.0.255

 !
! Configure the Vif1 virtual interface for multicast service reflection
!
 interface Vif1
 ip address 10.1.1.1 255.255.255.0
 ip pim sparse-mode
 ip service reflect Ethernet 0 destination 224.1.1.0 to 239.2.2.0 mask-len 24 source 10.1.1.2
 ip service reflect Ethernet 0 destination 224.1.1.0 to 239.3.3.0 mask-len 24 source 10.1.1.2
 ip igmp static-group 224.1.1.0
ip igmp static-group 224.1.1.1
 ip igmp static-group 224.1.1.2
 ip igmp static-group 224.1.1.3
  .
  .
  .
 ip igmp static-group 224.1.1.254
```

Enter these commands on the R2 router that is an anycast RP in the service provider network:

```
ip multicast-routing
interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
 interface loopback 0
 ip address 192.168.2.2 255.255.255.255
 ip pim sparse-mode
 interface loopback 1
description --- Anycast RP ---
 ip address 192.168.0.254 255.255.255.255
 ip pim sparse-mode
!
ip msdp peer 192.168.2.3 connect-source Loopback0
ip msdp originator-id Loopback0
!
ip pim rp-address 192.168.0.254 mcast-service-provider-groups override
ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
ip access-list standard mcast-service-provider-groups permit 239.3.3.0 0.0.0.255
```

Enter these commands on the R4 router that is an anycast RP in the service provider network:

```
ip multicast-routing
interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
 interface loopback 0
 ip address 192.168.2.3 255.255.255.255
 ip pim sparse-mode
 interface loopback 1
 ip address 192.168.0.254 255.255.255.255
 ip pim sparse-mode
!
ip pim rp-address 192.168.0.254 mcast-service-provider-groups override
ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
ip access-list standard mcast-service-provider-groups permit 239.3.3.0 0.0.0.255
!
ip msdp peer 192.168.2.2 connect-source Loopback0
ip msdp originator-id Loopback0
```

Enter these commands on the R3 and R5 routers in the service provider network:

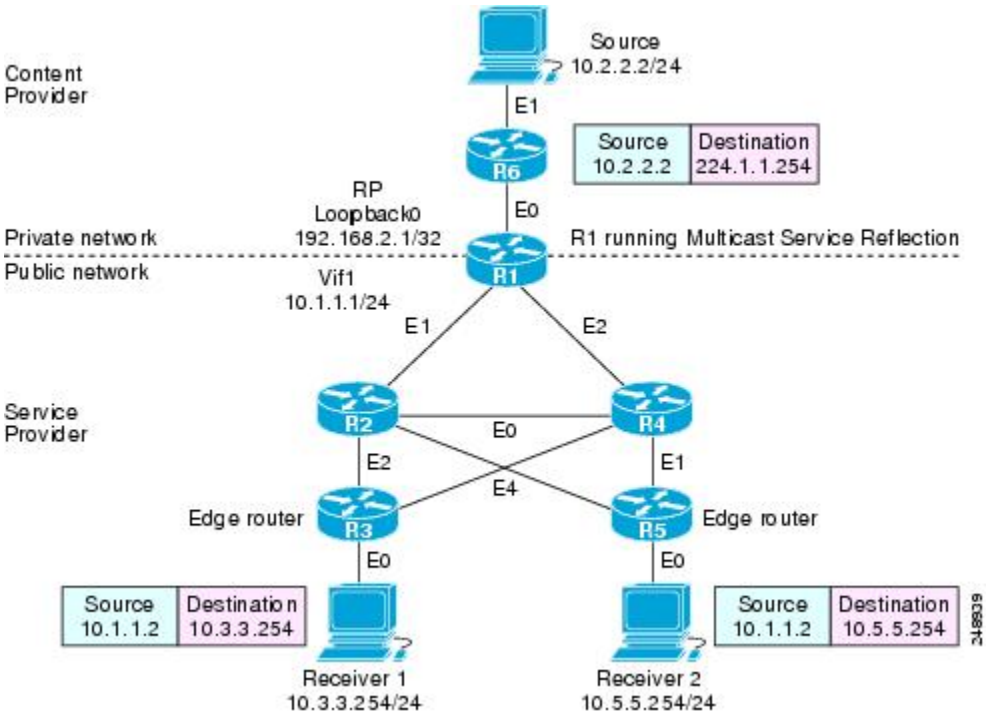
```
ip multicast-routing
 ip pim rp-address 192.168.0.254 mcast-service-provider-groups override
 ip access-list standard mcast-service-provider-groups permit 239.2.2.0 0.0.0.255
permit 239.3.3.0 0.0.0.255
 !
```

Example Multicast-to-Unicast Destination Splitting

The following example shows how to implement multicast service reflection (multicast-to-unicast destination splitting where the multicast single stream is converted into two unique unicast streams) in a service provider network. Multicast-to-Unicast Destination Splitting allows service providers to translate externally received content provider multicast destination addresses to multiple unicast destination addresses that conform to the service provider's internal addressing policy.

This example uses the topology illustrated in the figure.

Figure 4: Multicast Service Reflection (Multicast-to-Unicast Destination Splitting) in a Service Provider Network Example Topology



In this example topology, a content provider is sending financial market information to a service provider, which in turn is sending that information to active receivers (brokerage houses). The service provider may be receiving market data from multiple content providers.

Router R1 is an edge router in the service provider's PIM domain.

Router R1 is acting as a RP for the 224.1.1.0/24 address range.

Router R1 has a Vif1 interface and is running the multicast service reflection application.

Routers R2, R3, R4 and R5 are not PIM enabled and are running unicast routing only in the service provider network.

Enter these commands on the router running the multicast service reflection application (R1):

```
configure terminal
 ip multicast-routing
interface <all IP numbered interfaces>
 ip pim sparse-mode
 no shutdown
 !
! Configure the loopback interface for the Service Provider RP
!
 interface loopback 0
 ip address 192.168.2.1 255.255.255.255
ip pim sparse-mode
 !
 ip pim rp-address 192.168.2.1 mcast-content-provider-groups override
 ip access-list standard mcast-content-provider-groups permit 224.1.1.0 0.0.0.255
 !
! Configure the Vif1 virtual interface for multicast service reflection
!
 interface Vif1
 ip address 10.1.1.1 255.255.255.0
 ip pim sparse-mode
 ip service reflect Ethernet 0 destination 224.1.1.0 to 10.3.3.0 mask-len 24 source 10.1.1.2
ip service reflect Ethernet 0 destination 224.1.1.0 to 10.5.5.0 mask-len 24 source 10.1.1.2
 ip igmp static-group 224.1.1.0
 ip igmp static-group 224.1.1.1
 ip igmp static-group 224.1.1.2
 ip igmp static-group 224.1.1.3
 .
 .
 .
 ip igmp static-group 224.1.1.255
!
end
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Multicast commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Multicast Command Reference*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	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/cisco/web/support/index.html

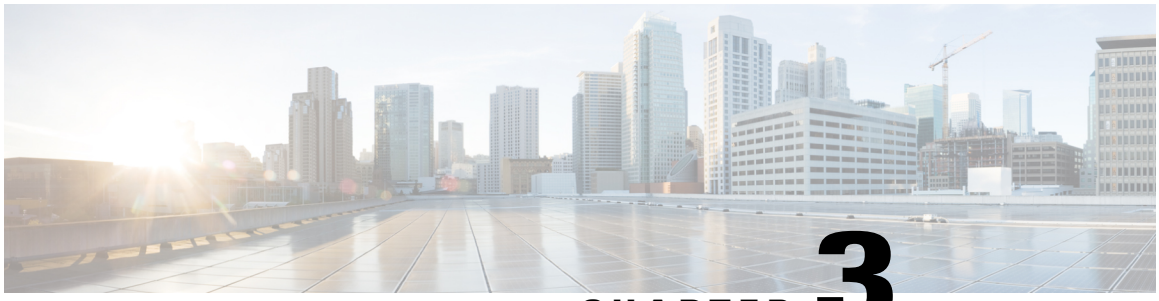
Feature Information for Multicast Service Reflection

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for Multicast Service Reflection

Feature Name	Releases	Feature Information
Multicast Service Reflection	12.2(33)SXI 12.4(4)T 12.2(50)SY Cisco IOS XE 3.4S	The Cisco Multicast Service Reflection feature allows you to translate externally received multicast or unicast destination addresses to multicast or unicast addresses that conform to their organization's internal addressing policy. Using this feature, users do not need to redistribute unicast routes from external sources at the translation boundary into their network infrastructure for Reverse Path Forwarding (RPF) to work properly. In addition, users can receive identical feeds from two ingress points in the network and route them independently. The following command was introduced or modified: **ip service reflect.**



CHAPTER 3

Multicast only Fast Re-Route

Multicast only Fast Re-Route (MoFRR) is an IP solution that minimizes packet loss in a network when there is a link or node failure. It works by making simple enhancements to multicast routing protocols like Protocol Independent Multicast (PIM).

MoFRR transmits a multicast join message from a receiver toward a source on a primary path, while also transmitting a secondary multicast join message from the receiver toward the source on a backup path. Data packets are received from both the primary path and the secondary paths. The redundant packets are discarded at topology merge points due to Reverse Path Forwarding (RPF) checks. When a failure is detected on the primary path, the repair is made by changing the interface on which packets are accepted to the secondary interface.Because the repair is local, it is fast--greatly improving convergence times in the event of node or link failures on the primary path.

- Finding Feature Information, page 25
- Prerequisites for MoFRR, page 26
- Restrictions for MoFRR, page 26
- Information About MoFRR, page 26
- How to Configure MoFRR, page 27
- Configuration Examples for MoFRR, page 31
- Additional References, page 31
- Feature Information for MoFRR, page 33

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 MoFRR

- Before performing the tasks in this module, you should be familiar with the concepts described in " IP Multicast Technology Overview " module.
- The tasks in this module assume that IP multicasting has been enabled and that PIM interfaces have been configured using the tasks described in the " Configuring Basic IP Multicast " module.

Restrictions for MoFRR

- The MoFRR feature is disabled by default and must be enabled using the CLI.
- The Equal Cost Multipath Protocol (ECMP) feature is a requirement in order for the MoFRR feature to function.
- MoFRR works only for Specific Multicast (SM) S, G, and Source Specific Multicast (SSM) routes.
- MoFRR is applicable to only IPv4 Multicast, not IPv6 Multicast.
- MoFRR does not support extranet routes.
- MoFRR works where the Reverse Path Forwarding (RPF) lookups are done in a single VRF.
- Both primary and secondary paths should exist in the same multicast topology.
- MoFRR is supported on images supporting IPv4 MFIB only.

Information About MoFRR

Overview of MoFRR

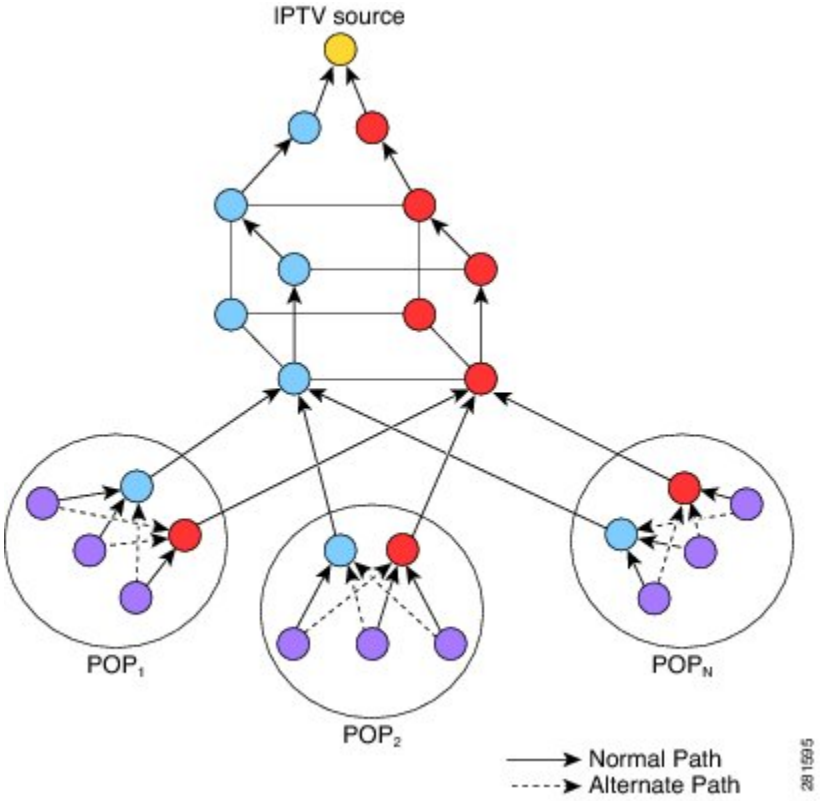
The MoFRR feature provides the ability to minimize packet loss in a network when there is a link or node failure by enhancing, but not changing, multicast routing protocols such as PIM. With MoFRR, multicast routing protocols do not have to wait or depend on unicast routing protocols to detect network failures.

The MoFRR feature can be divided into two planes, red and blue, that are fully disjoint from each other all the way into the points of presence (POPs) as shown in the figure.

This two-plane design eliminates single points of failure in the core network. The upstream full-line arrows indicate the normal path taken when the PIM joins the flow from the POPs toward the source of the network.

MoFRR adds the broken-arrow path where the provider edge (PE) routers send an alternate PIM join to their neighbor toward the source. Each PE router then receives two copies of the same stream, one from the blue plane and one from the red plane. As a result of multicast RPF checks, the following occurs:

- The multicast stream received over the primary path (in the reverse direction of the full-line arrows) is accepted and forwarded to the downstream links.
- The copy of the stream received on the alternate path (in the reverse direction of the broken-line arrows) is discarded



When a routing failure occurs, for example due to a link failure in the blue path, the red upstream router in the red plane becomes the primary upstream router to reach the source. This link to the router then becomes the RPF interface, and the copy of the multicast stream being received on the link is accepted and forwarded to the downstream links.

MoFRR achieves faster convergence by prebuilding the alternate multicast tree and receiving the traffic on that alternate path. The example discussed above is a simple case where there are two paths from each PE device toward the source, one along the blue plane and one along the red plane. MoFRR switchover as a result of routing convergence is expected to be in the order of -200 milliseconds.

How to Configure MoFRR

Enabling MoFRR

Perform this task to configure MoFRR.

Multiple ACL configurations are not allowed. Multicast routes are enabled for MoFRR based on the first match in the ACL.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing [vrf vrf-name] [distributed]**
4. **interface type number [name-tag]**
5. **ip address** *ip-address mask* [**secondary** [**vrf** *vrf-name*]]
6. **ip pim** {**dense-mode**[**proxy-register**{**list** *access-list* | **route-map** *map-name*}] | **passive** | **sparse-mode** | **sparse-dense-mode**}
7. **exit**
8. Repeat Steps 4 through 7 for each interface to be configured.
9. **ip multicast [vrf vrf-name] rpf mofrr {access-list-number | access-list-name} [sticky]**
10. **ip access-list { standard | extended } {** *access-list-name* | *access-list-number* **}**
11. [**sequence-number**] **permit source** [**source-wildcard**[
12. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip multicast-routing [vrf vrf-name] [distributed]** **Example:** `Device(config)# ip multicast-routing vrf vrf1`	Enables multicast routing. Depending on your release, the **distributed** keyword may not be supported for this command. • In this example, multicast routing is enabled on a vrf instance named vrf1.
Step 4	**interface type number [name-tag]** **Example:** `Device(config)# interface loopback 4`	Selects an interface that is connected to hosts on which PIM can be enabled. • In this example, loopback interface 4 is selected.
Step 5	**ip address** *ip-address mask* [**secondary** [**vrf** *vrf-name*]]	Sets a primary or secondary IP address for the interface. • In this example, 209.165.200.225 is set as the primary address for loopback interface 4.

	Command or Action	Purpose
	Example: `Device(config-if)# ip address 209.165.200.225 255.255.255.224`	
Step 6	**ip pim** {**dense-mode**[**proxy-register**{**list** *access-list* | **route-map** *map-name*}] | **passive** | **sparse-mode** | **sparse-dense-mode**} **Example:** `Device(config-if)# ip pim sparse-dense-mode`	Enables PIM sparse-dense mode on an interface.
Step 7	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	Repeat Steps 4 through 7 for each interface to be configured.	--
Step 9	**ip multicast [vrf vrf-name] rpf mofrr {access-list-number | access-list-name} [sticky]** **Example:** `Device(config)# ip multicast rpf mofrr 150`	Enables MoFRR for a multicast routing entry that is specific to a source and a group (S, G) matching the ACL. • In this example, MoFRR is enabled for the S, G matching the ACL numbered 150.
Step 10	**ip access-list** { **standard** | **extended** } { *access-list-name* | *access-list-number* } **Example:** `Device(config)# ip access-list extended 150`	Defines a standard or extended IP access list or object group access control list (OGACL) by name or number. • In this example, an ACL numbered 150 is defined. **Note** MoFRR accepts extended ACLs only. It does not accept standard ACLs.
Step 11	[**sequence-number**] **permit source** [**source-wildcard**[**Example:** `Device(config-ext-nacl)# permit 192.168.34.0 0.0.0.255`	Sets conditions to allow a packet to pass a numbered IP access list. • In this example, packets from source address 192.168.34.0 are allowed to pass the ACL.
Step 12	**end** **Example:** `Device(config-ext-nacl)# end`	Exits standard named access list configuration mode and returns to privileged EXEC mode.

Verifying That MoFRR Is Enabled

Perform these steps to verify the configuration of MoFRR.

SUMMARY STEPS

1. **enable**
2. **show ip rpf** [**vrf vrf-name**] **source-address** [**group-address**] [**rd route-distinguisher**]} [**metric**]
3. **show ip mroute** [**vrf** *vrf-name*] [[**active** [*kbps*] [**interface** *type number*] | **bidirectional** | **count** [**terse**] | **dense** | **interface** *type number* | **proxy** | **pruned** | **sparse** | **ssm** | **static** | **summary**] | [*group-address* [*source-address*]] [**count** [*terse*] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*source-address group-address*] [**count** [**terse**] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*group-address*] **active** [*kbps*] [**interface** *type number* | **verbose**]]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip rpf** [**vrf vrf-name**] **source-address** [**group-address**] [**rd route-distinguisher**]} [**metric**] **Example:** `Device# show ip rpf 10.1.1.100`	Displays the information that IP multicast routing uses to perform the Reverse Path Forwarding (RPF) check for a multicast source. **Note** The MoFRR keyword will be displayed in the command output for MoFRR-enabled routes.
Step 3	**show ip mroute** [**vrf** *vrf-name*] [[**active** [*kbps*] [**interface** *type number*]	**bidirectional**	**count** [**terse**]	**dense**	**interface** *type number*	**proxy**	**pruned**	**sparse**	**ssm**	**static**	**summary**]	[*group-address* [*source-address*]] [**count** [*terse*]	**interface** *type number*	**proxy**	**pruned**	**summary**]	[*source-address group-address*] [**count** [**terse**]	**interface** *type number*	**proxy**	**pruned**	**summary**]	[*group-address*] **active** [*kbps*] [**interface** *type number*	**verbose**]] **Example:** `Device# show ip mroute`	Displays the contents of the multicast routing (mroute) table. **Note** The MoFRR keyword will be displayed in the command output for MoFRR-enabled routes.

Configuration Examples for MoFRR

Example Enabling MoFRR

This example shows MoFRR being enabled for the S, G matching ACL 125.

```
Device> enable
Device# configure terminal
Device(config)# ip multicast-routing vrf2
Device(config)# interface fastethernet 0/0
Device(config-if)# ip address 209.165.200.225 0.0.0.0
Device(config-if)# ip pim sparse-dense-mode
Device(config-if)# exit
Device(config)# ip multicast rpf mofrr 125
Device(config)# ip access-list
extended 125
Device(config-ext-nacl)# permit 209.165.201.1 255.255.255.224
Device(config-ext-nacl)# end
```

Example Verifying That MoFRR Is Enabled

The smaple output in the following example shows that MoFRR is enabled for the 209.165.200.225 multicast source IP address. The relevant command output is shown in bold.

```
device> enable
Device# show ip rpf 209.165.200.225
RPF information for ? (209.165.200.225) MoFRR Enabled
  RPF interface: Ethernet1/4
  RPF neighbor: ? (209.165.201.1)
  RPF route/mask: 255.255.255.224
  RPF type: unicast (ospf 200)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
  Secondary RPF interface: Ethernet1/3
  Secondary RPF neighbor: ? (209.165.202.129)
```

For a detailed explanation of the output, see the **show ip rpf** command in the *Cisco Ip Multicast Command Reference*.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IP multicast commands: complete command syntax, command mode, defaults, command history, usage guidelines, and examples	*Cisco IOS IP Multicast Command Reference*
Overview of the IP multicast technology area	IP Multicast Technology Overview module

Related Topic	Document Title
Concepts, tasks, and examples for configuring an IP multicast network using PIM	Configuring a Basic IP Multicast module

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.	--

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 and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for MoFRR

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for MoFRR

Feature Name	Releases	Feature Information
MoFRR	Cisco IOS XE Release 3.2S 15.2(3)T 15.1(2)SY	The MoFRR feature provides the ability to minimize packet loss in a network when there is a link or node failure by enhancing, but not changing, multicast routing protocols such as PIM. With MoFRR, multicast routing protocols do not have to wait or depend on unicast routing protocols to detect network failures. The following commands were introduced or modified: **ip access-list, ip multicast rpf mofrr, ip multicast-routing, permit (IP), show ip mroute, show ip rpf** .