Implementing Multicast Service Reflection

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

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for Multicast Service Reflection" section on page 12.

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Prerequisites for Implementing Multicast Service Reflection

The following prerequisites apply to implementing multicast service reflection:

- Because virtual interface (Vif1) handling of replicated packets to the multicast code is done in the same switching context as the one in which it receives the initial packet, you must enable the **ip mroute-cache** command to avoid process switching.
- 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 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

The following restrictions apply to implementing multicast services 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 Source Specific Multicast, 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, 192.168.1.2, 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 multicast services reflection feature is implemented only in the fast switching path. There is no hardware support.

Information About Implementing Multicast Service Reflection

To implement multicast service reflection, you should understand the following concepts:

Benefits of Using Multicast Service Reflection

- Users can translate externally received multicast destination addresses to addresses that conform to their company's internal addressing policy.

- Provides logical separation between private and public multicast networks.
- Provides the flexibility to forward multicast packets—translate 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.
- Users can 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, sources must send their traffic to the RP. This traffic is then forwarded to receivers down a shared distribution tree. By default, when the first hop router of the receiver learns about the source, it will send a Join message directly to the source, creating a source-based distribution tree from the source to the receiver. This source tree does not include the RP unless the RP is located within the shortest path between the source and receiver.

In most cases, the placement of the RP in the network is not a complex decision. By default, the RP is needed only to start new sessions with sources and receivers. Consequently, the RP experiences little overhead from traffic flow or processing. In PIM version 2, the RP performs less processing than in PIM version 1 because sources must register only periodically with the RP to create state.

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 included in the routing protocol updates (RIP, OSPF, and so on).

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

The 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), the IP reflect service is not integrated into IP multicast routing. When a packet is forwarded to the Vif1 interface, the packet's source IP address is changed to the IP address of the Vif subnet thereby preventing RPF failures. Finally, the destination IP address is translated to the new multicast group. Additionally, the original multicast packet can be forwarded untranslated through the router. For example, users that have not yet moved to the new multicast group can still receive the untranslated stream.

Each configured multicast service reflection line 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 acts like a "sink" or 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 acts like a Designated Router (DR) for the source 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. There is no hard limit to the number of multicast service reflection statements you can configure under the Vif1 interface.

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.

General Configuration Procedure for Implementing Multicast Service Reflection

To implement multicast service reflection, you would complete the following procedure:

1. Identify the multicast groups to be translated.
2. On the Vif1 interface, statically configure an IGMP join to the service provider multicast group(s).
3. Configure the IP reflect service application to translate the destination addresses in the content provider's multicast group into a pool of multicast addresses that can be used in your PIM domain, and define a new source for those addresses.
4. Advertise the newly created source address to your interior gateway protocol (OSPF, IS-IS, EIGRP, and so on).

How to Implement Multicast Service Reflection

This section contains the following task:

- Configuring Multicast Service Reflection, page 5

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** *type number*
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.
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** *type number* **Example:** `Router(config)# interface Vif1`	Enters interface configuration mode for the specified interface type and number. • The Vif1 interface is the virtual interface for multicast service reflection.
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.

	Command or Action	Purpose
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, where they are handled like any other packets arriving from an interface.
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, or to statically forward for a multicast group onto the interface.

Step 14	`end`
	
	Example:
	`Router(config-if)# end`
		Exits interface configuration mode, and returns to privileged EXEC mode.

Configuration Examples for Multicast Service Reflection

This section contains the following example:

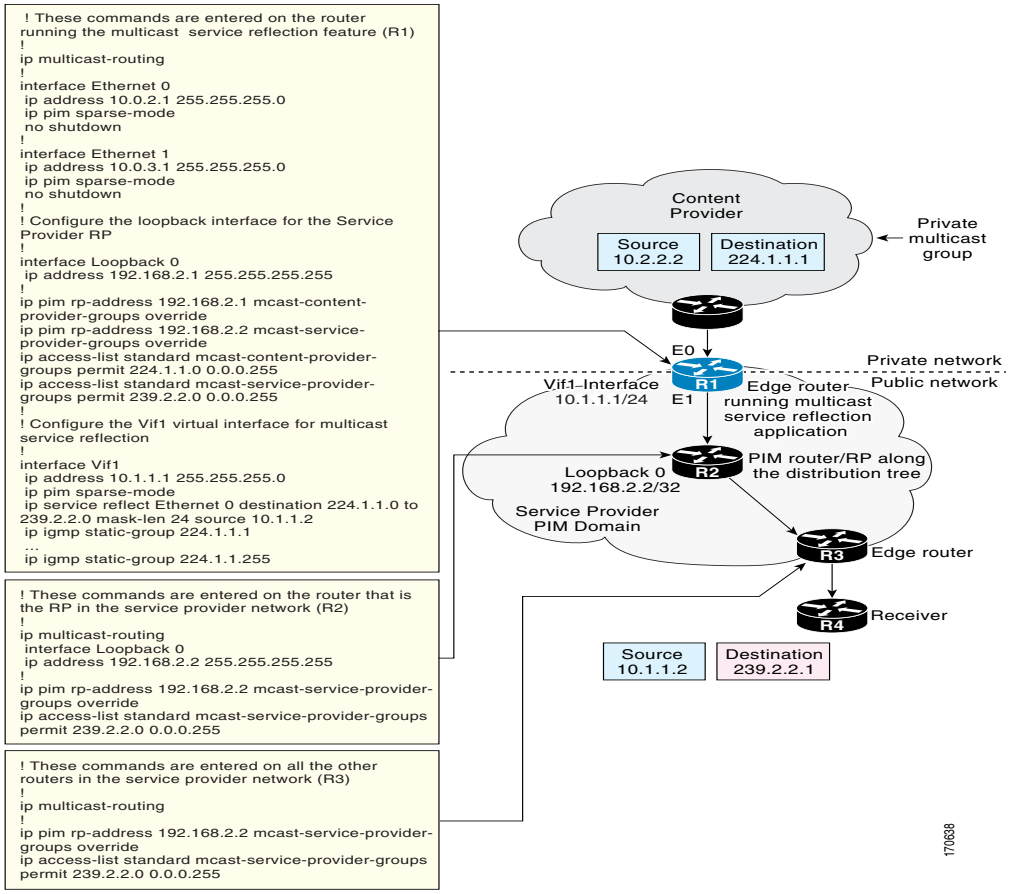
• Multicast Service Reflection in a Service Provider Network: Example, page 7

Multicast Service Reflection in a Service Provider Network: Example

The following example shows how to implement multicast service reflection in a service provider network.

This example uses the topology illustrated in Figure 1.

Figure 1 Multicast Service Reflection 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. 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 address range.

Router R3 is another edge router in the service provider's PIM domain.

```
! Enter these commands on the router running the multicast service reflection application
(R1 in Figure 1)
!
configure terminal
ip multicast-routing
interface Ethernet 0
ip address 10.0.2.1 255.255.255.0
ip pim sparse-mode
no shutdown
!
interface Ethernet 1
ip address 10.0.3.1 255.255.255.0
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 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 224.1.1.1
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 in
Figure 1)
!
ip multicast-routing
interface loopback 0
ip address 192.168.2.2 255.255.255.255
!
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 in
Figure 1)
!
ip multicast-routing
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
!
```

Additional References

The following sections provide references related to the Multicast Service Reflection feature.

Related Documents

Related Topic	Document Title
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 IOS 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 Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and technical documentation. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Glossary

distribution tree—Multicast traffic flows from the source to the multicast group over a distribution tree that connects all of the sources to all of the receivers in the group. This tree may be shared by all sources (a shared tree), or a separate distribution tree can be built for each source (a source tree). The shared tree may be one-way or bidirectional.

multicast—A routing technique that allows IP traffic to be sent from one source or multiple sources and delivered to multiple destinations. Instead of sending individual packets to each destination, a single packet is sent to a group of destinations known as a multicast group, which is identified by a single IP destination group address. Multicast addressing supports the transmission of a single IP datagram to multiple hosts.

Protocol Independent Multicast (PIM)—A multicast routing architecture defined by the IETF that enables IP multicast routing on existing IP networks. Its key point is its independence from any underlying unicast protocol such as OSPF or BGP.

rendezvous point (RP)—The multicast router that is the root of the PIM-SM shared multicast distribution tree.

source tree—A multicast distribution path that directly connects the source's and receivers' designated router (or the rendezvous point) to obtain the shortest path through the network. This results in most efficient routing of data between source and receivers, but may result in unnecessary data duplication throughout the network if built by anything other than the RP.

unicast—Point-to-point transmission requiring the source to send an individual copy of a message to each requester.

Feature Information for Multicast Service Reflection

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

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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 Multicast Service Reflection

Feature Name	Releases	Feature Information
Multicast Service Reflection	12.4(4)T	The Multicast Service Reflection feature allows you translate externally received multicast destination addresses to addresses that conform to an organization's internal addressing policy. Using this feature, users do not need to redistribute routes at the translation boundary into their network infrastructure for Reverse Path Forwarding (RPF) to work properly, and users can receive identical feeds from two ingress points in the network and route them independently. The following sections provide information about this feature: • Multicast Service Reflection Application, page 4 • Configuring Multicast Service Reflection, page 5 The following command was introduced by this feature: **ip service reflect.**

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