Configuring Basic IP Multicast

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IP multicast is a bandwidth-conserving technology that reduces traffic by delivering a single stream of information simultaneously to potentially thousands of corporate businesses and homes. Applications that take advantage of multicast include video conferencing, corporate communications, distance learning, and distribution of software, stock quotes, and news. This module describes the tasks used to configure basic IP multicast.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see 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 at the end of this document.

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

Prerequisites for Configuring Basic IP Multicast

- Before performing the tasks in this module, you should be familiar with the concepts explained in the "IP Multicast Technology Overview" module.
- To determine which of the tasks contained in this module you will have to perform, you must decide which Protocol Independent Multicast (PIM) mode will be used. This determination is based on the applications you intend to support on your network.

- All access lists you intend to use with the tasks in this module should be configured prior to beginning the configuration task. For information about how to configure an access list, see the " Creating an IP Access List and Applying It to an Interface " module.

Information About Configuring Basic IP Multicast

Auto-RP Overview

The Role of Auto-RP in a PIM Network

Auto-RP automates the distribution of group-to-rendezvous point (RP) mappings in a PIM network. To make Auto-RP work, a router must be designated as an RP mapping agent, which receives the RP announcement messages from the RPs and arbitrates conflicts. The RP mapping agent then sends the consistent group-to-RP mappings to all other routers by way of dense mode flooding.
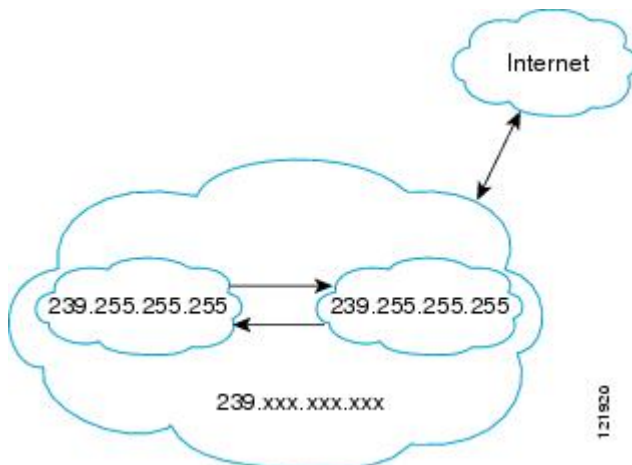
Thus, all routers automatically discover which RP to use for the groups they support. The Internet Assigned Numbers Authority (IANA) has assigned two group addresses, 224.0.1.39 and 224.0.1.40, for Auto-RP.

The mapping agent receives announcements of intention to become the RP from Candidate-RPs. The mapping agent then announces the winner of the RP election. This announcement is made independently of the decisions by the other mapping agents.

IP Multicast Boundary

As shown in the figure, address scoping defines domain boundaries so that domains with RPs that have the same IP address do not leak into each other. Scoping is performed on the subnet boundaries within large domains and on the boundaries between the domain and the Internet.

Figure 1   *Address Scoping at Boundaries*

You can set up an administratively scoped boundary on an interface for multicast group addresses using the **ip multicast boundary** command with the *access-list* argument. A standard access list defines the range of addresses affected. When a boundary is set up, no multicast data packets are allowed to flow across the boundary from either direction. The boundary allows the same multicast group address to be reused in different administrative domains.

The Internet Assigned Numbers Authority (IANA) has designated the multicast address range 239.0.0.0 to 239.255.255.255 as the administratively scoped addresses. This range of addresses can be reused in domains administered by different organizations. They would be considered local, not globally unique.

You can configure the **filter-autorp** keyword to examine and filter Auto-RP discovery and announcement messages at the administratively scoped boundary. Any Auto-RP group range announcements from the Auto-RP packets that are denied by the boundary access control list (ACL) are removed. An Auto-RP group range announcement is permitted and passed by the boundary only if all addresses in the Auto-RP group range are permitted by the boundary ACL. If any address is not permitted, the entire group range is filtered and removed from the Auto-RP message before the Auto-RP message is forwarded.

Benefits of Auto-RP in a PIM Network

- Auto-RP allows any change to the RP designation to be configured only on the routers that are RPs, not on the leaf routers.
- Auto-RP offers the ability to scope the RP address within a domain. Scoping can be achieved by using the **ip multicast boundary** command with the **filter-autorp** keyword.

Anycast RP Overview

Anycast RP is a useful application of MSDP. Originally developed for interdomain multicast applications, MSDP used for Anycast RP is an intradomain feature that provides redundancy and load-sharing capabilities. Enterprise customers typically use Anycast RP for configuring a Protocol Independent Multicast sparse mode (PIM-SM) network to meet fault tolerance requirements within a single multicast domain.

In anycast RP, two or more RPs are configured with the same IP address on loopback interfaces. The anycast RP loopback address should be configured with a 32-bit mask, making it a host address. All the downstream routers should be configured so that the anycast RP loopback address is the IP address of their local RP. IP routing will automatically select the topologically closest RP for each source and receiver. Assuming that the sources are evenly spaced around the network, an equal number of sources will register with each RP. That is, the process of registering the sources will be shared equally by all the RPs in the network.

Because a source may register with one RP and receivers may join to a different RP, a method is needed for the RPs to exchange information about active sources. This information exchange is done with MSDP.

In anycast RP, all the RPs are configured to be MSDP peers of each other. When a source registers with one RP, an SA message will be sent to the other RPs informing them that there is an active source for a particular multicast group. The result is that each RP will know about the active sources in the area of the other RPs. If any of the RPs were to fail, IP routing would converge, and one of the RPs would become the active RP in more than one area. New sources would register with the backup RP. Receivers would join the new RP and connectivity would be maintained.

The RP is normally needed only to start new sessions with sources and receivers. The RP facilitates the shared tree so that sources and receivers can establish a direct multicast data flow. If a multicast data flow is already established between a source and the receiver, an RP failure will not affect that session. Anycast RP ensures that new sessions with sources and receivers can begin at any time.

BSR Overview

BSR Election and Functionality

PIM uses the BSR to discover and announce RP-set information for each group prefix to all the routers in a PIM domain. This is the same function performed by Auto-RP, but the BSR is part of the PIM Version 2 specification. The BSR mechanism interoperates with Auto-RP on Cisco routers.

To avoid a single point of failure, you can configure several candidate BSRs in a PIM domain. A BSR is elected among the candidate BSRs automatically; they use bootstrap messages to discover which BSR has the highest priority. This router then announces to all PIM routers in the PIM domain that it is the BSR.

Following the election of the BSR, candidate RPs use unicast to announce to the BSR their willingness to be the RP. The BSR advertises the entire group-to-RP mapping set to the router link local address 224.0.0.13. Unlike the RP mapping agent in Auto-RP, which is used by Auto-RP to select the RP, every router in the BSR network is responsible for selecting the RP.

BSR lacks the ability to scope RP advertisements; however, BSR is used when vendor interoperability or open standard adherence is a requirement.

BSR Border Interface

A border interface in a PIM sparse mode domain requires precautions to prevent exchange of certain traffic with a neighboring domain reachable through that interface, especially if that domain is also running PIM sparse mode. BSR and Auto-RP messages should not be exchanged between different domains, because routers in one domain may elect RPs in the other domain, resulting in protocol malfunction or loss of isolation between the domains. Configure a BSR border interface to prevent BSR messages from being sent or received through an interface.

Static RP Overview

If you are configuring PIM sparse mode, you must configure a PIM RP for a multicast group. An RP can either be configured statically in each device, or learned through a dynamic mechanism. This task explains how to statically configure an RP, as opposed to the router learning the RP through a dynamic mechanism such as Auto-RP.

PIM designated routers (DRs) forward data from directly connected multicast sources to the RP for distribution down the shared tree. Data is forwarded to the RP in one of two ways. It is encapsulated in register packets and unicast directly to the RP, or, if the RP has itself joined the source tree, it is multicast forwarded per the RPF forwarding algorithm. Last hop routers directly connected to receivers may, at their discretion, join themselves to the source tree and prune themselves from the shared tree.

A single RP can be configured for multiple groups that are defined by an access list. If no RP is configured for a group, the router treats the group as dense using the PIM dense mode techniques. (You can prevent this occurrence by configuring the **no ip pim dm-fallback**command.)

If dynamic and static group-to-RP mappings are used together and there is an RP address conflict, the RP address configured for a static group-to-RP mapping (with the **ip pim rp-address override**command) will take precedence.

> **Note** If the **override** keyword is not specified and there is RP address conflict, dynamic group-to-RP mappings will take precedence over static group-to-RP mappings.

Bidir-PIM Overview

Bidir-PIM shares many of its shortest path tree (SPT) operations with PIM-SM. Bidir-PIM also has unconditional forwarding of source traffic toward the RP upstream on the shared tree, but has no registering process for sources as in PIM-SM. These modifications allow forwarding of traffic in all routers based solely on the (*, G) multicast routing entries. This form of forwarding eliminates any source-specific state and allows scaling capability to an arbitrary number of sources.

Multicast Group Modes

In PIM, packet traffic for a multicast group is routed according to the rules of the mode configured for that multicast group. The Cisco implementation of PIM supports four modes for a multicast group:

- PIM bidirectional mode
- PIM dense mode
- PIM sparse mode
- PIM Source Specific Mode (SSM)

A router can simultaneously support all four modes or any combination of them for different multicast groups.
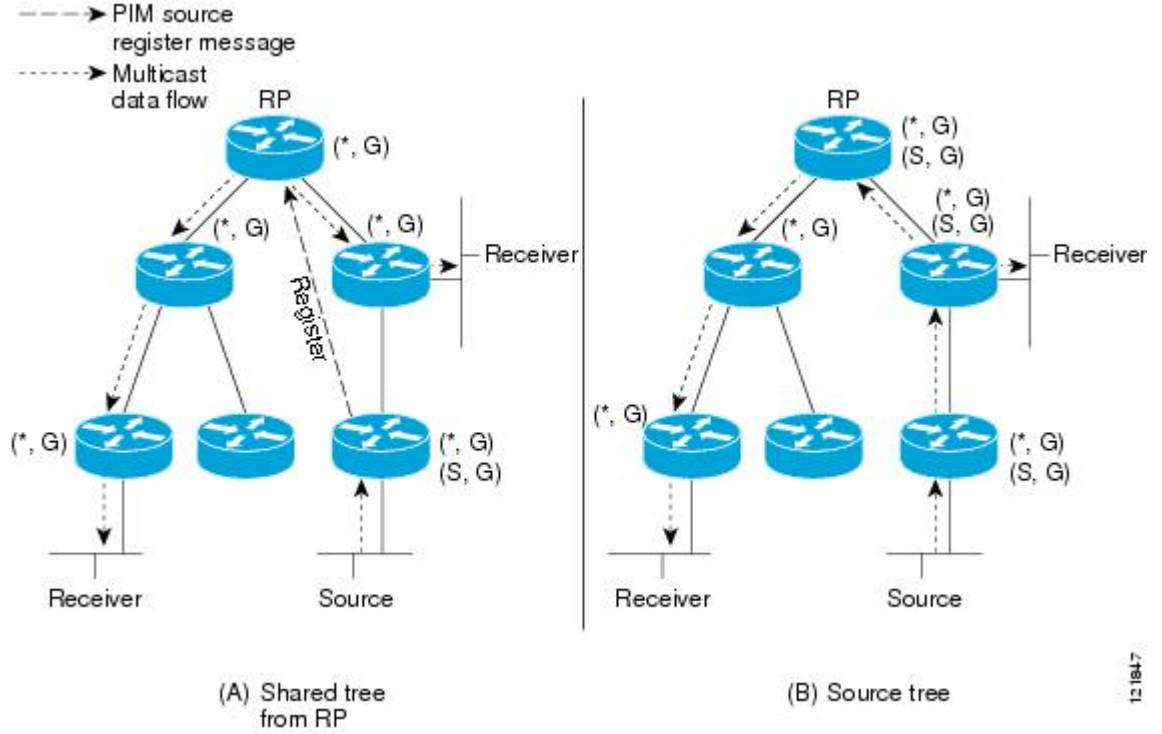
Bidirectional Shared Tree

In bidirectional mode, traffic is routed only along a bidirectional shared tree that is rooted at the rendezvous point (RP) for the group. In bidir-PIM, the IP address of the RP acts as the key to having all routers establish a loop-free spanning tree topology rooted in that IP address. This IP address need not be a router, but can be any unassigned IP address on a network that is reachable throughout the PIM domain. This technique is the preferred configuration method for establishing a redundant RP configuration for bidir-PIM.
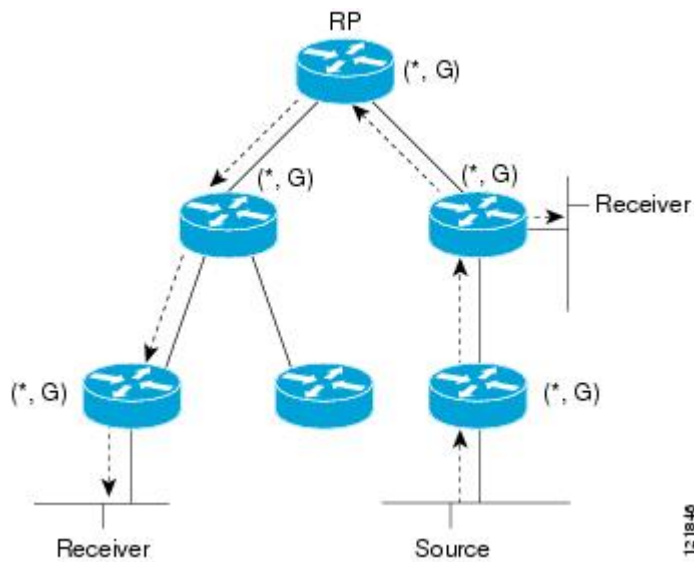
Membership in a bidirectional group is signaled by way of explicit Join messages. Traffic from sources is unconditionally sent up the shared tree toward the RP and passed down the tree toward the receivers on each branch of the tree.

The figures below show the difference in state created per router for a unidirectional shared tree and source tree versus a bidirectional shared tree.

Figure 2 **Unidirectional Shared Tree and Source Tree**

(A) Shared tree from RP

(B) Source tree

Figure 3 **Bidirectional Shared Tree**

For packets that are forwarded downstream from the RP toward receivers, there are no fundamental differences between bidir-PIM and PIM-SM. Bidir-PIM deviates substantially from PIM-SM for traffic that is passed from sources upstream toward the RP.

PIM-SM cannot forward traffic in the upstream direction of a tree because it accepts traffic from only one Reverse Path Forwarding (RPF) interface. This interface (for the shared tree) points toward the RP, thus allowing only downstream traffic flow. Upstream traffic is first encapsulated into unicast register messages, which are passed from the designated router (DR) of the source toward the RP. Second, the RP joins an SPT that is rooted at the source. Therefore, in PIM-SM, traffic from sources destined for the RP does not flow upstream in the shared tree, but downstream along the SPT of the source until it reaches the RP. From the RP, traffic flows along the shared tree toward all receivers.

In bidir-PIM, the packet-forwarding rules have been improved over PIM-SM, allowing traffic to be passed up the shared tree toward the RP. To avoid multicast packet looping, bidir-PIM introduces a new mechanism called designated forwarder (DF) election, which establishes a loop-free SPT rooted at the RP.

DF Election

On every network segment and point-to-point link, all PIM routers participate in a procedure called designated forwarder (DF) election. The procedure selects one router as the DF for every RP of bidirectional groups. This router is responsible for forwarding multicast packets received on that network.

The DF election is based on unicast routing metrics. The router with the most preferred unicast routing metric to the RP becomes the DF. Use of this method ensures that only one copy of every packet will be sent to the RP, even if there are parallel equal-cost paths to the RP.

A DF is selected for every RP of bidirectional groups. As a result, multiple routers may be elected as DF on any network segment, one for each RP. Any particular router may be elected as DF on more than one interface.

Bidirectional Group Tree Building

The procedure for joining the shared tree of a bidirectional group is almost identical to that used in PIM-SM. One main difference is that, for bidirectional groups, the role of the DR is assumed by the DF for the RP.

On a network that has local receivers, only the router elected as the DF populates the outgoing interface list (olist) upon receiving Internet Group Management Protocol (IGMP) Join messages, and sends (*, G) Join and Leave messages upstream toward the RP. When a downstream router wishes to join the shared tree, the RPF neighbor in the PIM Join and Leave messages is always the DF elected for the interface that lead to the RP.

When a router receives a Join or Leave message, and the router is not the DF for the receiving interface, the message is ignored. Otherwise, the router updates the shared tree in the same way as in sparse mode.

In a network where all routers support bidirectional shared trees, (S, G) Join and Leave messages are ignored. There is also no need to send PIM assert messages because the DF election procedure eliminates parallel downstream paths from any RP. An RP never joins a path back to the source, nor will it send any register stops.

Packet Forwarding

A router creates (*, G) entries only for bidirectional groups. The olist of a (*, G) entry includes all the interfaces for which the router has been elected DF and that have received either an IGMP or PIM Join message. If a router is located on a sender-only branch, it will also create a (*, G) state, but the olist will not include any interfaces.

If a packet is received from the RPF interface toward the RP, the packet is forwarded downstream according to the olist of the (*, G) entry. Otherwise, only the router that is the DF for the receiving interface forwards the packet upstream toward the RP; all other routers must discard the packet.

Benefits of Bidirectional PIM

- Bidir-PIM removes the performance cost of maintaining a routing state table for a large number of sources.
- Bidir-PIM is designed to be used for many-to-many applications within individual PIM domains. Multicast groups in bidirectional PIM mode can scale to an arbitrary number of sources without incurring overhead due to the number of sources.

How to Configure Basic IP Multicast

The tasks described in this section configure the basic IP multicast modes. No single task in this section is required; however, at least one of the tasks must be performed to configure IP multicast in a network. More than one of the tasks may be needed.

Configuring Sparse Mode with Auto-RP

This section contains information about and instructions on how to configure auto-rendezvous point (Auto-RP). Auto-RP can also be optionally used with anycast RP.

Note The simultaneous deployment of Auto-RP and bootstrap router (BSR) is not supported.

- When configuring Auto-RP, you must either configure the Auto-RP listener feature using the **ip pim autorp listener** command (Step 5) and specify sparse mode using the **ip pim sparse-mode** command (Step 7) or specify sparse-dense mode (Step 8) using the **ip pim sparse-dense mode** command.

Note When you configure sparse-dense mode, dense mode failover may result in a network dense-mode flood. To avoid this condition, use PIM sparse mode with the Auto-RP listener feature.

- An interface configured in sparse-dense mode is treated in either sparse mode or dense mode of operation, depending on the mode in which the multicast group operates. You must decide how to configure your interfaces.
- All access lists that are needed when Auto-RP is configured should be configured prior to beginning the configuration task. For information about how to configure an access list, see the " Creating an IP Access List and Applying It to an Interface " module.
- If a group has no known RP and the interface is configured to be sparse-dense mode, the interface is treated as if it were in dense mode, and data is flooded over the interface. To avoid this data flooding,

configure the Auto-RP listener using the **ip pim autorp listener** command and then configure the interface as sparse mode using the **ip pim sparse mode** command.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **ip multicast-routing** [**distributed**]

4. Either perform Steps 5 through 7 or perform Steps 6 and 8.

5. **ip pim autorp listener**

6. **interface** *type number*

7. **ip pim sparse-mode**

8. **ip pim sparse-dense-mode**

9. **exit**

10. Repeat Steps 1 through 9 on all PIM interfaces.

11. **ip pim send-rp-announce** {*interface-type interface-number* | *ip-address*} **scope** *ttl-value* [**group-list** *access-list*] [**interval** *seconds*] [**bidir**]

12. **ip pim send-rp-discovery** [*interface-type interface-number*] **scope** *ttl-value* [**interval** *seconds*]

13. **ip pim rp-announce-filter rp-list** *access-list* **group-list** *access-list*

14. **no ip pim dm-fallback**

15. **interface** *type number*

16. **ip multicast boundary** *access-list* [**filter-autorp**]

17. **end**

18. **show ip pim autorp**

19. **show ip pim rp** [**mapping**] [*rp-address*]

20. **show ip igmp groups** [*group-name* | *group-address* | *interface-type interface-number*] [**detail**]

21. **show ip mroute** [*group-address* | *group-name*] [*source-address* | *source-name*] [*interface-type interface-number*] [**summary**] [**count**] [**active** *kbps*]

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-routing** [**distributed**] **Example:** Router(config)# ip multicast-routing	Enables IP multicast routing. • Use the **distributed** keyword to enabled Multicast Distributed Switching.
Step 4	Either perform Steps 5 through 7 or perform Steps 6 and 8.	--
Step 5	**ip pim autorp listener** **Example:** Router(config)# ip pim autorp listener	Causes IP multicast traffic for the two Auto-RP groups 224.0.1.39 and 224.0.1.40 to be PIM dense mode flooded across interfaces operating in PIM sparse mode. • Skip this step if you are configuring sparse-dense mode in Step 8.
Step 6	**interface** *type number* **Example:** Router(config)# interface Gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 7	**ip pim sparse-mode** **Example:** Router(config-if)# ip pim sparse-mode	Enables PIM sparse mode on an interface. When configuring Auto-RP in sparse mode, you must also configure the Auto-RP listener in the next step. • Skip this step if you are configuring sparse-dense mode in Step 8.
Step 8	**ip pim sparse-dense-mode** **Example:** Router(config-if)# ip pim sparse-dense-mode	Enables PIM sparse-dense mode on an interface. • Skip this step if you configured sparse mode in Step 7.
Step 9	**exit** **Example:** Router(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 10	Repeat Steps 1 through 9 on all PIM interfaces.	--

Command or Action	Purpose
Step 11 **ip pim send-rp-announce** {*interface-type interface-number* | *ip-address*} **scope** *ttl-value* [**group-list** *access-list*] [**interval** *seconds*] [**bidir**] **Example:** `Router(config)# ip pim send-rp-announce loopback0 scope 31 group-list 5`	Sends RP announcements out all PIM-enabled interfaces. • Perform this step on the RP router only. • Use the *interface-type* and *interface-number* arguments to define which IP address is to be used as the RP address. • Use the *ip-address* argument to specify a directly connected IP address as the RP address. **Note** If the *ip-address* argument is configured for this command, the RP-announce message will be sourced by the interface to which this IP address is connected (that is, the source address in the IP header of the RP-announce message is the IP address of that interface). • This example shows that the interface is enabled with a maximum of 31 hops. The IP address by which the router wants to be identified as RP is the IP address associated with loopback interface 0. Access list 5 describes the groups for which this router serves as RP.
Step 12 **ip pim send-rp-discovery** [*interface-type interface-number*] **scope** *ttl-value* [**interval** *seconds*] **Example:** `Router(config)# ip pim send-rp-discovery loopback 1 scope 31`	Configures the router to be an RP mapping agent. • Perform this step on RP mapping agent routers or on combined RP/RP mapping agent routers. **Note** Auto-RP allows the RP function to run separately on one router and the RP mapping agent to run on one or multiple routers. It is possible to deploy the RP and the RP mapping agent on a combined RP/RP mapping agent router. • Use the optional *interface-type* and *interface-number* arguments to define which IP address is to be used as the source address of the RP mapping agent. • Use the **scope** keyword and *ttl-value* argument to specify the Time-to-Live (TTL) value in the IP header of Auto-RP discovery messages. • Use the optional **interval** keyword and *seconds* argument to specify the interval at which Auto-RP discovery messages are sent. **Note** Lowering the interval at which Auto-RP discovery messages are sent from the default value of 60 seconds results in more frequent floodings of the group-to-RP mappings. In some network environments, the disadvantages of lowering the interval (more control packet overhead) may outweigh the advantages (more frequent group-to-RP mapping updates). • The example shows limiting the Auto-RP discovery messages to 31 hops on loopback interface 1.

Command or Action	Purpose
Step 13 **ip pim rp-announce-filter rp-list** *access-list* **group-list** *access-list* **Example:** `Router(config)# ip pim rp-announce-filter rp-list 1 group-list 2`	Filters incoming RP announcement messages sent from candidate RPs (C-RPs) to the RP mapping agent. • Perform this step on the RP mapping agent only.
Step 14 **no ip pim dm-fallback** **Example:** `Router(config)# no ip pim dm-fallback`	(Optional) Prevents PIM dense mode fallback. • Skip this step if all interfaces have been configured to operate in PIM sparse mode. **Note** The **no ip pim dm-fallback** command behavior is enabled by default if all the interfaces are configured to operate in PIM sparse mode (using the **ip pim sparse-mode** command).
Step 15 **interface** *type number* **Example:** `Router(config)# interface gigabitethernet 1/0/0`	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 16 **ip multicast boundary** *access-list* [**filter-autorp**] **Example:** `Router(config-if)# ip multicast boundary 10 filter-autorp`	Configures an administratively scoped boundary. • Perform this step on the interfaces that are boundaries to other routers. • The access list is not shown in this task. • An access list entry that uses the **deny** keyword creates a multicast boundary for packets that match that entry.
Step 17 **end** **Example:** `Router(config-if)# end`	Returns to global configuration mode.
Step 18 **show ip pim autorp** **Example:** `Router# show ip pim autorp`	(Optional) Displays the Auto-RP information.

Command or Action	Purpose
Step 19 **show ip pim rp** [**mapping**] [*rp-address*] **Example:** `Router# show ip pim rp mapping`	(Optional) Displays RPs known in the network and shows how the router learned about each RP.
Step 20 **show ip igmp groups** [*group-name* | *group-address*| *interface-type interface-number*] [**detail**] **Example:** `Router# show ip igmp groups`	(Optional) Displays the multicast groups having receivers that are directly connected to the router and that were learned through Internet Group Management Protocol (IGMP). • A receiver must be active on the network at the time that this command is issued in order for receiver information to be present on the resulting display.
Step 21 **show ip mroute** [*group-address* | *group-name*] [*source-address* | *source-name*] [*interface-type interface-number*] [**summary**] [**count**] [**active kbps**] **Example:** `Router# show ip mroute cbone-audio`	(Optional) Displays the contents of the IP multicast routing (mroute) table.

• What to Do Next, page 13

What to Do Next

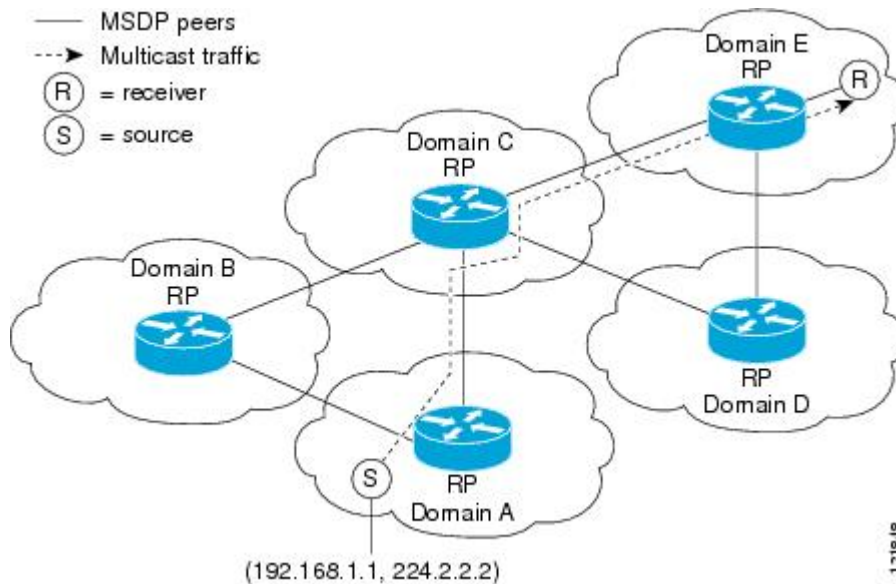Proceed to the " Verifying IP Multicast Operation " module.

Configuring Sparse Mode with Anycast RP

This section describes how to configure sparse mode with anycast RP for RP redundancy.

Anycast RPs are configured statically, and interfaces are configured to operate in Protocol Independent Multicast-Sparse Mode (PIM-SM). In an anycast RP configuration, two or more RPs are configured with the same IP address on loopback interfaces. The Anycast RP loopback address should be configured with a 32-bit mask, making it a host address. An Anycast RP configuration is easy to configure and troubleshoot because the same host address is used as the RP address regardless of which router it is configured on.

Anycast RP allows two or more rendezvous points (RPs) to share the load for source registration and have the ability to act as hot backup routers for each other. Multicast Source Discovery Protocol (MSDP) is the key protocol that makes anycast RP possible.

Figure 4   MSDP Sharing Source Information Between RPs in Each Domain

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **interface** *type number*
5. **ip pim sparse-mode**
6. **ip pim rp-address** *rp-address*
7. Repeat Steps 1 through 6 on two or more routers assigning the same RP address to each.
8. **interface loopback** [*interface-number*] **ip address** [*ip-address*] [*mask*]
9. **interface loopback** [*interface-number*] **ip address** [*ip-address*] [*mask*]
10. **exit**
11. **ip msdp peer** {*peer-name* | *peer-address*} [**connect-source** *interface-type* **interface-number**] [**remote-as** *as-number*]
12. **ip msdp originator-id loopback** [*interface*]
13. Repeat Steps 8 through 12 on the redundant RPs.

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 Multicast Distributed Switching.
Step 4	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 5	**ip pim sparse-mode** **Example:** Router(config-if)# ip pim sparse-mode	Enables sparse mode.
Step 6	**ip pim rp-address** *rp-address* **Example:** Router(config-if)# ip pim rp-address 10.0.0.1	Configures the address of a PIM RP for a particular group.
Step 7	Repeat Steps 1 through 6 on two or more routers assigning the same RP address to each.	--

	Command or Action	Purpose

Step 8	**interface loopback** [*interface-number*] **ip address** [*ip-address*] [*mask*]
	
	Example:
	
	`Router(config-if)# interface loopback 0`
	
	Example:
	
	`ip address 10.0.0.1 255.255.255.255`
		Configures the interface loopback IP address for the RP router.
		
		• Perform this step on the RP routers.

Step 9	**interface loopback** [*interface-number*] **ip address** [*ip-address*] [*mask*]
	
	Example:
	
	`Router(config-if)# interface loopback 1`
	
	Example:
	
	`ip address 10.1.1.1 255.255.255.255`
		Configures the interface loopback IP address for MSDP peering.

Step 10	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 11	**ip msdp peer** {*peer-name* | *peer-address*} [**connect-source** *interface-type* **interface-number**] [**remote-as** *as-number*] **Example:** `Router(config)# ip msdp peer 10.1.1.2 connect-source loopback 1`	Configures an MSDP peer. • Perform this step on the RP routers.
Step 12	**ip msdp originator-id loopback** [*interface*] **Example:** `Router(config)# ip msdp originator-id loopback 1`	Allows an MSDP speaker that originates a SA message to use the IP address of the interface as the RP address in the SA message. • Perform this step on the RP routers.
Step 13	Repeat Steps 8 through 12 on the redundant RPs.	--

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What to Do Next

Proceed to the " Verifying IP Multicast Operation " module.

Configuring Sparse Mode with a Bootstrap Router

This section describes how to configure a bootstrap router (BSR), which provides a fault-tolerant, automated RP discovery and distribution mechanism so that routers learn the group-to-RP mappings dynamically.

Note The simultaneous deployment of Auto-RP and BSR is not supported.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **interface** *type number*
5. **ip pim sparse-mode**
6. **end**
7. Repeat Steps 1 through 6 on every multicast-enabled interface on every router.
8. **ip pim bsr-candidate** *interface-type interface-number* [*hash-mask-length* [*priority*]]
9. **ip pim rp-candidate** *interface-type interface-number* [group-list *access-list*] [**interval** seconds] [**priority** *value*]
10. Repeat Steps 8 through 10 on all RP and BSR routers.
11. **interface** *type number*
12. **ip pim bsr-border**
13. **end**
14. Repeat Steps 11 through 13 on all the routers that have boundary interfaces where the messages should not be sent or received.
15. **show ip pim rp** [**mapping**] [*rp-address*]
16. **show ip pim rp-hash** [*group-address*] [*group-name*]
17. **show ip pim bsr-router**
18. **show ip igmp groups** [*group-name | group-address| interface-type interface-number*] [**detail**]
19. **show ip mroute**

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 Multicast Distributed Switching.
Step 4	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 5	**ip pim sparse-mode** **Example:** Router(config-if)# ip pim sparse-mode	Enables sparse mode.
Step 6	**end** **Example:** Router(config-if)# end	Returns to global configuration mode.
Step 7	Repeat Steps 1 through 6 on every multicast-enabled interface on every router.	--

	Command or Action	Purpose
Step 8	**ip pim bsr-candidate** *interface-type interface-number* [*hash-mask-length* [*priority*]] **Example:** `Router(config)# ip pim bsr-candidate gigibitethernet 0/0/0 0 192`	Configures the router to announce its candidacy as a bootstrap router (BSR). • Perform this step on the RP or on combined RP/BSR routers. **Note** BSR allows the RP function to run separately on one router and the BSR to run on one or multiple routers. It is possible to deploy the RP and the BSR on a combined RP/BSR router. • This command configures the router to send BSR messages to all its PIM neighbors, with the address of the designated interface (configured for the *interface-type* and *interface-number*arguments) as the BSR address. • Use the optional *hash-mask-length* argument to set the length of a mask (32 bits maximum) that is to be ANDed with the group address before the PIMv2 hash function is called. All groups with the same seed hash (correspond) to the same RP. For example, if this value is 24, only the first 24 bits of the group addresses matter. The hash mask length allows one RP to be used for multiple groups. The default hash mask length is 0. • Use the optional *priority* argument (after you set the hash mask length) to specify the priority of the BSR as a C-RP. The priority range is from 0 to 255. The BSR C-RP with the highest priority (the lowest priority value) is preferred. If the priority values are the same, the router with the higher IP address is preferred. The default priority value is 0. **Note** The Cisco IOS and Cisco IOS XE implementation of PIM BSR uses the value 0 as the default priority for candidate RPs and BSRs. This implementation predates the draft-ietf-pim-sm-bsr IETF draft, the first IETF draft to specify 192 as the default priority value. The Cisco IOS and Cisco IOS XE implementation, thus, deviates from the IETF draft. To comply with the default priority value specified in the draft, you must explicitly set the priority value to 192.

	Command or Action	Purpose
Step 9	**ip pim rp-candidate** *interface-type interface-number* [group-list *access-list*] [**interval** seconds] [**priority** *value*] **Example:** Router(config)# ip pim rp-candidate gigabitethernet 2/0/0 group-list 4 priority 192	Configures the router to advertise itself as a PIM Version 2 candidate RP to the BSR. • Perform this step on the RP or on combined RP/BSR routers. **Note** BSR allows the RP function to run separately on one router and the BSR to run on one or multiple routers. It is possible to deploy the RP and the BSR on a combined RP/BSR router. • When an interval is specified, the candidate RP advertisement interval is set to the number of seconds specified. The default interval is 60 seconds. Tuning this interval down can reduce the time required to fail over to a secondary RP at the expense of generating more PIMv2 messages. • The Cisco IOS and Cisco IOS XE implementation of PIM BSR selects an RP from a set of candidate RPs using a method that is incompatible with the specification in RFC 2362. See the BSR and RFC 2362 Interoperable Candidate RP Example, page 29 section for a configuration workaround. See CSCdy56806 using the Cisco Bug Toolkit for more information. **Note** The Cisco IOS and Cisco IOS XE implementation of PIM BSR uses the value 0 as the default priority for candidate RPs and BSRs. This implementation predates the draft-ietf-pim-sm-bsr IETF draft, the first IETF draft to specify 192 as the default priority value. The Cisco IOS and Cisco IOS XE implementation, thus, deviates from the IETF draft. To comply with the default priority value specified in the draft, you must explicitly set the priority value to 192.
Step 10	Repeat Steps 8 through 10 on all RP and BSR routers.	--
Step 11	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 12	**ip pim bsr-border** **Example:** Router(config-if)# ip pim bsr-border	Prevents the bootstrap router (BSR) messages from being sent or received through an interface. • See the BSR Border Interface, page 4 section for more information.

	Command or Action	Purpose
Step 13	**end** **Example:** Router(config-if)# end	Ends the current configuration session and returns to privileged EXEC mode.
Step 14	Repeat Steps 11 through 13 on all the routers that have boundary interfaces where the messages should not be sent or received.	--
Step 15	**show ip pim rp** [**mapping**] [*rp-address*] **Example:** Router# show ip pim rp	(Optional) Displays active rendezvous points (RPs) that are cached with associated multicast routing entries.
Step 16	**show ip pim rp-hash** [*group-address*] [*group-name*] **Example:** Router# show ip pim rp-hash 239.1.1.1	(Optional) Displays which rendezvous point (RP) is being selected for a specified group.
Step 17	**show ip pim bsr-router** **Example:** Router# show ip pim bsr-router	(Optional) Displays the bootstrap router (BSR) information.
Step 18	**show ip igmp groups** [*group-name*	*group-address*| *interface-type interface-number*] [**detail**] **Example:** Router# show ip igmp groups	(Optional) Displays the multicast groups having receivers that are directly connected to the router and that were learned through IGMP. • A receiver must be active on the network at the time that this command is issued in order for receiver information to be present on the resulting display.
Step 19	**show ip mroute** **Example:** Router# show ip mroute cbone-audio	(Optional) Displays the contents of the IP mroute table.

• [What to Do Next, page 13](#)

What to Do Next

Proceed to the " Verifying IP Multicast Operation " module.

Configuring Sparse Mode with a Single Static RP

A rendezvous point (RP) is required in networks running Protocol Independent Multicast sparse mode (PIM-SM). In PIM-SM, traffic will be forwarded only to network segments with active receivers that have explicitly requested multicast data.

This section describes how to configure sparse mode with a single static RP.

All access lists that are needed when sparse mode is configured with a single static RP should be configured prior to beginning the configuration task.

Note The same RP address cannot be used for both bidirectional and sparse mode PIM groups.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **interface** *type number*
5. **ip pim sparse-mode**
6. Repeat Steps 1 through 5 on every interface that uses IP multicast.
7. **exit**
8. **ip pim rp-address** *rp-address* [*access-list*] [**override**]
9. **end**
10. **show ip pim rp** [**mapping**] [*rp-address*]
11. **show ip igmp groups** [*group-name | group-address| interface-type interface-number*] [**detail**]
12. **show ip mroute**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
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 Multicast Distributed Switching.
Step 4	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 5	**ip pim sparse-mode** **Example:** Router(config-if)# ip pim sparse-mode	Enables PIM on an interface. You must use sparse mode.
Step 6	Repeat Steps 1 through 5 on every interface that uses IP multicast.	--
Step 7	**exit** **Example:** Router(config-if)# exit	Returns to global configuration mode.

	Command or Action	Purpose

Step 8	**ip pim rp-address** *rp-address* [*access-list*] [**override**]
	
	Example:
	
	`Router(config)# ip pim rp-address`
	`192.168.0.0`
		Configures the address of a PIM RP for a particular group.
		
		• The optional *access-list* argument is used to specify the number or name a standard access list that defines the multicast groups to be statically mapped to the RP.
		
		Note If no access list is defined, the RP will map to all multicast groups, 224/4.
		
		• The optional **override** keyword is used to specify that if dynamic and static group-to-RP mappings are used together and there is an RP address conflict, the RP address configured for a static group-to-RP mapping will take precedence.
		
		Note If the **override** keyword is not specified and there is RP address conflict, dynamic group-to-RP mappings will take precedence over static group-to-RP mappings.

Step 9	**end** **Example:** `Router(config)# end`	Ends the current configuration session and returns to EXEC mode.
Step 10	**show ip pim rp** [**mapping**] [*rp-address*] **Example:** `Router# show ip pim rp mapping`	(Optional) Displays RPs known in the network and shows how the router learned about each RP.
Step 11	**show ip igmp groups** [*group-name*	*group-address*| *interface-type interface-number*] [**detail**] **Example:** `Router# show ip igmp groups`	(Optional) Displays the multicast groups having receivers that are directly connected to the router and that were learned through IGMP. • A receiver must be active on the network at the time that this command is issued in order for receiver information to be present on the resulting display.
Step 12	**show ip mroute** **Example:** `Router# show ip mroute`	(Optional) Displays the contents of the IP mroute table.

What to Do Next

Proceed to the " Verifying IP Multicast Operation " module.

Configuring Bidirectional PIM

This section describes how to configure bidirectional PIM (bidir-PIM).

All access lists needed when configuring bidirectional PIM must be configured prior to beginning the configuration task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **interface** *type number*
5. **ip pim sparse-mode**
6. **exit**
7. **ip pim bidir-enable**
8. **ip pim rp-address** *rp-address* [*access-list*] [**override**] **bidir**
9. **end**
10. Repeat Steps 2 through 9 on every multicast-enabled interface on every router.
11. **show ip pim rp** [**mapping**] [*rp-address*]
12. **show ip mroute**
13. **show ip pim interface** [*type number*] [**df** | **count**] [*rp-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 multicast-routing** [**distributed**] **Example:** Router(config)# ip multicast-routing	Enables IP multicast routing. • Use the **distributed** keyword to enable Multicast Distributed Switching.

	Command or Action	Purpose
Step 4	**interface** *type number* **Example:** Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which PIM can be enabled.
Step 5	**ip pim sparse-mode** **Example:** Router(config-if)# ip pim sparse-mode	Enables sparse mode.
Step 6	**exit** **Example:** Router(config-if)# exit	Returns to global configuration mode.
Step 7	**ip pim bidir-enable** **Example:** Router(config)# ip pim bidir-enable	Enables bidir-PIM on a router. • Perform this step on every router.
Step 8	**ip pim rp-address** *rp-address* [*access-list*] [**override**] **bidir** **Example:** Router(config)# ip pim rp-address 10.0.1.1 45 bidir	Configures the address of a PIM RP for a particular group. • Perform this step on every router. • This command defines the RP as bidirectional and defines the bidirectional group by way of the access list. • The optional **override** keyword is used to specify that if dynamic and static group-to-RP mappings are used together and there is an RP address conflict, the RP address configured for a static group-to-RP mapping will take precedence. **Note** If the **override** keyword is not specified and there is RP address conflict, dynamic group-to-RP mappings will take precedence over static group-to-RP mappings.
Step 9	**end** **Example:** Router(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.
Step 10	Repeat Steps 2 through 9 on every multicast-enabled interface on every router.	--

	Command or Action	Purpose
Step 11	**show ip pim rp** [**mapping**] [*rp-address*] **Example:** Router# show ip pim rp	(Optional) Displays active RPs that are cached with associated multicast routing entries.
Step 12	**show ip mroute** **Example:** Router# show ip mroute	(Optional) Displays the contents of the IP mroute table.
Step 13	**show ip pim interface** [*type number*] [**df** | **count**] [*rp-address*] **Example:** Router# show ip pim interface	(Optional) Displays information about the elected DF for each RP of an interface, along with the unicast routing metric associated with the DF.

Configuration Examples for Basic IP Multicast

Sparse Mode with Auto-RP Example

The following example configures sparse mode with Auto-RP:

```
ip multicast-routing
ip pim autorp listener
ip pim send-rp-announce Loopback0 scope 16 group-list 1
ip pim send-rp-discovery Loopback1 scope 16
no ip pim dm-fallback
access-list 1 permit 239.254.2.0 0.0.0.255
access-list 1 permit 239.254.3.0 0.0.0.255
.
.
.
access-list 10 permit 224.0.1.39
access-list 10 permit 224.0.1.40
access-list 10 permit 239.254.2.0 0.0.0.255
access-list 10 permit 239.254.3.0 0.0.0.255
```
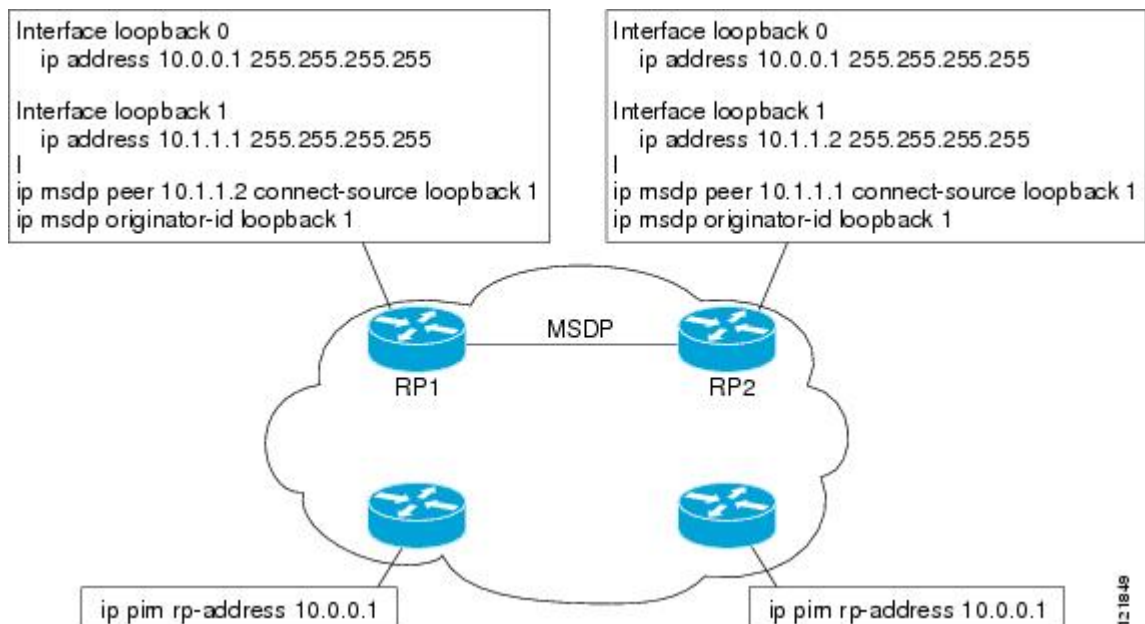
Sparse Mode with Anycast RP Example

The main purpose of an Anycast RP implementation is that the downstream multicast routers will have just one address for an RP. The example given in the figure below shows how loopback interface 0 of the RPs (RP1 and RP2) is configured with the 10.0.0.1 IP address. If this 10.0.0.1 address is configured on all RPs as the address for loopback interface 0 and then configured as the RP address, IP routing will converge on the closest RP. This address must be a host route; note the 255.255.255.255 subnet mask.

The downstream routers must be informed about the 10.0.0.1 RP address. In the figure below, the routers are configured statically with the **ip pim rp-address 10.0.0.1**global configuration command. This configuration could also be accomplished using the Auto-RP or bootstrap router (BSR) features.

The RPs in the figure must also share source information using MSDP. In this example, loopback interface 1 of the RPs (RP1 and RP2) is configured for MSDP peering. The MSDP peering address must be different from the anycast RP address.

Figure 5   *AnyCast RP Configuration*

Many routing protocols choose the highest IP address on loopback interfaces for the router ID. A problem may arise if the router selects the anycast RP address for the router ID. It is recommended that you avoid this problem by manually setting the router ID on the RPs to the same address as the MSDP peering address (for example, the loopback 1 address in the figure above). In Open Shortest Path First (OSPF), the router ID is configured using the **router-id**router configuration command. In Border Gateway Protocol (BGP), the router ID is configured using the **bgp router-id** router configuration command. In many BGP topologies, the MSDP peering address and the BGP peering address must be the same in order to pass the RPF check. The BGP peering address can be set using the **neighbor update-source** router configuration command.

The anycast RP example above uses IP addresses taken from RFC 1918. These IP addresses are normally blocked at interdomain borders and therefore are not accessible to other ISPs. You must use valid IP addresses if you want the RPs to be reachable from other domains.

The following example shows how to perform an Anycast RP configuration.

On RP 1

```
ip pim rp-address 10.0.0.1
interface loopback 0
 ip address 10.0.0.1 255.255.255.255
!
interface loopback 1
 ip address 10.1.1.1. 255.255.255.255
!
 ip msdp peer 10.1.1.2 connect-source loopback 1
 ip msdp originator-id loopback 1
```

On RP 2

```
ip pim rp-address 10.0.0.1
interface loopback 0
 ip address 10.0.0.1 255.255.255.255
interface loopback 1
 ip address 10.1.1.2. 255.255.255.255
!
 ip msdp peer 10.1.1.1 connect-source loopback 1
 ip msdp originator-id loopback 1
```

All Other Routers

```
ip pim rp-address 10.0.0.1
```

Sparse Mode with Bootstrap Router Example

The following example is a configuration for a candidate BSR, which also happens to be a candidate RP:

```
!
ip multicast-routing
!
interface GigabitEthernet0/0/0
 ip address 172.69.62.35 255.255.255.240
 ip pim sparse-mode
!
interface GigabitEthernet1/0/0
 ip address 172.21.24.18 255.255.255.248
 ip pim sparse-mode
!
interface GigabitEthernet2/0/0
 ip address 172.21.24.12 255.255.255.248
 ip pim sparse-mode
!
ip pim bsr-candidate GigabitEthernet2/0/0 30 10
ip pim rp-candidate GigabitEthernet2/0/0 group-list 5
access-list 5 permit 239.255.2.0 0.0.0.255
```

BSR and RFC 2362 Interoperable Candidate RP Example

When Cisco and non-Cisco routers are being operated in a single PIM domain with PIM Version 2 BSR, care must be taken when configuring candidate RPs because the Cisco implementation of the BSR RP selection is not fully compatible with RFC 2362.

RFC 2362 specifies that the BSR RP be selected as follows (RFC 2362, 3.7):

1 Select the candidate RP with the highest priority (lowest configured priority value).
2 If there is a tie in the priority level, select the candidate RP with the highest hash function value.
3 If there is a tie in the hash function value, select the candidate RP with the highest IP address.

Cisco routers always select the candidate RP based on the longest match on the announced group address prefix before selecting an RP based on priority, hash function, or IP address.

Inconsistent candidate RP selection between Cisco and non-Cisco RFC 2362-compliant routers in the same domain if multiple candidate RPs with partially overlapping group address ranges are configured can occur. Inconsistent candidate RP selection can prevent connectivity between sources and receivers in the PIM domain. A source may register with one candidate RP and a receiver may connect to a different candidate RP even though it is in the same group.

The following example shows a configuration that can cause inconsistent RP selection between a Cisco and a non-Cisco router in a single PIM domain with PIM Version 2 BSR:

```
access-list 10 permit 224.0.0.0  7.255.255.255
ip pim rp-candidate gigabitethernet1/0/0 group-list 10 priority 20
access-list 20 permit 224.0.0.0 15.255.255.255
ip pim rp-candidate gigabitethernet2/0/0 group-list 20 priority 10
```

In this example, a candidate RP on GigabitEthernet interface 1/0/0 announces a longer group prefix of 224.0.0.0/5 with a lower priority of 20. The candidate RP on GigabitEthernet interface 2/0/0 announces a shorter group prefix of 224.0.0.0/4 with a higher priority of 10. For all groups that match both ranges a Cisco router will always select the candidate RP on Ethernet interface 1 because it has the longer announced group prefix. A non-Cisco fully RFC 2362-compliant router will always select the candidate RP on GigabitEthernet interface 2/0/0 because it is configured with a higher priority.

To avoid this interoperability issue, do not configure different candidate RPs to announce partially overlapping group address prefixes. Configure any group prefixes that you want to announce from more than one candidate RP with the same group prefix length.

The following example shows how to configure the previous example so that there is no incompatibility between a Cisco router and a non-Cisco router in a single PIM domain with PIM Version 2 BSR:

```
access-list 10 permit 224.0.0.0  7.255.255.255
ip pim rp-candidate gigabitethernet1/0/0 group-list 10 priority 20
access-list 20 permit 224.0.0.0  7.255.255.255
access-list 20 permit 232.0.0.0  7.255.255.255
ip pim rp-candidate gigabitethernet2/0/0 group-list 20 priority 10
```

In this configuration the candidate RP on Ethernet interface 2 announces group address 224.0.0.0/5 and 232.0.0.0/5 which equal 224.0.0.0/4, but gives the interface the same group prefix length (5) as the candidate RP on Ethernet 1. As a result, both a Cisco router and an RFC 2362-compliant router will select the RP Ethernet interface 2.

Sparse Mode with a Single Static RP Example

The following example sets the PIM RP address to 192.168.1.1 for all multicast groups and defines all groups to operate in sparse mode:

```
ip multicast-routing
interface gigiabitethernet 1/0/0
 ip pim sparse-mode
ip pim rp-address 192.168.1.1
```

Note   The same RP cannot be used for both bidirectional and sparse mode groups.

The following example sets the PIM RP address to 172.16.1.1 for the multicast group 225.2.2.2 only:

```
access list 1 225.2.2.2 0.0.0.0
 ip pim rp-address 172.17.1.1
```

Bidir-PIM Example

By default, a bidirectional RP advertises all groups as bidirectional. An access list on the RP can be used to specify a list of groups to be advertised as bidirectional. Groups with the **deny** keyword will operate in dense mode. A different, nonbidirectional RP address is required for groups that operate in sparse mode because a single access list only allows either a **permit** or **deny** keyword.

The following example shows how to configure an RP for both sparse mode and bidirectional mode groups. The groups identified as 224/8 and 227/8 are bidirectional groups, and 226/8 is a sparse mode group. The RP must be configured to use different IP addresses for the sparse mode and bidirectional mode operations. Two loopback interfaces are used to allow this configuration. The addresses of these loopback interfaces must be routed throughout the PIM domain in such a way that the other routers in the PIM domain can communicate with the RP.

```
ip multicast-routing
!
.
.
.
!
interface loopback 0
 description One loopback address for this router's Bidir Mode RP function
 ip address 10.0.1.1 255.255.255.0
!
interface loopback 1
description One loopback address for this router's Sparse Mode RP function
 ip address 10.0.2.1 255.255.255.0
!
.
.
.
!
ip pim bidir-enable
ip pim rp-address 10.0.1.1 45 bidir
ip pim rp-address 10.0.2.1 46
!
access-list 45 permit 224.0.0.0 0.255.255.255
access-list 45 permit 227.0.0.0 0.255.255.255
access-list 46 permit 226.0.0.0 0.255.255.255
```

Additional References

Related Documents

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

Standards

Standard	Title
draft-kouvelas-pim-bidir-new-00.txt	A New Proposal for Bi-directional PIM

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 software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 1112	Host Extensions for IP Multicasting
RFC 1918	Address Allocation for Private Internets
RFC 2770	GLOP Addressing in 233/8
RFC 3569	An Overview of Source-Specific Multicast (SSM)

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 Configuring Basic IP Multicast

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 Configuring Basic IP Multicast*

Feature Name	Releases	Feature Information
AutoRP Enhancement	12.2(33)SXH	This feature enhancement avoids DM Fallback in the event that all RPs fail.
Bidirectional PIM	12.2(17d)SXB1	Bidirectional PIM is an extension to the PIM suite of protocols that implements shared sparse trees with bidirectional data flow. In contrast to PIM-Sparse Mode, Bidirectional PIM avoids keeping source-specific state in a router and allows trees to scale to an arbitrary number of sources.
PIM Dense Mode Fallback Prevention in a Network Following RP Information Loss	12.3(4)T 12.0(28)S 12.2(33)SRA 12.2(33)SXH 15.0(1)S	The PIM Dense Mode Fallback Prevention in a Network Following RP Information Loss feature enables you to prevent PIM-DM fallback when all RPs fail. Preventing the use of dense mode is very important to multicast networks whose reliability is critical. This feature provides a mechanism to keep the multicast groups in sparse mode, thereby preventing dense mode flooding. The following command was introduced by this feature: **ip pim dm-fallback**.