Cisco Nexus 3600 NX-OS Multicast Routing Configuration Guide, Release 9.2(x)

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Audience

This publication is for network administrators who install, configure, and maintain the Cisco Nexus Fabric Manager.

Document Conventions

Command descriptions use the following conventions:

Convention	Description
bold	Bold text indicates the commands and keywords that you enter literally as shown.
Italic	Italic text indicates arguments for which you supply the values.
[x]	Square brackets enclose an optional element (keyword or argument).
[x | y]	Square brackets enclosing keywords or arguments that are separated by a vertical bar indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments that are separated by a vertical bar indicate a required choice.
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
`variable`	Indicates a variable for which you supply values, in context where italics cannot be used.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string includes the quotation marks.

Examples use the following conventions:

Convention	Description
`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information that you must enter is in boldface screen font.
italic screen font	Arguments for which you supply values are in italic screen font.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

Related Documentation for Cisco Nexus Fabric Manager

- Cisco Nexus 9000 Series NX-OS Fundamentals Configuration Guide, Release 7.x

  http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/fundamentals/configuration/guide/b_Cisco_Nexus_9000_Series_NX-OS_Fundamentals_Configuration_Guide_7x.html

- Cisco Nexus 9000 Series NX-OS Interfaces Configuration Guide, Release 7.x

  http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/interfaces/configuration/guide/b_Cisco_Nexus_9000_Series_NX-OS_Interfaces_Configuration_Guide_7x.html

- Cisco Nexus 9000 Series NX-OS System Management Configuration Guide, Release 7.x

  http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/system_management/configuration/guide/b_Cisco_Nexus_9000_Series_NX-OS_System_Management_Configuration_Guide_7x.html

- Cisco Nexus 9000 Series NX-OS VXLAN Configuration Guide, Release 7.x

  http://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/vxlan/configuration/guide/b_Cisco_Nexus_9000_Series_NX-OS_VXLAN_Configuration_Guide_7x.html

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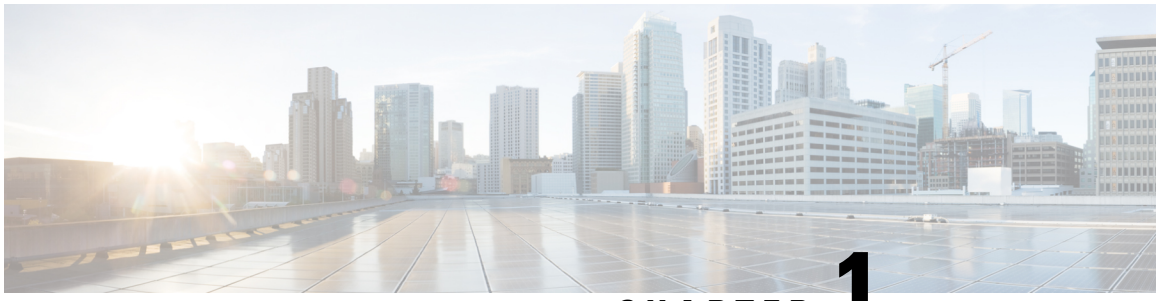
Cisco Bug Search Tool (BST) is a web-based tool that acts as a gateway to the Cisco bug tracking system that maintains a comprehensive list of defects and vulnerabilities in Cisco products and software. BST provides you with detailed defect information about your products and software.



CHAPTER 1

New and Changed Information

This chapter provides release-specific information for each new and changed feature in the *Cisco Nexus 3600 NX-OS Multicast Routing Configuration Guide, Release 9.2(x)*.

- New and Changed Information, on page 1

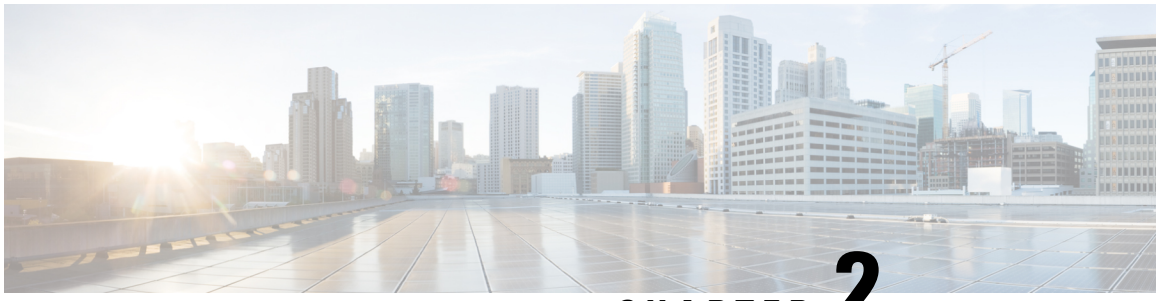
New and Changed Information

This table summarizes the new and changed features for the *Cisco Nexus 3600 Series NX-OS Multicast Routing Configuration Guide, Release 9.2(x)* and tells you where they are documented.

Table 1: New and Changed Features for Cisco NX-OS Release 9.2(x)

Feature	Description	Added of Changed in Release	Where Documented
MSDP	Introduced this feature	9.2(2)	About MSDP, on page 79
IGMP Snooping	Added the ability to disable the forwarding of IGMP Snooping queries.	9.2(1)	Guidelines and Limitations for IGMP Snooping, on page 69
MVR	Adding the ability to suppress IGMP general queries from VLANs.	9.2(1)	Suppressing IGMP Query Forwarding from VLANs, on page 98

New and Changed Information



CHAPTER 2

Overview

This chapter describes the Cisco NX-OS multicast features for Cisco Nexus 3600 platform switches.

This chapter includes the following sections:

Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the *Cisco NX-OS Licensing Guide* and the *Cisco NX-OS Licensing Options Guide*.

Supported Platforms

Starting with Cisco NX-OS release 7.0(3)I7(1), use the Nexus Switch Platform Support Matrix to know from which Cisco NX-OS releases various Cisco Nexus 9000 and 3000 switches support a selected feature.

About Multicast

IP multicast is a method of forwarding the same set of IP packets to several hosts within a network. You can use multicast in IPv4 networks to provide efficient delivery of data to multiple destinations.

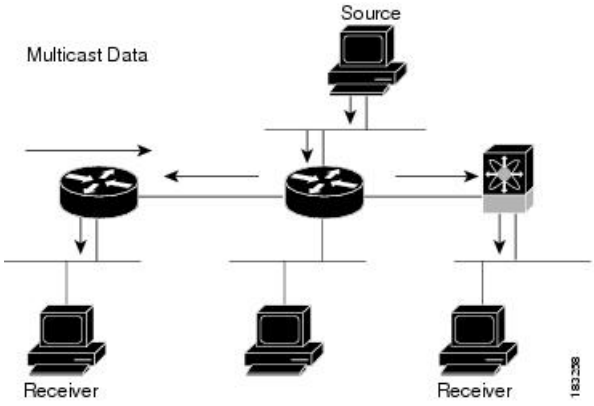
Multicast involves both a method of delivery and discovery of senders and receivers of multicast data, which is transmitted on IP multicast addresses called groups. A multicast address that includes a group and source IP address is often referred to as a channel. The Internet Assigned Number Authority (IANA) has assigned 224.0.0.0 through 239.255.255.255 as IPv4 multicast addresses. For more information, see http://www.iana.org/assignments/multicast-addresses.

Note For a complete list of RFCs related to multicast, see IETF RFCs for IP Multicast.

The routers in the network listen for receivers to advertise their interest in receiving multicast data from selected groups. The routers then replicate and forward the data from sources to the interested receivers. Multicast data for a group is transmitted only to those LAN segments with receivers that requested it.

The following figure shows one source transmitting multicast data that is delivered to two receivers. In the figure, because the center host is on a LAN segment where no receiver requested multicast data, no data is delivered to that receiver.

Figure 1: Multicast Traffic from One Source to Two Receivers



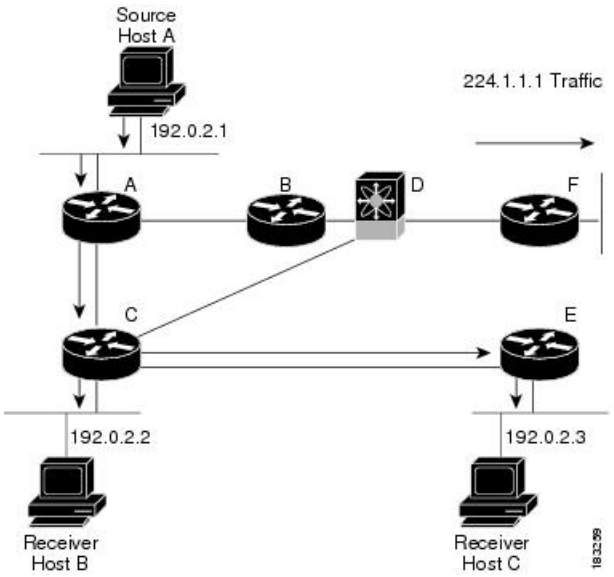
Multicast Distribution Trees

A multicast distribution tree represents the path that multicast data takes between the routers that connect sources and receivers. The multicast software builds different types of trees to support different multicast methods.

Source Trees

A source tree represents the shortest path that the multicast traffic takes through the network from the sources that transmit to a particular multicast group to receivers that requested traffic from that same group. Because of the shortest path characteristic of a source tree, this tree is often referred to as a shortest path tree (SPT). The following figure shows a source tree for group 224.1.1.1 that begins at host A and connects to hosts B and C.

Figure 2: Source Tree

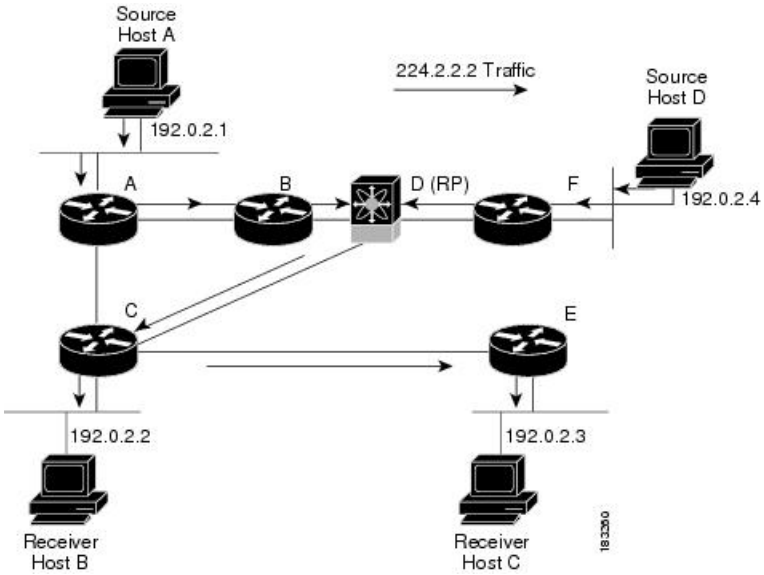


The notation (S, G) represents the multicast traffic from source S on group G. The SPT in this figure is written (192.0.2.1, 224.1.1.1). Multiple sources can be transmitting on the same group.

Shared Trees

A shared tree represents the shared distribution path that the multicast traffic takes through the network from a shared root or rendezvous point (RP) to each receiver. (The RP creates an SPT to each source.) A shared tree is also called an RP tree (RPT). The following figure shows a shared tree for group 224.1.1.1 with the RP at router D. Source hosts A and D send their data to router D, the RP, which then forwards the traffic to receiver hosts B and C.

Figure 3: Shared Tree



The notation (*, G) represents the multicast traffic from any source on group G. The shared tree in Figure above is written (*, 224.2.2.2).

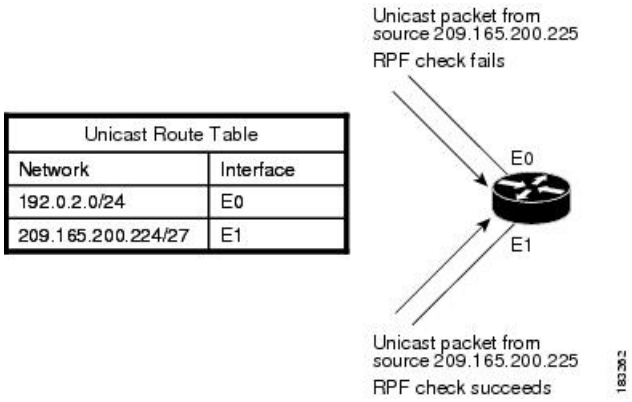
Multicast Forwarding

Because multicast traffic is destined for an arbitrary group of hosts, the router uses reverse path forwarding (RPF) to route data to active receivers for the group. When receivers join a group, a path is formed either toward the source (SSM mode) or the RP (ASM mode). The path from a source to a receiver flows in the reverse direction from the path that was created when the receiver joined the group.

For each incoming multicast packet, the router performs an RPF check. If the packet arrives on the interface leading to the source, the packet is forwarded out each interface in the outgoing interface (OIF) list for the group. Otherwise, the router drops the packet.

The following figure shows an example of RPF checks on packets coming in from different interfaces. The packet that arrives on E0 fails the RPF check because the unicast route table lists the source of the network on interface E1. The packet that arrives on E1 passes the RPF check because the unicast route table lists the source of that network on interface E1.

Figure 4: RPF Check Example



PIM

Cisco NX-OS supports multicasting with Protocol Independent Multicast (PIM) sparse mode. PIM is IP routing protocol independent and can leverage whichever unicast routing protocols are used to populate the unicast routing table. In PIM sparse mode, multicast traffic is sent only to locations of the network that specifically request it. PIM dense mode is not supported by Cisco NX-OS.

Note In this publication, the term “PIM” is used for PIM sparse mode version 2.

To access multicast commands, you must enable the PIM feature. Multicast is enabled only after you enable PIM on an interface of each router in a domain. You configure PIM for an IPv4 network. By default, IGMP runs on the system.

PIM, which is used between multicast-capable routers, advertises group membership across a routing domain by constructing multicast distribution trees. PIM builds shared distribution trees on which packets from

multiple sources are forwarded, as well as source distribution trees, on which packets from a single source are forwarded.

The distribution trees change automatically to reflect the topology changes due to link or router failures. PIM dynamically tracks both multicast-capable sources and receivers.

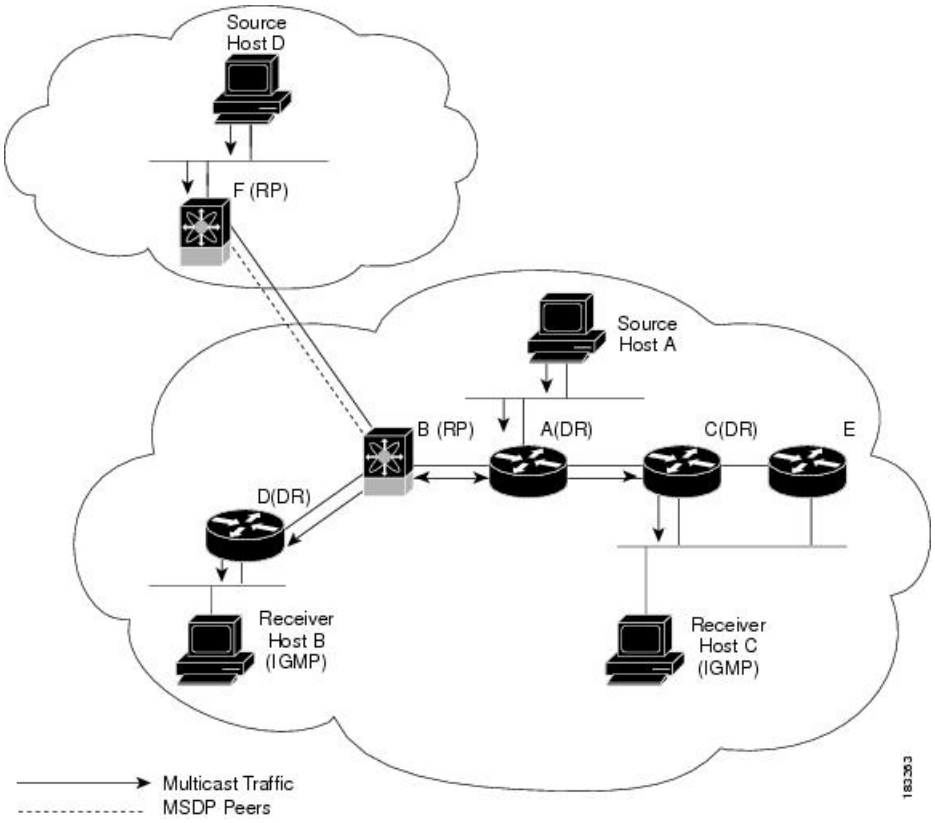
The router uses the unicast routing table and RPF routes for multicast to create multicast routing information.

The following figure shows two PIM domains in an IPv4 network.

Note In this publication, "PIM for IPv4" refer to the Cisco NX-OS implementation of PIM sparse mode. A PIM domain can include an IPv4 network.

The following figure shows two PIM domains in an IPv4 network.

Figure 5: PIM Domains in an IPv4 Network



- The lines with arrows show the path of the multicast data through the network. The multicast data originates from the sources at hosts A and D.
- Hosts B and C receive multicast data by using Internet Group Management Protocol (IGMP) to advertise requests to join a multicast group.
- Routers A, C, and D are designated routers (DRs). When more than one router is connected to a LAN segment, such as C and E, the PIM software chooses one router to be the DR so that only one router is responsible for putting multicast data on the segment.

Router B is the rendezvous point (RP) for one PIM domain, and router F is the RP for the other PIM domain. The RP provides a common point for connecting sources and receivers within a PIM domain.

PIM supports these multicast modes for connecting sources and receivers:

- Any source multicast (ASM)
- Source-Specific Multicast (SSM)

Cisco NX-OS supports a combination of these modes for different ranges of multicast groups. You can also define RPF routes for multicast.

ASM

Any Source Multicast (ASM) is a PIM tree building mode that uses shared trees to discover new sources and receivers as well as source trees to form shortest paths from receivers to sources. The shared tree uses a network node as the root, called the rendezvous point (RP). The source tree is rooted at first-hop routers, directly attached to each source that is an active sender. The ASM mode requires an RP for a group range. An RP can be configured statically or learned dynamically by the Auto-RP or BSR group-to-RP discovery protocols.

The ASM mode is the default mode when you configure RPs.

For information about configuring ASM, see the Configuring ASM section.

SSM

Source-Specific Multicast (SSM) is a PIM mode that builds a source tree that originates at the designated router on the LAN segment that receives a request to join a multicast source. Source trees are built by sending PIM join messages in the direction of the source. The SSM mode does not require you to configure RPs.

The SSM mode allows receivers to connect to sources outside the PIM domain.

For information about configuring SSM, see the Configuring SSM section.

RPF Routes for Multicast

You can configure static multicast RPF routes to override what the unicast routing table uses. This feature is used when the multicast topology is different than the unicast topology.

For information about configuring RPF routes for multicast, see the Configuring RPF Routes for Multicast section.

IGMP

By default, the Internet Group Management Protocol (IGMP) for PIM is running on the system.

The IGMP protocol is used by hosts that want to receive multicast data to request membership in multicast groups. Once the group membership is established, multicast data for the group is directed to the LAN segment of the requesting host.

You can configure IGMPv2 or IGMPv3 on an interface. You will usually configure IGMPv3 to support SSM mode. By default, the software enables IGMPv2.

For information about configuring IGMP, see Configuring IGMP, on page 13.

IGMP Snooping

IGMP snooping is a feature that limits multicast traffic on VLANs to the subset of ports that have known receivers. By examining (snooping) IGMP membership report messages from interested hosts, multicast traffic is sent only to VLAN ports that interested hosts reside on. By default, IGMP snooping is running on the system.

For information about configuring IGMP snooping, see Configuring IGMP Snooping, on page 67.

Interdomain Multicast

Cisco NX-OS provides several methods that allow multicast traffic to flow between PIM domains.

SSM

The PIM software uses SSM to construct a shortest path tree from the designated router for the receiver to a known source IP address, which may be in another PIM domain. The ASM mode cannot access sources from another PIM domain without the use of another protocol.

Once you enable PIM in your networks, you can use SSM to reach any multicast source that has an IP address known to the designated router for the receiver.

For information about configuring SSM, see the Configuring SSM (PIM), on page 48 section.

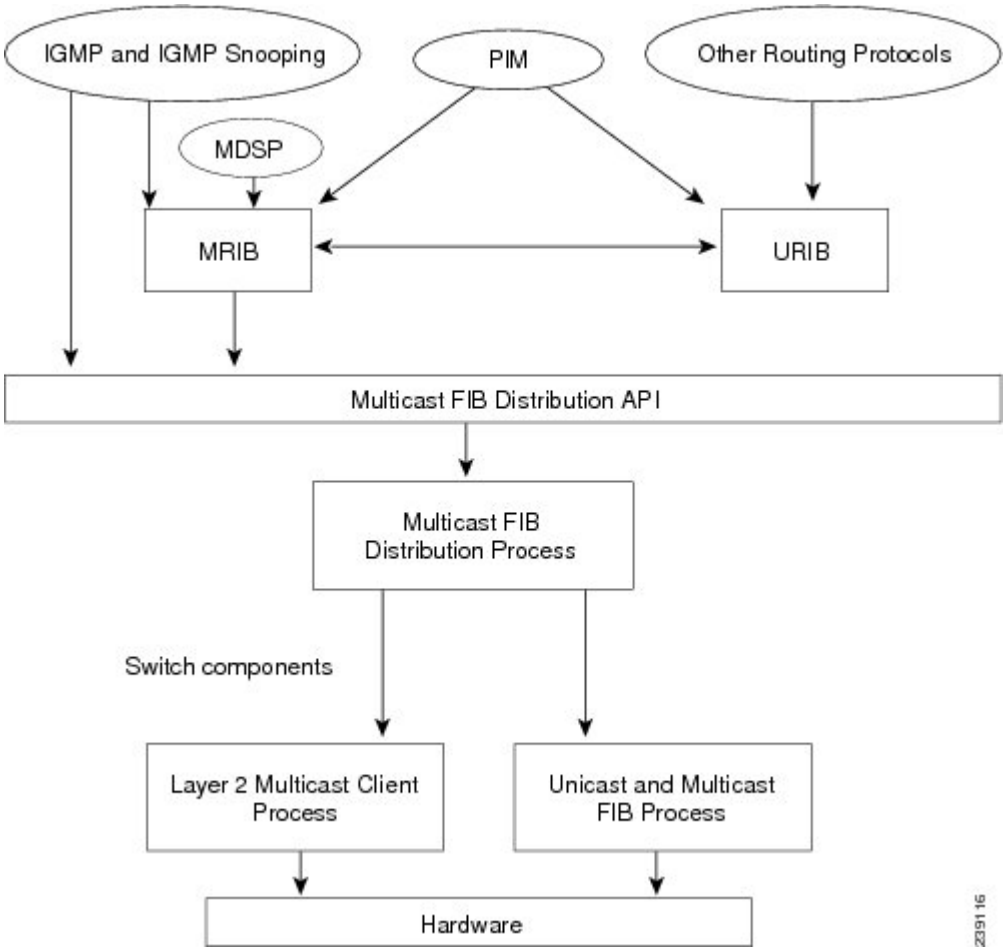
MRIB

The Cisco NX-OS IPv4 Multicast Routing Information Base (MRIB) is a repository for route information that is generated by multicast protocols such as PIM and IGMP. The MRIB does not affect the route information itself. The MRIB maintains independent route information for each virtual routing and forwarding (VRF) instance.

The following figure shows the major components of the Cisco NX-OS multicast software architecture:

- The Multicast FIB (MFIB) Distribution (MFDM) API defines an interface between the multicast Layer 2 and Layer 3 control plane modules, including the MRIB, and the platform forwarding plane. The control plane modules send the Layer 3 route update and Layer 2 lookup information using the MFDM API.
- The multicast FIB distribution process distributes the multicast update messages to the switch.
- The Layer 2 multicast client process sets up the Layer 2 multicast hardware forwarding path.
- The unicast and multicast FIB process manages the Layer 3 hardware forwarding path.

Figure 6: Cisco NX-OS Multicast Software Architecture



General Multicast Restrictions

The following are the guidelines and limitations for multicast on Cisco Nexus 3600 platform switches:

- Cisco Nexus 3600 platform switches do not support Pragmatic General Multicast (PGM).
- Layer 3 IPv6 multicast routing is not supported.
- Layer 2 IPv6 multicast packets are flooded on the incoming VLAN.
- Multicast counters are not supported on the Cisco Nexus 3600 platform switches.

Troubleshooting Inconsistency Between SW and HW Multicast Routes

Symptom

This section provides symptoms, possible causes, and recommended actions for when *, G, or S,G entries that are seen in the MRIB with active flow, but are not programmed in MFIB.

Possible Cause

The issue can be seen when numerous active flows are received beyond the hardware capacity. This causes some of the entries not to be programmed in hardware while there is no free hardware index.

If the number of active flows are significantly reduced to free up the hardware resource, inconsistency may be seen between MRIB and MFIB for flows that were previously affected when the hardware table was full until the entry, times out, repopulates, and triggers programming.

There is currently no mechanism to walk the MRIB table and reprogram missing entries in HW after hardware resource is freed.

Corrective Action

To ensure reprogramming of the entries, use the **clear ip mroute *** command.

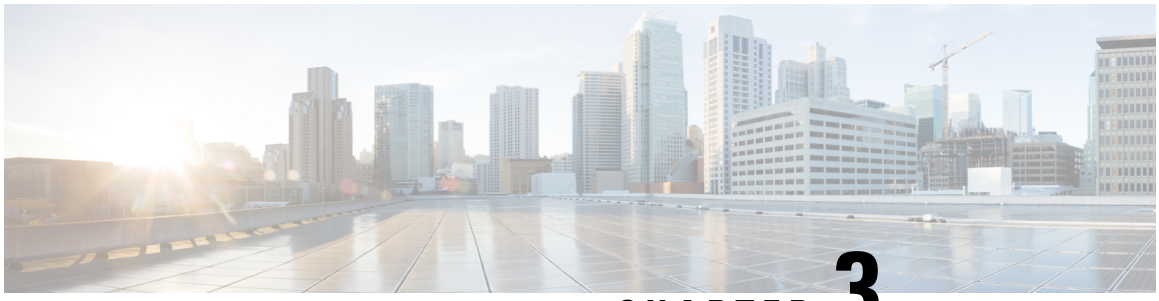
Additional References

For additional information related to implementing multicast, see the following sections:

- IETF RFCs for IP Multicast

MIBs

MIBs	MIBs Link
IP Multicast	To locate and download MIBs, go to the following: MIB



CHAPTER 3

Configuring IGMP

This chapter describes how to configure the Internet Group Management Protocol (IGMP) on Cisco Nexus 3600 platform switches for IPv4 networks.

This chapter includes the following sections:

About IGMP

IGMP is an IPv4 protocol that a host uses to request multicast data for a particular group. Using the information that is obtained through IGMP, the software maintains a list of multicast group or channel memberships on a per-interface basis. The systems that receive these IGMP packets send multicast data that they receive for requested groups or channels out the network segment of the known receivers.

By default, the IGMP process is running. You cannot enable IGMP manually on an interface. IGMP is automatically enabled when you perform one of the following configuration tasks on an interface:

- Enable PIM.
- Statically bind a local multicast group.
- Enable link-local group reports

IGMP Versions

The switch supports IGMPv2 and IGMPv3, and IGMPv1 report reception.

By default, the software enables IGMPv2 when it starts the IGMP process. You can enable IGMPv3 on interfaces where you want its capabilities.

IGMPv3 includes the following key changes from IGMPv2:

- Support for Source-Specific Multicast (SSM), which builds shortest path trees from each receiver to the source, through the following features:
  - Host messages that can specify both the group and the source.
  - The multicast state that is maintained for groups and sources, not just for groups as in IGMPv2.
- Hosts no longer perform report suppression, which means that hosts always send IGMP membership reports when an IGMP query message is received.

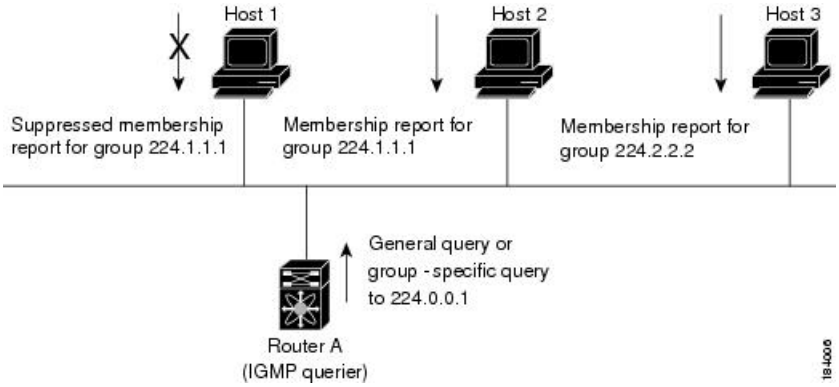
For detailed information about IGMPv2, see RFC 2236.

For detailed information about IGMPv3, see RFC 3376.

IGMP Basics

The basic IGMP process of a router that discovers multicast hosts is shown in this figure. Hosts 1, 2, and 3 send unsolicited IGMP membership report messages to initiate receiving multicast data for a group or channel.

Figure 7: IGMPv1 and IGMPv2 Query-Response Process



In the figure **IGMPv1 and IGMPv2 Query-Response Process**, router A, which is the IGMP designated querier on the subnet, sends query messages to the all-hosts multicast group at 224.0.0.1 periodically to discover whether any hosts want to receive multicast data. You can configure the group membership timeout value that the router uses to determine that no members of a group or source exist on the subnet. For more information about configuring the IGMP parameters, see the Configuring IGMP Interface Parameters section.

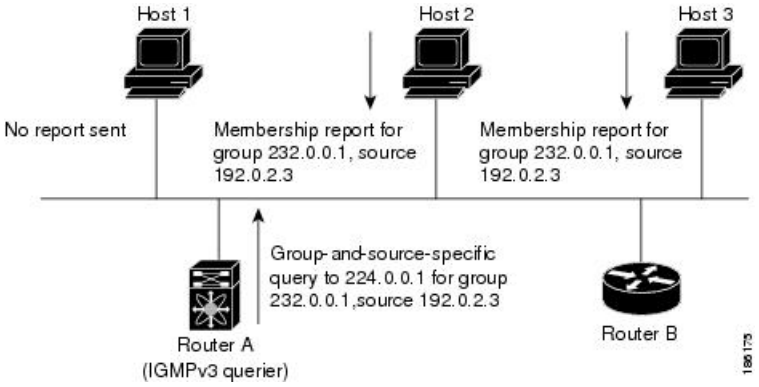
The software elects a router as the IGMP querier on a subnet if it has the lowest IP address. As long as a router continues to receive query messages from a router with a lower IP address, it resets a timer that is based on its querier timeout value. If the querier timer of a router expires, it becomes the designated querier. If that router later receives a host query message from a router with a lower IP address, it drops its role as the designated querier and sets its querier timer again.

In this figure, host 1's membership report is suppressed and host 2 sends its membership report for group 224.1.1.1 first. Host 1 receives the report from host 2. Because only one membership report per group needs to be sent to the router, other hosts suppress their reports to reduce network traffic. Each host waits for a random time interval to avoid sending reports at the same time. You can configure the query maximum response time parameter to control the interval in which hosts randomize their responses.

Note IGMPv1 and IGMPv2 membership report suppression occurs only on hosts that are connected to the same port.

In the following figure, router A sends the IGMPv3 group-and-source-specific query to the LAN. Hosts 2 and 3 respond to the query with membership reports that indicate that they want to receive data from the advertised group and source. This IGMPv3 feature supports SSM. For information about configuring SSM translation to support SSM for IGMPv1 and IGMPv2 hosts, see the Configuring an IGMP SSM Translation, on page 23 section.

Figure 8: IGMPv3 Group-and-Source-Specific Query



Note IGMPv3 hosts do not perform IGMP membership report suppression.

Messages that are sent by the designated querier have a time-to-live (TTL) value of 1, which means that the directly connected routers on the subnet do not forward the messages. You can configure the frequency and number of query messages sent specifically for IGMP startup, and you can configure a short query interval at startup so that the group state is established as quickly as possible. Although unnecessary, you can tune the query interval that is used after startup to a value that balances the responsiveness to host group membership messages and the traffic that is created on the network.

Caution Changing the query interval can severely impact multicast forwarding.

When a multicast host leaves a group, a host that runs IGMPv2 or later sends an IGMP leave message. To check if this host is the last host to leave the group, the software sends an IGMP query message and starts a timer that you can configure called the last member query response interval. If no reports are received before the timer expires, the software removes the group state. The router continues to send multicast traffic for a group until its state is removed.

You can configure a robustness value to compensate for packet loss on a congested network. The robustness value is used by the IGMP software to determine the number of times to send messages.

Link local addresses in the range 224.0.0.0/24 are reserved by the Internet Assigned Numbers Authority (IANA). Network protocols on a local network segment use these addresses; routers do not forward these

addresses because they have a TTL of 1. By default, the IGMP process sends membership reports only for nonlink local addresses, but you can configure the software to send reports for link local addresses.

For more information about configuring the IGMP parameters, see the Configuring IGMP Interface Parameters section.

Virtualization Support

Cisco NX-OS supports virtual routing and forwarding (VRF). You can define multiple VRF instances. A VRF configured with IGMP supports the following IGMP features:

- IGMP is enabled or disabled on per interface.
- IGMPv1, IGMPv2, and IGMPv3 provide router-side support.
- IGMPv2 and IGMPv3 provide host-side support.
- Supports configuration of IGMP querier parameters
- IGMP reporting is supported for link local multicast groups.
- IGMP SSM-translation supports mapping of IGMPv2 groups to a set of sources.
- Supports multicast traceroute (Mtrace) server functionality to process Mtrace requests.

For information about configuring VRFs, see the Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide.

Guidelines and Limitations for IGMP

IGMP has the following guidelines and limitations:

- All external multicast router ports (either statically configured or dynamically learned) use the global LTL index. When there is a miss, traffic in VLAN X goes out on all multicast router ports that allow VLAN X.
- You can use the ip igmp join-group command to bind the switch to a multicast group. The switch generates an IGMP join for the specified group, and any multicast packets that are destined to the group are sent to the CPU. You cannot use the ip igmp join-group command to program any Outgoing Interface Lists (OILs). Even if there are receivers that request for the stream, no packets are sent to them. To bind the switch to a multicast group, use the ip igmp static-oif command instead of the ip igmp join-group command.
- Excluding or blocking a list of sources according to IGMPv3 (RFC 3376) is not supported.

Default Settings for IGMP

This table lists the default settings for IGMP parameters.

Table 2: Default IGMP Parameters

Parameters	Default
IGMP version	2
Startup query interval	30 seconds
Startup query count	2
Robustness value	2
Querier timeout	255 seconds
Query timeout	255 seconds
Query max response time	10 seconds
Query interval	125 seconds
Last member query response interval	1 second
Last member query count	2
Group membership timeout	260 seconds
Report link local multicast groups	Disabled
Enforce router alert	Disabled
Immediate leave	Disabled

Configuring IGMP Parameters

You can configure the IGMP global and interface parameters to affect the operation of the IGMP process.

Configuring IGMP Interface Parameters

You can configure the optional IGMP interface parameters that are described in the following table.

Table 3: IGMP Interface Parameters

Parameter	Description
IGMP version	IGMP version that is enabled on the interface. The IGMP version can be 2 or 3. The default is 2.

Parameter	Description
Static multicast groups	Multicast groups that are statically bound to the interface. You can configure the groups to join the interface with the (*, G) state or specify a source IP to join with the (S, G) state. You can specify a route-map policy name that lists the group prefixes, group ranges, and source prefixes to use with the **match ip multicast** command. **Note** Although you can configure the (S, G) state, the source tree is built only if you enable IGMPv3. For information about SSM translation, see the Configuring an IGMP SSM Translation section. You can configure a multicast group on all the multicast-capable routers on the network so that pinging the group causes all the routers to respond.
Static multicast groups on OIF	Multicast groups that are statically bound to the output interface. You can configure the groups to join the output interface with the (*, G) state or specify a source IP to join with the (S, G) state. You can specify a route-map policy name that lists the group prefixes, group ranges, and source prefixes to use with the **match ip multicast** command. **Note** Although you can configure the (S, G) state, the source tree is built only if you enable IGMPv3. For information about SSM translation, see the Configuring an IGMP SSM Translation section.
Startup query interval	Startup query interval. By default, this interval is shorter than the query interval so that the software can establish the group state as quickly as possible. Values range from 1 to 18,000 seconds. The default is 31 seconds.
Startup query count	Number of queries that are sent at startup that are separated by the startup query interval. Values range from 1 to 10. The default is 2.
Robustness value	Robustness variable that you can tune to reflect expected packet loss on a congested network. You can increase the robustness variable to increase the number of times that packets are resent. Values range from 1 to 7. The default is 2.
Querier timeout	Number of seconds that the software waits after the previous querier has stopped querying and before it takes over as the querier. Values range from 1 to 65,535 seconds. The default is 255 seconds.
Query max response time	Maximum response time that is advertised in IGMP queries. You can tune the IGMP messages on the network by setting a larger value so that host responses are spread out over a longer time. This value must be less than the query interval. Values range from 1 to 25 seconds. The default is 10 seconds.
Query interval	Frequency at which the software sends IGMP host query messages. You can tune the number of IGMP messages on the network by setting a larger value so that the software sends IGMP queries less often. Values range from 1 to 18,000 seconds. The default is 125 seconds.

Parameter	Description
Last member query response interval	Interval in which the software sends a response to an IGMP query after receiving a host leave message from the last known active host on the subnet. If no reports are received in the interval, the group state is deleted. You can use this value to tune how quickly the software stops transmitting on the subnet. The software can detect the loss of the last member of a group or source more quickly when the values are smaller. Values range from 1 to 25 seconds. The default is 1 second.
Last member query count	Number of times that the software sends an IGMP query, which is separated by the last member query response interval, in response to a host leave message from the last known active host on the subnet. Values range from 1 to 5. The default is 2. **Caution** Setting this value to 1 means that a missed packet in either direction causes the software to remove the multicast state from the queried group or channel. The software may wait until the next query interval before the group is added again.
Group membership timeout	Group membership interval that must pass before the router decides that no members of a group or source exist on the network. Values range from 3 to 65,535 seconds. The default is 260 seconds.
Report link local multicast groups	Option that enables sending reports for groups in 224.0.0.0/24. Link local addresses are used only by protocols on the local network. Reports are always sent for nonlink local groups. The default is disabled.
Report policy	Access policy for IGMP reports that is based on a route-map policy. **Note** To configure route-map policies, see the Cisco Nexus 3600 NX-OS Unicast Routing Configuration Guide.
Access groups	Option that configures a route-map policy to control the multicast groups that hosts on the subnet that is serviced by an interface can join.
Immediate leave	Option that minimizes the leave latency of IGMPv2 group memberships on a given IGMP interface because the device does not send group-specific queries. When immediate leave is enabled, the device removes the group entry from the multicast routing table immediately upon receiving a leave message for the group. The default is disabled. **Note** Use this command only when there is one receiver behind the interface for a given group.
global-leave-ignore-gss-mrt	Beginning with Cisco NX-OS Release 5.0(3)U1(2), you can use the configured Maximum Response Time (MRT) value in group-specific queries against a lower MRT value in response to IGMP global leave messages (IGMP leave reports to group 0.0.0.0).

For information about configuring multicast route maps, see the Configuring Route Maps to Control RP Information Distribution section.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface** *interface*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Enters interface mode on the interface type and number, such as **ethernet** *slot/port*.

Step 3	**no switchport**
	Example:
	`switch(config-if)# no switchport`
	`switch(config-if)#`	

Step 4	**ip igmp version** *value* **Example:** `switch(config-if)# ip igmp version 3`	Sets the IGMP version to the value specified. Values can be 2 or 3. The default is 2. The **no** form of the command sets the version to 2.
Step 5	**ip igmp join-group** {**group** [**source** *source*] | **route-map** *policy-name*} **Example:** `switch(config-if)# ip igmp join-group 230.0.0.0`	Configures an interface on the device to join the specified group or channel. The device accepts the multicast packets for CPU consumption only. **Caution** The device CPU must be able to handle the traffic generated by using this command. Because of CPU load constraints, using this command, especially in any form of scale, is not recommended. Consider using the **ip igmp static-oif** command instead.
Step 6	**ip igmp static-oif** {*group* [**source** *source*] | **route-map** *policy-name*} **Example:** `switch(config-if)# ip igmp static-oif 230.0.0.0`	Statically binds a multicast group to the outgoing interface, which is handled by the device hardware. If you specify only the group address, the (*, G) state is created. If you specify the source address, the (S, G) state is created. You can specify a route-map policy name that lists the group prefixes, group ranges, and source prefixes to use with the **match ip multicast** command. **Note** A source tree is built for the (S, G) state only if you enable IGMPv3.

	Command or Action	Purpose
Step 7	**ip igmp startup-query-interval** *seconds* **Example:** `switch(config-if)# ip igmp startup-query-interval 25`	Sets the query interval used when the software starts up. Values can range from 1 to 18,000 seconds. The default is 31 seconds.
Step 8	**ip igmp startup-query-count** *count* **Example:** `switch(config-if)# ip igmp startup-query-count 3`	Sets the query count used when the software starts up. Values can range from 1 to 10. The default is 2.
Step 9	**ip igmp robustness-variable** *value* **Example:** `switch(config-if)# ip igmp robustness-variable 3`	Sets the robustness variable. Values can range from 1 to 7. The default is 2.
Step 10	**ip igmp querier-timeout** *seconds* **Example:** `switch(config-if)# ip igmp querier-timeout 300`	Sets the querier timeout that the software uses when deciding to take over as the querier. Values can range from 1 to 65,535 seconds. The default is 255 seconds.
Step 11	**ip igmp query-timeout** *seconds* **Example:** `switch(config-if)# ip igmp query-timeout 300`	Sets the query timeout that the software uses when deciding to take over as the querier. Values can range from 1 to 65,535 seconds. The default is 255 seconds. **Note** This command has the same functionality as the **ip igmp querier-timeout** command.
Step 12	**ip igmp query-max-response-time** *seconds* **Example:** `switch(config-if)# ip igmp query-max-response-time 15`	Sets the response time advertised in IGMP queries. Values can range from 1 to 25 seconds. The default is 10 seconds.
Step 13	**ip igmp query-interval** *interval* **Example:** `switch(config-if)# ip igmp query-interval 100`	Sets the frequency at which the software sends IGMP host query messages. Values can range from 1 to 18,000 seconds. The default is 125 seconds.
Step 14	**ip igmp last-member-query-response-time** *seconds* **Example:** `switch(config-if)# ip igmp last-member-query-response-time 3`	Sets the query interval waited after sending membership reports before the software deletes the group state. Values can range from 1 to 25 seconds. The default is 1 second.
Step 15	**ip igmp last-member-query-count** *count* **Example:**	Sets the number of times that the software sends an IGMP query in response to a host

	Command or Action	Purpose
	`switch(config-if)# ip igmp last-member-query-count 3`	leave message. Values can range from 1 to 5. The default is 2.
Step 16	**ip igmp group-timeout** *seconds* **Example:** `switch(config-if)# ip igmp group-timeout 300`	Sets the group membership timeout for IGMPv2. Values can range from 3 to 65,535 seconds. The default is 260 seconds.
Step 17	**ip igmp report-link-local-groups** **Example:** `switch(config-if)# ip igmp report-link-local-groups`	Enables sending reports for groups in 224.0.0.0/24. Reports are always sent for nonlink local groups. By default, reports are not sent for link local groups.
Step 18	**ip igmp report-policy** *policy* **Example:** `switch(config-if)# ip igmp report-policy my_report_policy`	Configures an access policy for IGMP reports that is based on a route-map policy.
Step 19	**ip igmp access-group** *policy* **Example:** `switch(config-if)# ip igmp access-group my_access_policy`	Configures a route-map policy to control the multicast groups that hosts on the subnet serviced by an interface can join. **Note** Only the **match ip multicast group** command is supported in this route map policy. The **match ip address** command for matching an ACL is not supported.
Step 20	**ip igmp immediate-leave** **Example:** `switch(config-if)# ip igmp immediate-leave`	Enables the device to remove the group entry from the multicast routing table immediately upon receiving a leave message for the group. Use this command to minimize the leave latency of IGMPv2 group memberships on a given IGMP interface because the device does not send group-specific queries. The default is disabled. **Note** Use this command only when there is one receiver behind the interface for a given group.
Step 21	**ip igmp global-leave-ignore-gss-mrt** **Example:** `switch(config-if)# ip igmp global-leave-ignore-gss-mrt`	Enables the switch to use the general Maximum Response Time (MRT) in response to an IGMP global leave message for general queries.

	Command or Action	Purpose
Step 22	(Optional) **show ip igmp interface** [*interface*] [**vrf** *vrf-name* | **all**] [**brief**] **Example:** `switch(config)# show ip igmp interface`	Displays IGMP information about the interface.
Step 23	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration. Saves the configuration changes

Configuring an IGMP SSM Translation

You can configure an SSM translation to provide SSM support when the router receives IGMPv1 or IGMPv2 membership reports. Only IGMPv3 provides the capability to specify group and source addresses in membership reports. By default, the group prefix range is 232.0.0.0/8. To modify the PIM SSM range, see the Configuring SSM section.

This table lists the example SSM translations.

Table 4: Example SSM Translations

Group Prefix	Source Address
232.0.0.0/8	10.1.1.1
232.0.0.0/8	10.2.2.2
232.1.0.0/16	10.3.3.3
232.1.1.0/24	10.4.4.4

The following table shows the resulting MRIB routes that the IGMP process creates when it applies an SSM translation to the IGMP membership report. If more than one translation applies, the router creates the (S, G) state for each translation.

Table 5: Example Result of Applying SSM Translations

IGMPv2 Membership Report	Resulting MRIB Route
232.1.1.1	(10.4.4.4, 232.1.1.1)
232.2.2.2	(10.1.1.1, 232.2.2.2) (10.2.2.2, 232.2.2.2)

Note This feature is similar to SSM mapping found in some Cisco IOS software.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip igmp ssm-translate** *group-prefix source-addr* **Example:** `switch(config)# ip igmp ssm-translate 232.0.0.0/8 10.1.1.1`	Configures the translation of IGMPv1 or IGMPv2 membership reports by the IGMP process to create the (S,G) state as if the router had received an IGMPv3 membership report.
Step 3	(Optional) **show running-configuration igmp** **Example:** `switch(config)# show running-configuration igmp`	Shows the running-configuration information, including **ssm-translate** command lines.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring the Enforce Router Alert Option Check

You can configure the enforce router alert option check for IGMPv2 and IGMPv3 packets.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	(Optional) **[no] ip igmp enforce-router-alert** **Example:** `switch(config-if)# ip igmp enforce-router-alert`	Enables or Disables the enforce router alert option check for IGMPv2 and IGMPv3 packets. By default, the enforce router alert option check is enabled.
Step 3	(Optional) **show running-configuration igmp** **Example:** `switch(config)# show running-configuration igmp`	Shows the running-configuration information, including the **enforce-router-alert** command line.

	Command or Action	Purpose
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Verifying the IGMP Configuration

To display the IGMP configuration information, perform one of the following tasks:

Command	Purpose
show ip igmp interface [*interface*] [**vrf**] *vrf-name*| **all**] [**brief**]	Displays IGMP information about all interfaces or a selected interface, the default VRF, a selected VRF, or all VRFs.
show ip igmp groups *group*|*interface*] [**vrf** *vrf-name* | **all**]	Displays the IGMP attached group membership for a group or interface, the default VRF, a selected VRF, or all VRFs.
show ip igmp route*group* | *interface* **vrf** *vrf-name* | **all**	Displays the IGMP attached group membership for a group or interface, the default VRF, a selected VRF, or all VRFs.
show ip igmp local-groups	Displays the IGMP local group membership.
show running-configuration igmp	Displays the IGMP running-configuration information.
show startup-configuration igmp	Displays the IGMP startup-configuration information.

Configuration Examples for IGMP

The following example shows how to configure the IGMP parameters:

```
switch# configure terminal
switch(config)# ip igmp ssm-translate 232.0.0.0/8 10.1.1.1
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip igmp version 3
switch(config-if)# ip igmp join-group 230.0.0.0
switch(config-if)# ip igmp startup-query-interval 25
switch(config-if)# ip igmp startup-query-count 3
switch(config-if)# ip igmp robustness-variable 3
switch(config-if)# ip igmp querier-timeout 300
switch(config-if)# ip igmp query-timeout 300
switch(config-if)# ip igmp query-max-response-time 15
switch(config-if)# ip igmp query-interval 100
switch(config-if)# ip igmp last-member-query-response-time 3
switch(config-if)# ip igmp last-member-query-count 3
switch(config-if)# ip igmp group-timeout 300
```

```
switch(config-if)# ip igmp report-link-local-groups
switch(config-if)# ip igmp report-policy my_report_policy
switch(config-if)# ip igmp access-group my_access_policy
switch(config-if)# ip igmp immediate-leave
switch(config-if)# ip igmp global-leave-ignore-gss-mrt
```

This example shows how to configure a route map that accepts all multicast reports (joins):

```
switch(config)# route-map foo
switch(config-route-map)# exit
switch(config)# interface vlan 10
switch(config-if)# no switchport
switch(config-if)# ip pim sparse-mode
switch(config-if)# ip igmp report-policy foo
```

This example shows how to configure a route map that denies all multicast reports (joins):

```
switch(config)# route-map foo deny 10
switch(config-route-map)# exit
switch(config)# interface vlan 5
switch(config-if)# ip pim sparse-mode
switch(config-if)# ip igmp report-policy foo
```

This example shows how to configure a route map to accept joins for multicast group 224.1.1.0/24:

```
switch(config)# route-map route-map igmp-join-grp permit 10
switch(config-route-map)# match ip multicast group 224.1.1.0/24
switch(config-route-map)# exit
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip igmp join-group route-map igmp-join-grp
```

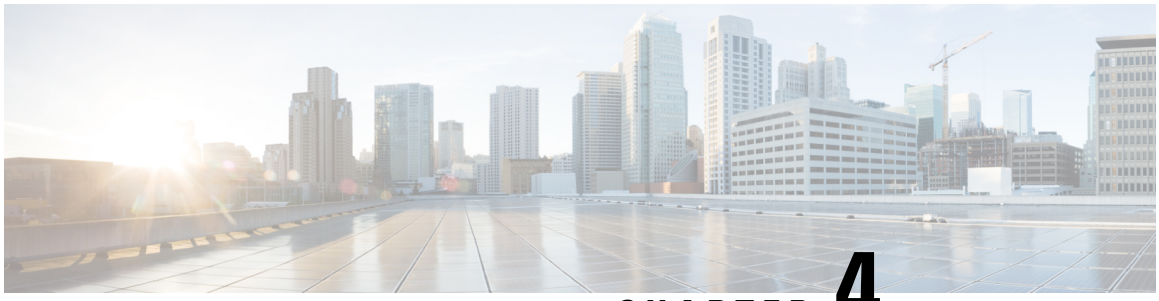
This example shows how to configure a route map to create OIFs for multicast group 225.1.1.0/24:

```
switch(config)# route-map route-map igmp-static-grp permit 10
switch(config-route-map)# match ip multicast group 225.1.1.0/24
switch(config-route-map)# exit
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip igmp static-oif route-map igmp-static-grp
```

Where to Go Next

You can enable the following features that work with PIM and IGMP:

-
- Configuring IGMP Snooping, on page 67



CHAPTER 4

Configuring PIM

This chapter describes how to configure the Protocol Independent Multicast (PIM) features on Cisco Nexus 3600 platform switches in your IPv4 networks.

This chapter includes the following sections:

Information about PIM

PIM, which is used between multicast-capable routers, advertises group membership across a routing domain by constructing multicast distribution trees. PIM builds shared distribution trees on which packets from multiple sources are forwarded, as well as source distribution trees on which packets from a single source are forwarded. For more information about multicast, see the About Multicast section.

Cisco NX-OS supports PIM sparse mode for IPv4 networks (PIM). (In PIM sparse mode, multicast traffic is sent only to locations of the network that specifically request it.) You can configure PIM to run simultaneously on a router. You can use PIM global parameters to configure rendezvous points (RPs), message packet filtering, and statistics. You can use PIM interface parameters to enable multicast, identify PIM borders, set the PIM hello message interval, and set the designated router (DR) priority. For more information, see the Configuring PIM Sparse Mode section.

Note Cisco Nexus 3600 platform switches do not support PIM dense mode.

In Cisco NX-OS, multicast is enabled only after you enable the PIM feature on each router and then enable PIM sparse mode on each interface that you want to participate in multicast. You can configure PIM for an

IPv4 network. In an IPv4 network, if you have not already enabled IGMP on the router, PIM enables it automatically. For information about configuring IGMP, see Configuring IGMP, on page 13.

Note Cisco Nexus 3600 platform switches do not support PIM6.

You use the PIM global configuration parameters to configure the range of multicast group addresses to be handled by each of the two distribution modes:

- Any Source Multicast (ASM) provides discovery of multicast sources. It builds a shared tree between sources and receivers of a multicast group and supports switching over to a source tree when a new receiver is added to a group. ASM mode requires that you configure an RP.
- Source-Specific Multicast (SSM) builds a source tree that originates at the designated router on the LAN segment that receives a request to join a multicast source. SSM mode does not require you to configure RPs. Source discovery must be accomplished through other means.

You can combine the modes to cover different ranges of group addresses. For more information, see the Configuring PIM section.

For more information about PIM sparse mode and shared distribution trees used by the ASM mode, see RFC 4601.

For more information about PIM in SSM mode, see RFC 3569.

Note Multicast equal-cost multipathing (ECMP) is on by default in the Cisco NX-OS for the Cisco Nexus 3548 Switch; you cannot turn ECMP off. If multiple paths exist for a prefix, PIM selects the path with the lowest administrative distance in the routing table. Cisco NX-OS supports up to 16 paths to a destination.

PIM SSM with vPC

You can enable PIM SSM on Cisco Nexus 3600 platform switches with an upstream Layer 3 cloud along with the vPC feature. If there are no downstream PIM neighbors, you can form a PIM neighbor relationship between two switches over a vPC VLAN through a vPC peer link.

Hello Messages

The router establishes PIM neighbor adjacencies by sending PIM hello messages to the multicast address 224.0.0.13. Hello messages are sent periodically at the interval of 30 seconds. When all neighbors have replied, the PIM software chooses the router with the highest priority in each LAN segment as the designated router (DR). The DR priority is based on a DR priority value in the PIM hello message. If the DR priority value is not supplied by all routers or the priorities match, the highest IP address is used to elect the DR.

Caution If you change the PIM hello interval to a lower value, we recommend that you ensure it is appropriate for your network environment.

The hello message also contains a hold-time value, which is typically 3.5 times the hello interval. If this hold time expires without a subsequent hello message from its neighbor, the switch detects a PIM failure on that link.

For added security, you can configure an MD5 hash value that the PIM software uses to authenticate PIM hello messages with PIM neighbors. The IGMP snooping software also processes PIM hello messages.

For information about configuring hello message authentication, see the Configuring PIM Sparse Mode section.

Join-Prune Messages

When the DR receives an IGMP membership report message from a receiver for a new group or source, the DR creates a tree to connect the receiver to the source by sending a PIM join message out the interface toward the rendezvous point (ASM mode) or source (SSM mode). The rendezvous point (RP) is the root of a shared tree, which is used by all sources and hosts in the PIM domain in ASM mode. SSM does not use an RP but builds a shortest path tree (SPT) that is the lowest cost path between the source and the receiver.

When the DR determines that the last host has left a group or source, it sends a PIM prune message to remove the path from the distribution tree.

The routers forward the join or prune action hop by hop up the multicast distribution tree to create (join) or tear down (prune) the path.

Note In this publication, the terms PIM join message and PIM prune message are used to simplify the action taken when referring to the PIM join-prune message with only a join or prune action.

Join-prune messages are sent as quickly as possible by the software. You can filter the join-prune messages by defining a routing policy. For information about configuring the join-prune message policy, see the Configuring PIM Sparse Mode section.

You can prebuild the SPT for all known (S, G) in the routing table by triggering PIM joins upstream. To prebuild the SPT for all known (S, G)s in the routing table by triggering PIM joins upstream, even in the absence of any receivers, use the **ip pim pre-build-spt** command. By default, PIM (S, G) joins are triggered upstream only if the OIF-list for the (S, G) is not empty.

State Refreshes

PIM requires that multicast entries are refreshed within a 3.5-minute timeout interval. The state refresh ensures that traffic is delivered only to active listeners, and it keeps routers from using unnecessary resources.

To maintain the PIM state, the last-hop DR sends join-prune messages once per minute. State creation applies to both (*, G) and (S, G) states as follows:

- (*, G) state creation example—An IGMP (*, G) report triggers the DR to send a (*, G) PIM join message toward the RP.
- (S, G) state creation example—An IGMP (S, G) report triggers the DR to send an (S, G) PIM join message toward the source.

If the state is not refreshed within 180 seconds, the PIM software tears down the distribution tree by removing the forwarding paths in the multicast outgoing interface list of the upstream routers.

Rendezvous Points

A rendezvous point (RP) is a router that you select in a multicast network domain that acts as a shared root for a multicast shared tree. You can configure as many RPs as you like, and you can configure them to cover different group ranges.

Static RP

You can statically configure an RP for a multicast group range. You must configure the address of the RP on every router in the domain.

You can define static RPs for the following reasons:

- To configure routers with the Anycast-RP address
- To manually configure an RP on a switch

For information about configuring static RPs, see the Configuring Static RPs section.

BSRs

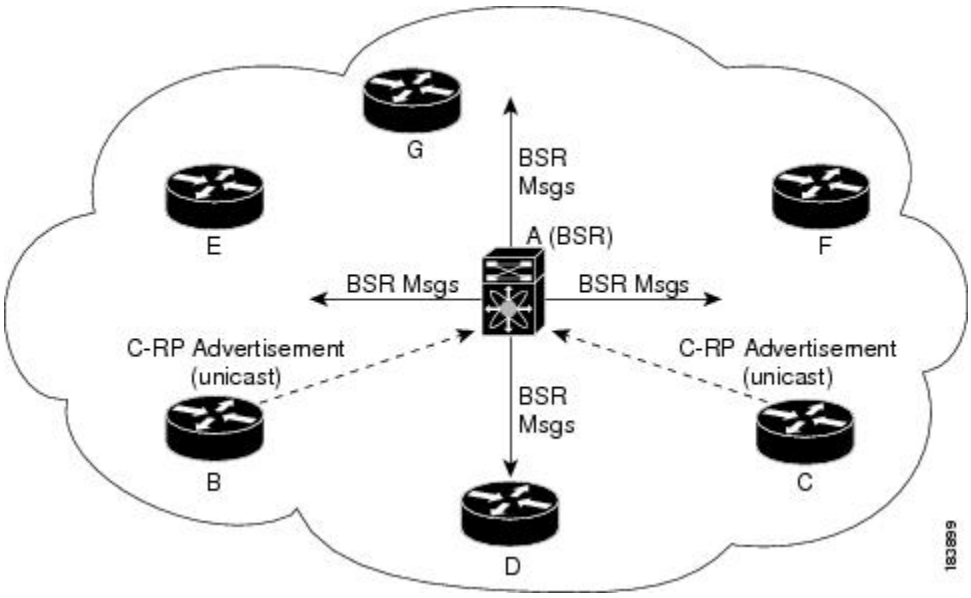
The bootstrap router (BSR) ensures that all routers in the PIM domain have the same RP cache as the BSR. You can configure the BSR to help you select an RP set from BSR candidate RPs. The function of the BSR is to broadcast the RP set to all routers in the domain. You select one or more candidate BSRs to manage the RPs in the domain. Only one candidate BSR is elected as the BSR for the domain.

Caution Do not configure both Auto-RP and BSR protocols in the same network.

The following figure shows where the BSR mechanism, router A, the software-elected BSR, sends BSR messages out all enabled interfaces (shown by the solid lines in the figure). The messages, which contain the RP set, are flooded hop by hop to all routers in the network. Routers B and C are candidate RPs that send their candidate-RP advertisements directly to the elected BSR (shown by the dashed lines in the figure).

The elected BSR receives candidate-RP messages from all the candidate RPs in the domain. The bootstrap message sent by the BSR includes information about all of the candidate RPs. Each router uses a common algorithm to select the same RP address for a given multicast group.

Figure 9: BSR Mechanism



In the RP selection process, the RP address with the best priority is determined by the software. If the priorities match for two or more RP addresses, the software may use the RP hash in the selection process. Only one RP address is assigned to a group.

By default, routers are not enabled to listen or forward BSR messages. You must enable the BSR listening and forwarding feature so that the BSR mechanism can dynamically inform all routers in the PIM domain of the RP set assigned to multicast group ranges.

Note The BSR mechanism is a nonproprietary method of defining RPs that can be used with third-party routers.

For information about configuring BSRs and candidate RPs, see the Configuring BSRs and Configuring Static RPs section.

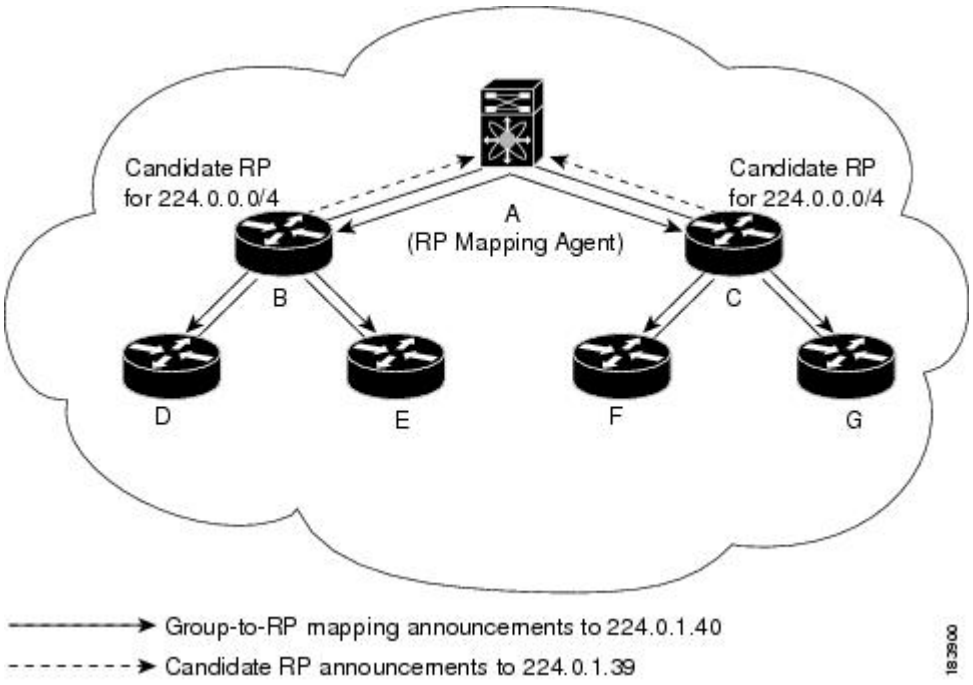
Auto-RP

Auto-RP is a Cisco protocol that was introduced prior to the Internet standard bootstrap router mechanism. You configure Auto-RP by selecting candidate mapping agents and RPs. Candidate RPs send their supported group range in RP-Announce messages to the Cisco RP-Announce multicast group 224.0.1.39. An Auto-RP mapping agent listens for RP-Announce messages from candidate RPs and forms a Group-to-RP mapping table. The mapping agent multicasts the Group-to-RP mapping table in RP-Discovery messages to the Cisco RP-Discovery multicast group 224.0.1.40.

Caution Do not configure both Auto-RP and BSR protocols in the same network.

The following figure shows the Auto-RP mechanism. Periodically, the RP mapping agent multicasts the RP information that it receives to the Cisco-RP-Discovery group 224.0.1.40 (shown by the solid lines in the figure).

Figure 10: Auto-RP Mechanism



By default, routers are not enabled to listen or forward Auto-RP messages. You must enable the Auto-RP listening and forwarding feature so that the Auto-RP mechanism can dynamically inform routers in the PIM domain of the Group-to-RP mapping.

For information about configuring Auto-RP, see the Configuring Auto RP section.

Anycast-RP

Anycast-RP has two implementations: one uses Multicast Source Discovery Protocol (MSDP) and the other is based on RFC 4610. This section describes how to configure PIM Anycast-RP.

You can use PIM Anycast-RP to assign a group of routers, called the Anycast-RP set, to a single RP address that is configured on multiple routers. The set of routers that you configure as Anycast-RPs is called the Anycast-RP set. This method is the only RP method that supports more than one RP per multicast group, which allows you to load balance across all RPs in the set. The Anycast RP supports all multicast groups.

PIM register messages are sent to the closest RP and PIM join-prune messages are sent in the direction of the closest RP as determined by the unicast routing protocols. If one of the RPs goes down, unicast routing ensures these message will be sent in the direction of the next-closest RP.

For more information about PIM Anycast-RP, see RFC 4610

For information about configuring Anycast-RPs, see the Configuring a PIM Anycast RP Set (PIM) section.

PIM Register Messages

PIM register messages are unicast to the RP by designated routers (DRs) that are directly connected to multicast sources. The PIM register message has the following functions:

- To notify the RP that a source is actively sending to a multicast group.

- To deliver multicast packets sent by the source to the RP for delivery down the shared tree.

The DR continues to send PIM register messages to the RP until it receives a Register-Stop message from the RP. The RP sends a Register-Stop message in either of the following cases:

- The RP has no receivers for the multicast group being transmitted.
- The RP has joined the SPT to the source but has not started receiving traffic from the source.

You can use the **ip pim register-source** command to configure the IP source address of register messages when the IP source address of a register message is not a uniquely routed address to which the RP can send packets. This situation might occur if the source address is filtered so that the packets sent to it are not forwarded or if the source address is not unique to the network. In these cases, the replies sent from the RP to the source address fails to reach the DR, resulting in Protocol Independent Multicast sparse mode (PIM-SM) protocol failures.

The following example shows how to configure the IP source address of the register message to the loopback 3 interface of a DR:

```
switch # configuration terminal
switch(config)# vrf context Enterprise
switch(config-vrf)# ip pim register-source ethernet 2/3
switch(config-vrf)#
```

Note In Cisco NX-OS, PIM register messages are rate limited to avoid overwhelming the RP.

You can filter PIM register messages by defining a routing policy. For information about configuring the PIM register message policy, see the Configuring Message Filtering section.

Designated Routers

In PIM ASM and SSM modes, the software chooses a designated router (DR) from the routers on each network segment. The DR is responsible for forwarding multicast data for specified groups and sources on that segment.

The DR for each LAN segment is determined as described in the PIM SSM with vPC section.

In SSM mode, the DR triggers (S, G) PIM join messages toward the source. The path from the receiver to the source is determined hop by hop. The source must be known to the receiver or the DR.

In ASM mode, the DR triggers (S, G) or (*, G) PIM join messages toward the source depending on the IGMP membership reports that it receives. When a DR receives an IGMP membership report from a directly connected host or receiver, the shortest path is formed to the RP. Additionally, the DR is responsible for sending PIM register messages to the RP when the source becomes active. The result is a shared tree that connects all sources transmitting to the same multicast group with all the receivers of that group.

For information about configuring the DR priority, see the Configuring PIM Sparse Mode section.

Administratively Scoped IP Multicast

The administratively scoped IP multicast method allows you to set boundaries on the delivery of multicast data. For more information, see RFC 2365.

You can configure an interface as a PIM boundary so that PIM messages are not sent out that interface. For information about configuring the domain border parameter, see the Configuring Message Filtering section.

You can use the Auto-RP scope parameter to set a time-to-live (TTL) value. For more information, see the Configuring Auto RP section.

Virtualization Support

You can define multiple virtual routing and forwarding (VRF) instances. For each VRF, independent multicast system resources are maintained, including the MRIB.

You can use the PIM **show** commands with a VRF argument to provide a context for the information displayed. The default VRF is used if no VRF argument is supplied.

For information about configuring VRFs, see the Cisco Nexus 3600 NX-OS Unicast Routing Configuration Guide.

Prerequisites for PIM

PIM has the following prerequisites:

- For global commands, you are in the correct virtual routing and forwarding (VRF) mode. The default configuration mode shown in the examples in this chapter applies to the default VRF.

Guidelines and Limitations for PIM

PIM has the following guidelines and limitations:

- Cisco Nexus 3600 platform switches do not support PIM adjacency with a vPC leg or with a router behind a vPC.
- The loopback interface that is used as an RP in multicast must have the ip pim sparse-mode configuration. This is an extra configuration guideline.
- PIM does not interoperate with any version of PIM dense mode or PIM Sparse Mode version 1.
- PIM6 is not supported.
- PIM Bidir is not supported.
- We recommend that you do not configure both Auto-RP and BSR protocols in the same network.
- Configure candidate RP intervals to a minimum of 15 seconds.
- You must configure PIM on the loopback interface that is used for the PIM Anycast-RP.
- Only VRF-lite (no import or export) is supported with PIM.

Default Settings for PIM

The following table lists the default settings for PIM parameters.

Table 6: Default PIM Parameters

Parameters	Default
Use shared trees only	Disabled
Flush routes on restart	Disabled
Log Neighbor changes	Disabled
Auto-RP message action	Disabled
BSR message action	Disabled
SSM multicast group range or policy	232.0.0.0/8 for IPv4
PIM sparse mode	Disabled
Designated router priority	0
Hello authentication mode	Disabled
Domain border	Disabled
RP address policy	No message filtering
PIM register message policy	No message filtering
BSR candidate RP policy	No message filtering
BSR policy	No message filtering
Auto-RP mapping agent policy	No message filtering
Auto-RP RP candidate policy	No message filtering
Join-prune policy	No message filtering
Neighbor adjacency policy	Become adjacent with all PIM neighbors

Configuring PIM

You can configure PIM for each interface.

Note Cisco NX-OS supports PIM sparse mode version 2. In this publication, PIM refers to PIM sparse mode version 2.

You can configure separate ranges of addresses in the PIM domain using the multicast distribution modes described in Table below.

Table 7: PIM Multicast Distribution Modes

Multicast Distribution Mode	Requires RP Configuration	Description
ASM	Yes	Any source multicast
SSM	No	Single source multicast
RPF routes for multicast	No	RPF routes for multicast

To configure PIM, follow these steps:

Procedure

Step 1 From the multicast distribution modes described in table, **PIM Multicast Distribution Modes**, select the range of multicast groups that you want to configure in each mode.

Step 2 Enable the PIM or PIM6 features. See the Enabling the PIM Feature section.

Step 3 Configure PIM sparse mode on each interface that you want to participate in a PIM domain. See the Configuring PIM Sparse Mode section.

Step 4 Follow the configuration steps for the multicast distribution modes that you selected in Step 1 as follows:

- For ASM mode, see the Configuring ASM section.
- For SSM mode, see the Configuring SSM (PIM) section.
- For RPF routes for multicast, see the Configuring RPF Routes for Multicast section.

Step 5 If you are configuring message filtering. See the Configuring Message Filtering section.

Enabling the PIM Feature

Before you can access the PIM commands, you must enable the PIM feature.

Before you begin

Ensure that you have installed the LAN Base Services license.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

	Command or Action	Purpose
Step 2	**feature pim** **Example:** `switch(config)# feature pim`	Enables PIM. By default, PIM is disabled.
Step 3	(Optional) **show running-configuration pim** **Example:** `switch(config)# show running-configuration pim`	Shows the running-configuration information for PIM, including the **feature** command.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring PIM Sparse Mode

You configure PIM sparse mode on every switch interface that you want to participate in a sparse mode domain.

Note For information about configuring multicast route maps, see the Configuring Route Maps to Control RP Information Distribution section.

Note To configure the join-prune policy, see the Configuring Message Filtering section.

Before you begin

Ensure that you have installed the LAN Base Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	(Optional) **ip pim auto-rp** {**listen** [**forward**] | **forward** [**listen**]} **Example:** `switch(config)# ip pim auto-rp listen`	Enables listening for or forwarding of Auto-RP messages. The default is disabled, which means that the software does not listen to or forward Auto-RP messages.

	Command or Action	Purpose
Step 3	(Optional) **ip pim bsr** {**listen** [**forward**] | **forward** [**listen**]} **Example:** `switch(config)# ip pim bsr forward`	Enables listening for or forwarding of BSR messages. The default is disabled, which means that the software does not listen for or forward BSR messages.
Step 4	(Optional) **ip pim rp** [*ip prefix*] **vrf** *vrf-name*| **all** **Example:** `switch(config)# show ip pim rp`	Displays PIM RP information, including Auto-RP and BSR listen and forward states.
Step 5	(Optional) **ip pim register-rate-limit** *rate* **Example:** `switch(config)# ip pim register-rate-limit 1000`	Configures the rate limit in packets per second. The range is from 1 to 65,535. The default is no limit.
Step 6	(Optional) **show running-configuration pim** **Example:** `switch(config)# show running-configuration pim`	Displays PIM running-configuration information, including the register rate limit.

Step 7	**interface** *interface*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Enters interface mode on the interface type and number, such as **ethernet** *slot/port.*

Step 8	**no switchport** **Example:** `sswitch(config-if)# no switchport`	Configures the interface as a Layer 3 routed interface.
Step 9	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Enables PIM sparse mode on this interface. The default is disabled.
Step 10	(Optional) **ip pim dr-priority** *priority* **Example:** `switch(config-if)# ip pim dr-priority 192`	Sets the designated router (DR) priority that is advertised in PIM hello messages. Values range from 1 to 4294967295. The default is 1.
Step 11	(Optional) **ip pim hello-authentication ah-md5** *auth-key* **Example:** `switch(config-if)# ip pim hello-authentication ah-md5 my_key`	Enables an MD5 hash authentication key in PIM hello messages. You can enter an unencrypted (cleartext) key or one of these values followed by a space and the MD5 authentication key: • 0-Specifies an unencrypted (cleartext) key

	Command or Action	Purpose
		• 3-Specifies a 3-DES encrypted key • 7-Specifies a Cisco Type 7 encrypted key
Step 12	(Optional) **ip pim hello-interval** *interval* **Example:** `switch(config-if)# ip pim hello-interval 25000`	Configures the interval at which hello messages are sent in milliseconds. The range is from 1 to 4294967295. The default is 30000. **Note** The minimum value is 1 millisecond.
Step 13	(Optional) **ip pim border** **Example:** `switch(config-if)# ip pim border`	Enables the interface to be on the border of a PIM domain so that no bootstrap, candidate-RP, or Auto-RP messages are sent or received on the interface. The default is disabled.
Step 14	(Optional) **ip pim neighbor-policy** *policy name* **Example:** `switch(config-if)# ip pim neighbor-policy my_neighbor_policy`	Configures which PIM neighbors to become adjacent to based on a route-map policy with the **match ip address** command. The policy name can be up to 63 characters. The default is to become adjacent with all PIM neighbors. **Note** We recommend that you should configure this feature only if you are an experienced network administrator.
Step 15	(Optional) **show ip pim interface** [*interface* | **brief**] [**vrf** *vrf-name* | **all**] **Example:** `switch(config-if)# show ip pim interface`	Displays PIM interface information.
Step 16	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves configuration changes.

Configuring ASM

Any Source Multicast (ASM) is a multicast distribution mode that require the use of RPs to act as a shared root between sources and receivers of multicast data.

To configure ASM mode, you configure sparse mode and the RP selection method, where you indicate the distribution mode and assign the range of multicast groups.

Configuring Static RPs

You can configure an RP statically by configuring the RP address on every router that will participate in the PIM domain.

You can specify a route-map policy name that lists the group prefixes to use with the **match ip multicast** command.

Note We recommend that the RP address uses the loopback interface.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**ip pim rp-address** *rp-address* [**group-list** *ip-prefix* | **route-map** *policy-name*] **Example:** `switch(config)# ip pim rp-address 192.0.2.33 group-list 224.0.0.0/9`	Configures a PIM static RP address for a multicast group range. You can specify a route-map policy name that lists the group prefixes to use with the **match ip multicast** command. The default mode is ASM. The default group range is 224.0.0.0 through 239.255.255.255. The example configures PIM ASM mode for the specified group range.
Step 3	(Optional) **show ip pim group-range** [*ip-prefix* | **vrf** *vrf-name* | **all**] **Example:** `switch(config)#show ip pim group-range`	Displays PIM modes and group ranges.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring BSRs

You configure BSRs by selecting candidate BSRs and RPs.

Note We recommend that you do not configure both Auto-RP and BSR protocols in the same network.

You can configure a candidate BSR with the arguments described in the following table.

Table 8: Candidate BSR Arguments

Argument	Description
interface	Interface type and number used to derive the BSR source IP address used in bootstrap messages.
hash-length	Hash length is the number of high order 1s used to form a mask that is ANDed with group address ranges of candidate RPs to form a hash value. The mask determines the number of consecutive addresses to assign across RPs with the same group range. For PIM, this value ranges from 0 to 32 and has a default of 30.
priority	Priority assigned to this BSR. The software elects the BSR with the highest priority, or if the BSR priorities match, the software elects the BSR with the highest IP address. This value ranges from 0, the lowest priority, to 255 and has a default of 64.

You can configure a candidate RP with the arguments and keywords described in Table 4.

Table 9: BSR Candidate RP Arguments and Keywords

Argument or Keyword	Description
interface	Interface type and number used to derive the BSR source IP address used in boots messages.
group-list *ip-prefix*	Multicast groups handled by this RP specified in a prefix format.
interval	Number of seconds between sending candidate-RP messages. This value ranges f 1 to 65,535 and has a default of 60 seconds. **Note** We recommend that you configure the candidate RP interval to a minimum of 15 seconds.
priority	Priority assigned to this RP. The software elects the RP with the highest priority a range of groups or, if the priorities match, the highest IP address. (The highest priority is the lowest numerical value.) This value ranges from 0, the highest prio to 255 and has a default of 192. **Note** This priority differs from the BSR BSR-candidate priority, which pre the highest value between 0 and 255.

Tip You should choose the candidate BSRs and candidate RPs that have good connectivity to all parts of the PIM domain.

You can configure the same router to be both a BSR and a candidate RP. In a domain with many routers, you can select multiple candidate BSRs and RPs to automatically fail over to alternates if a BSR or an RP fails.

To configure candidate BSRs and RPs, follow these steps:

1. Configure whether each router in the PIM domain should listen and forward BSR messages. A router configured as either a candidate RP or a candidate BSR will automatically listen to and forward all bootstrap router protocol messages, unless an interface is configured with the domain border feature. For more information, see the Configuring PIM Sparse Mode section.
2. Select the routers to act as candidate BSRs and RPs.
3. Configure each candidate BSR and candidate RP as described in this section.
4. Configure BSR message filtering. See the Configuring Message Filtering section.

Configuring BSRs

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**ip pim** [**bsr**] **bsr-candidate** *interface* [**hash-len** *hash-length*] [**priority** *priority*] **Example:** `switch(config)# ip pim bsr-candidate ethernet 2/1 hash-len 24`	Configures a candidate bootstrap router (BSR). The source IP address used in a bootstrap message is the IP address of the interface. The hash length ranges from 0 to 32 and has a default of 30. The priority ranges from 0 to 255 and has a default of 64. For parameter details, see Table 10.
Step 3	**ip pim** [**bsr**] **rp-candidate** *interface* **group-list** *ip-prefix* **route-map** *policy-name* **priority** *priority* **interval** *interval* **Example:** `switch(config)# ip pim rp-candidate ethernet 2/1 group-list 239.0.0.0/24`	Configures a candidate RP for BSR. The priority ranges from 0, the highest priority, to 65,535 and has a default of 192. The interval ranges from 1 to 65,535 seconds and has a default of 60. **Note** We recommend that you configure the candidate RP interval to a minimum of 15 seconds. The example configures an ASM candidate RP.
Step 4	(Optional) **show ip pim group-range** [*ip-prefix*] [**vrf** *vrf-name* | **all**] **Example:**	Displays PIM modes and group ranges.

	Command or Action	Purpose
	`switch(config)# show ip pim group-range`	
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring Auto-RP

You can configure Auto-RP by selecting candidate mapping agents and RPs. You can configure the same router to be both a mapping agent and a candidate RP.

Caution Do not configure both Auto-RP and BSR protocols in the same network.

You can configure an Auto-RP mapping agent with the arguments described in the following table.

Table 10: Auto-RP Mapping Agent Arguments

Argument	Description
interface	Interface type and number used to derive the IP address of the Auto-RP mapping agent used in bootstrap messages.
scope *ttl*	Time-to-Live (TTL) value that represents the maximum number of hops that RP-Discovery messages are forwarded. This value can range from 1 to 255 and has a default of 32. **Note** See the border domain feature in the Configuring PIM Sparse Mode section.

If you configure multiple Auto-RP mapping agents, only one is elected as the mapping agent for the domain. The elected mapping agent ensures that all candidate RP messages are sent out. All mapping agents receive the candidate RP messages and advertise the same RP cache in their RP-discovery messages.

You can configure a candidate RP with the arguments and keywords described in the following table.

Table 11: Auto-RP Candidate RP Arguments and Keywords

Argument or Keyword	Description
interface	Interface type and number used to derive the IP address of the candidate RP used in bootstrap messages.
group-list *ip-prefix*	Multicast groups handled by this RP. Specified in a prefix format.
scope *ttl*	Time-to-Live (TTL) value that represents the maximum number of hops that RP-Discovery messages are forwarded. This value can range from 1 to 255 and has a default of 32. **Note** See the border domain feature in the Configuring PIM Sparse Mode section.

Argument or Keyword	Description
interval	Number of seconds between sending RP-Announce messages. This value can range from 1 to 65,535 and has a default of 60. **Note** We recommend that you configure the candidate RP interval to a minimum of 15 seconds.

Tip You should choose mapping agents and candidate RPs that have good connectivity to all parts of the PIM domain.

To configure Auto-RP mapping agents and candidate RPs, follow these steps:

1. For each router in the PIM domain, configure whether that router should listen and forward Auto-RP messages. A router configured as either a candidate RP or an Auto-RP mapping agent will automatically listen to and forward all Auto-RP protocol messages, unless an interface is configured with the domain border feature. For more information, see the Configuring PIM Sparse Mode section.
2. Select the routers to act as mapping agents and candidate RPs.
3. Configure each mapping agent and candidate RP as described in this section.
4. Configure Auto-RP message filtering. See the Configuring Message Filtering section.

Configuring Auto RP

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**ip pim** {**send-rp-discovery** | **auto-rp mapping-agent**} *interface* [**scope** *ttl*] **Example:** `switch(config)# ip pim auto-rp mapping-agent ethernet 2/1`	Configures an Auto-RP mapping agent. The source IP address used in Auto-RP Discovery messages is the IP address of the interface. The default scope is 32. For parameter details, see table **Auto-RP Mapping Agent Arguments**.
Step 3	**ip pim** {**send-rp-announce** | {**auto-rp rp-candidate**}} interface **group-list** *ip-prefix* [**scope** *ttl*] [**interval** *interval*] [**bidir**] **Example:**	Configures an Auto-RP candidate RP. The default scope is 32. The default interval is 60 seconds. By default, the command creates an ASM candidate RP. For parameter details, see

	Command or Action	Purpose
	`switch(config)# ip pim auto-rp rp-candidate ethernet 2/1 group-list 239.0.0.0/24`	table **Auto-RP Candidate RP Arguments and Keywords**. **Note** We recommend that you configure the candidate RP interval to a minimum of 15 seconds. The example configures ASM candidate RP.
Step 4	(Optional) **show ip pim group-range** [*ip-prefix* | **vrf** *vrf-name* | **all**] **Example:** `switch(config)# show ip pim group-range`	Displays PIM modes and group ranges.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring a PIM Anycast RP Set (PIM)

To configure a PIM Anycast-RP set, follow these steps:

Step 1 Select the routers in the PIM Anycast-RP set.

Step 2 Select an IP address for the PIM Anycast-RP set.

Step 3 Configure each peer RP and local address in the PIM Anycast-RP set as described in this section.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface loopback** *number*
	Example:
	`switch(config)# interface loopback 0`
	`switch(config-if)#`
		Configures an interface loopback.
		This example configures interface loopback 0.

Step 3	**ip address** *ip-prefix* **Example:**	Configures an IP address for this interface. This example configures an IP address for the Anycast-RP.

	Command or Action	Purpose
	`switch(config-if)# ip address 192.168.1.1/32`	
Step 4	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Enables PIM sparse mode on this interface. The default is disabled.
Step 5	**exit** **Example:** `switch(config)# exit`	Returns to configuration mode.

Step 6	**ip pim anycast-rp** *anycast-rp-address anycast-rp-peer-address*
	Example:
	`switch(config)# ip pim anycast-rp 192.0.2.3 192.0.2.31`
	`switch(config)# ip pim anycast-rp 192.0.2.3 192.0.2.32`
		Configures a PIM Anycast-RP peer address for the specified Anycast-RP address. Each command with the same Anycast-RP address forms an Anycast-RP set. The IP addresses of RPs are used for communication with RPs in the set.
		The example shows an Anycast-RP set of 192.0.2.31 and 192.0.2.32, and the Anycast-RP used in the network would be 192.0.2.3.

Step 7	Repeat Step 6 using the same Anycast-RP address for each peer RP in the Anycast-RP set.	—
Step 8	**show ip pim group-range** [*ip-prefix*] [**vrf** { *vrf-name* | **all** }]	Displays PIM modes and group ranges.
Step 9	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring Shared Trees Only for ASM

You can configure shared trees only on the last-hop router for Any Source Multicast (ASM) groups, which means that the router never switches over from the shared tree to the SPT when a receiver joins an active group. You can specify a group range where the use of shared trees is to be enforced with the **match ip[v6] multicast** command. This option does not affect the normal operation of the router when a source tree join-prune message is received.

The default is disabled, which means that the software can switch over to source trees.

Note In ASM mode, only the last-hop router switches from the shared tree to the SPT.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**ip pim use-shared-tree-only group-list** *policy-name* **Example:** `switch(config)# ip pim use-shared-tree-only group-list my_group_policy`	Builds only shared trees, which means that the software never switches over from the shared tree to the SPT. You specify a route-map policy name that lists the groups to use with the **match ip multicast** command. By default, the software triggers a PIM (S, G) join toward the source when it receives multicast packets for a source for which it has the (*, G) state.
Step 3	(Optional) **show ip pim group-range** [*ip-prefix* | **vrf** *vrf-name* | **all**] **Example:** `switch(config)# show ip pim group-range`	Displays PIM modes and group ranges.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves configuration changes.

Setting the Maximum Number of Entries in the Multicast Routing Table

You can set the maximum number of entries in the multicast routing table (MRT).

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**hardware profile multicast max-limit** *max-entries* **Example:** `switch(config)# hardware profile multicast max-limit 3000`	Sets the maximum number of entries in the multicast routing table. The maximum number of entries in the multicast routing table can range from 0 to 8000.

	Command or Action	Purpose
Step 3	(Optional) **show hardware profile status** **Example:** `switch(config)# show hardware profile status`	Displays information about the multicast routing table limits.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring SSM (PIM)

Source-Specific Multicast (SSM) is a multicast distribution mode where the software on the DR connected to a receiver that is requesting data for a multicast source builds a shortest path tree (SPT) to that source.

On an IPv4 network, a host can request multicast data for a specific source only if it is running IGMPv3 and the DR for that host is running IGMPv3. You will usually enable IGMPv3 when you configure an interface for PIM in the SSM mode. For hosts running IGMPv1 or IGMPv2, you can configure group to source mapping using SSM translation. For more information, see Configuring IGMP, on page 13

You can configure the group range that is used by SSM by specifying values on the command line. By default, the SSM group range for PIM is 232.0.0.0/8.

You can specify a route-map policy name that lists the group prefixes to use with the **match ip multicast** command.

Note If you want to use the default SSM group range, you do not need to configure the SSM group range.

Before you begin

Ensure that you have installed the LAN Base Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip pim ssm** {**prefix-list** *name* | **range** {*ip-prefix* | none} | route-map *policy-name*} **Example:** `switch(config)# ip pim ssm range 239.128.1.0/24`	The following options are available: • **prefix-list**—Specifies a prefix-list policy name for the SSM range. • **range**—Configures a group range for SSM. The default range is 232.0.0.0/8. If

	Command or Action	Purpose
	Example: `switch(config)# no ip pim ssm range none`	the keyword **none** is specified, all group ranges are removed. • **route-map**—Specifies a route-map policy name that lists the group prefixes to use with the **match ip multicast** command. The **no** option removes the specified prefix from the SSM range or removes the prefix-list or route-map policy. If the keyword **none** is specified, the **no** command resets the SSM range to the default value of 232.0.0.0/8. **Note** You can configure a maximum of four ranges for SSM multicast, using the **prefix-list**, **range**, or **route-map** commands.
Step 3	(Optional) **show ip pim group-range** [*ip-prefix* | **vrf** *vrf-name*] **Example:** `switch(config)# show ip pim group-range`	Displays PIM modes and group ranges.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring PIM SSM Over a vPC

Configuring PIM SSM over a vPC enables support for IGMPv3 joins and PIM S,G joins over vPC peers in the SSM range. This configuration is supported for orphan sources or receivers in the Layer 2 or Layer 3 domain.

(S,G) entries will have the RPF as the interface toward the source, and no *,G states will be maintained in the MRIB.

Before you begin

Ensure that you have the PIM and vPC features enabled.

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:**	Enters global configuration mode.

	Command or Action	Purpose
	`switch# configure terminal` `switch(config)#`	

Step 2	**vrf context name**
	Example:
	`switch(config)# vrf context Enterprise`
	`switch(config-vrf)#`
		Creates a new VRF and enters VRF configuration mode. The name can be any case-sensitive, alphanumeric string up to 32 characters.

Step 3	(Optional) [**no**] **ip pim ssm** { *prefix-list name* | *range* { **ip-prefix** | **none**} | *route-map policy-name*} **Example:** `switch(config-vrf)# ip pim ssm range 234.0.0.0/24`	The following options are available: • prefix-list—Specifies a prefix-list policy name for the SSM range. • range—Configures a group range for SSM. The default range is 232.0.0.0/8. If the keyword none is specified, all group ranges are removed. • route-map—Specifies a route-map policy name that lists the group prefixes to use with the match ip multicast command. You can override the default range by using this command. The command in the example overrides the default range to 234.0.0.0/24. The no option removes the specified prefix from the SSM range or removes the prefix-list or route-map policy. If the keyword none is specified, the no command resets the SSM range to the default value of 232.0.0.0/8
Step 4	(Optional) **show ip pim group-range** [*ip-prefix*] [**vrf** { *vrf-name* | **all** }] **Example:** `switch(config)# show ip pim group-range`	Displays PIM modes and group ranges.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Configuring RPF Routes for Multicast

You can define RPF routes for multicast when you want multicast data to diverge from the unicast traffic path. You can define RPF routes for multicast on border routers to enable reverse path forwarding (RPF) to an external network.

Multicast routes are used not to directly forward traffic but to make RPF checks. RPF routes for multicast cannot be redistributed. For more information about multicast forwarding, see the Multicast Forwarding section.

Before you begin

Ensure that you have installed the LAN Base Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip mroute** {*ip-addr mask* | *ip-prefix*} {*next-hop* | *nh-prefix* |} [*route-preference*] [**vrf** *vrf-name*] **Example:** `switch(config)# ip mroute 192.0.2.33/24 192.0.2.1`	Configures an RPF route for multicast for use in RPF calculations. Route preference values range from 1 to 255. The default preferenceis 1.
Step 3	(Optional) **show ip static-route** [**vrf** *vrf-name*] **Example:** `switch(config)# show ip static-route`	Displays configured static routes.
Step 4	(Optional) **copy running-config startup-config**	Saves configuration changes.

Disabling Multicast Multipath

By default, the RPF interface for multicast is chosen automatically when there are multiple ECMP paths available. Disabling the automatic selection allows you to specify a single RPF interface for multicast.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip multicast multipath none** **Example:** `switch(config)# ip multicast multipath none`	Disables multicast multipath.
Step 3	**clear ip mroute * vrf all** **Example:** `switch(config)# clear ip mroute * vrf all`	Clears multipath routes and activates multicast multipath suppression.

Configuring Route Maps to Control RP Information Distribution

You can configure route maps to help protect against some RP configuration errors and malicious attacks. You use route maps in commands that are described in this section.

By configuring route maps, you can control distribution of RP information that is distributed throughout the network. You specify the BSRs or mapping agents to be listened to on each client router and the list of candidate RPs to be advertised (listened to) on each BSR and mapping agent to ensure that what is advertised is what you expect.

Note Only the **match ipv6 multicast** command has an effect in the route map.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM6.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**route-map** *map-name* [**permit** | **deny**] [*sequence-number*]
	Example:
	`switch(config)# route-map ASM_only permit 10`
	`switch(config-route-map)#`
		Enters route-map configuration mode. This configuration method uses the **permit** keyword.

Step 3	**match ip multicast** {**rp** *ip-address* [**rp-type** *rp-type*] [**group** *ip-prefix*]} | {**group** *ip-prefix* **rp** *ip-address* [**rp-type** *rp-type*]} **Example:** `switch(config)# match ip multicast group 224.0.0.0/4 rp 0.0.0.0/0 rp-type ASM`	Matches the group, RP, and RP type specified. You can specify the RP type (ASM or Bidir). This configuration method requires the group and RP specified as shown in the examples.
Step 4	(Optional) **show route-map** **Example:** `switch(config-route-map)# show route-map`	Displays configured route maps.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config-route-map)# copy running-config startup-config`	Saves configuration changes.

Configuring Message Filtering

You can configure filtering of the PIM and PIM6 messages described in the following table.

Table 12: PIM and PIM6 Message Filtering

Message Type	Description
Global to the switch	
PIM register policy	Enables PIM register messages to be filtered based on a route-map policy,where you can specify group or group and source addresses with the **match ip multicast** command. This policy applies to routers that act as an RP. The default is disabled, which means that the software does not filter PIM register messages.
BSR candidate RP policy	Enables BSR candidate RP messages to be filtered by the router based on a route-map policy, where you can specify the RP and group addresses, and the type ASM with the **match ip multicast** command. This command can be used on routers that are eligible for BSR election. The default is no filtering of BSR messages.
BSR policy	Enables BSR messages to be filtered by the BSR client routers based on a route-map policy, where you can specify BSR source addresses with the **match ip multicast** command. This command can be used on client routers that listen to BSR messages. The default is no filtering of BSR messages.
Auto-RP candidate RP policy	Enables Auto-RP announce messages to be filtered by the Auto-RP mapping agents based on a route-map policy where you can specify the RP and group addresses, and the type ASM with the **match ip multicast** command. This command can be used on a mapping agent. The default is no filtering of Auto-RP messages.
Auto-RP mapping agent policy	Enables Auto-RP discover messages to be filtered by client routers based on a route-map policy where you can specify mapping agent source addresses with the **match ip multicast** command. This command can be used on client routers that listen to discover messages. The default is no filtering of Auto-RP messages.
Per Switch Interface	
Join-prune policy	Enables join-prune messages to be filtered based on a route-map policy where you can specify group, group and source, or group and RP addresses with the **match ip**[**v6**] **multicast** command. The default is no filtering of join-prune messages.

For information about configuring multicast route maps, see the Configuring Route Maps to Control RP Information Distribution section.

Configuring Message Filtering

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	(Optional) **ip pim register-policy** *policy-name* **Example:** `switch(config)# ip pim register-policy my_register_policy`	Enables PIM register messages to be filtered based on a route-map policy. You can specify group or group and source addresses with the **match ip multicast** command.
Step 3	(Optional) **ip pim bsr rp-candidate-policy** *policy-name* **Example:** `switch(config)# ip pim bsr rp-candidate-policy my_bsr_rp_candidate_policy`	Enables BSR candidate RP messages to be filtered by the router based on a route-map policy where you can specify the RP and group addresses, and the type ASM with the *match ip multicast* command. This command can be used on routers that are eligible for BSR election. The default is no filtering of BSR messages.
Step 4	(Optional) **ip pim bsr bsr-policy** *policy-name* **Example:** `switch(config)# ip pim bsr bsr-policy my_bsr_policy`	Enables BSR messages to be filtered by the BSR client routers based on a route-map policy where you can specify BSR source addresses with the **match ip multicast** command. This command can be used on client routers that listen to BSR messages. The default is no filtering of BSR messages.
Step 5	(Optional) **ip pim auto-rp rp-candidate-policy** *policy-name* **Example:** `switch(config)# ip pim auto-rp rp-candidate-policy my_auto_rp_candidate_policy`	Enables Auto-RP announce messages to be filtered by the Auto-RP mapping agents based on a route-map policy where you can specify the RP and group addresses with the **match ip multicast**command. This command can be used on a mapping agent. The default is no filtering of Auto-RP messages.
Step 6	(Optional) **ip pim auto-rp mapping-agent-policy** *policy-name* **Example:** `switch(config)# ip pim auto-rp mapping-agent-policy my_auto_rp_mapping_policy`	Enables Auto-RP discover messages to be filtered by client routers based on a route-map policy where you can specify mapping agent source addresses with the **match ip multicast** command. This command can be used on client routers that listen to discover messages. The default is no filtering of Auto-RP messages.

	Command or Action	Purpose

Step 7	**interface** *interface*
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		Enters interface mode on the specified interface.

Step 8	**no switchport** **Example:** `switch(config-if)# no switchport`	Configures the interface as a Layer 3 routed interface.
Step 9	(Optional) **ip pim jp-policy** *policy-name* [**in** | **out**] **Example:** `switch(config-if)# ip pim jp-policy my_jp_policy`	Enables join-prune messages to be filtered based on a route-map policy where you can specify group, group and source, or group and RP addresses with the **match ip multicast** command. The default is no filtering of join-prune messages. This command filters messages in both incoming and outgoing directions.
Step 10	(Optional) **show run pim** **Example:** `switch(config-if)# show run pim`	Displays PIM configuration commands.
Step 11	(Optional) **copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	Saves configuration changes.

Flushing the Routes

When routes are flushed, they are removed from the Multicast Routing Information Base (MRIB) and the Multicast Forwarding Information Base (MFIB).

When you restart PIM, the following tasks are performed:

- The PIM database is deleted.
- The MRIB and MFIB are unaffected and forwarding of traffic continues.
- The multicast route ownership is verified through the MRIB.
- Periodic PIM join and prune messages from neighbors are used to repopulate the database.

Before you begin

Ensure that you have installed the LAN Base Services license and enabled PIM.

Procedure

	Command or Action	Purpose
Step 1	**restart pim** **Example:** `switch# restart pim`	Restarts the PIM process.

Step 2	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 3	**ip pim flush-routes** **Example:** `switch(config)# ip pim flush-routes`	Removes routes when the PIM process is restarted. By default, routes are not flushed.
Step 4	**show running-configuration pim** **Example:** `switch(config)# show running-configuration pim`	Shows the PIM running-configuration information, including the **flush-routes** command.
Step 5	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Saves configuration changes.

Verifying the PIM Configuration

To display the PIM configuration information, perform one of the following tasks:

Command	Purpose
show ip mroute { *source* | *group* [*source*]} [**vrf** *vrf-name* | **all**]	Displays the IP multicast routing table.
show ip pim group-range [**vrf** *vrf-name* | **all**]	Displays the learned or configured group ranges and modes. For similar information, see also the **show ip pim rp** command.
show ip pim interface [*interface* | **brief**] [**vrf** *vrf-name* | **all**]	Displays information by the interface.
show ip pim neighbor [**vrf** *vrf-name* | **all**]	Displays neighbors by the interface.
show ip pim oif-list *group* [*source*] [**vrf** *vrf-name* | **all**]	Displays all the interfaces in the OIF-list.

Command	Purpose
show ip pim route {**source group** | **group** [**source**]} [**vrf** *vrf-name* | **all**]	Displays information for each multicast route, including interfaces on which a PIM join for that (S, G) has been received.
show ip pim rp [**vrf** *vrf-name* | **all**]	Displays rendezvous points (RPs) known to the software, how they were learned, and their group ranges. For similar information, see also the **show ip pim group-range** command.
show ip pim rp-hash [**vrf** *vrf-name* | **all**]	Displays the bootstrap router (BSR) RP hash information.
show running-configuration pim	Displays the running-configuration information.
show startup-configuration pim	Displays the running-configuration information.
show ip pim vrf [*vrf-name* | **all**] [**detail**]	Displays per-VRF information.

For detailed information about the fields in the output from these commands, see the Cisco Nexus 3000 Series Command Reference.

Displaying Statistics

You can display and clear PIM statistics by using the commands in this section.

Displaying PIM Statistics

You can display the PIM statistics and memory usage using the commands listed in the table below. Use the **show ip** form of the command for PIM.

Table 13: PIM Statistics Commands

Command	Description
show ip pim policy statistics	Displays policy statistics for Register, RP, and join-prune message policies.

Clearing PIM Statistics

You can clear the PIM statistics using the commands listed in the following Table.

Table 14: PIM Commands to Clear Statistics

Command	Description
clear ippim interface statistics *interface*	Clears counters for the specified interface.
clear ip pim policy statistics	Clears policy counters for Register, RP, and join-prune message policies.

Command	Description
clear ip pim statistics [**vrf** *vrf-name* | **all**]	Clears global counters handled by the PIM process.

Configuration Examples for PIM

This section describes how to configure PIM using different data distribution modes and RP selection methods.

Configuration Example for SSM

To configure PIM in SSM mode, follow these steps for each router in the PIM domain:

1. **Step 1**: Configure PIM sparse mode parameters on the interfaces that you want to participate in the domain. We recommend that you enable PIM on all interfaces.

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip pim sparse-mode
```

2. **Step 2**: Configure the parameters for IGMP that support SSM. See Configuring IGMP, on page 13. Usually, you configure IGMPv3 on PIM interfaces to support SSM.

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip igmp version 3
```

3. **Step 3**: Configure the SSM range if you do not want to use the default range.

```
switch# configure terminal
switch(config)# ip pim ssm range 239.128.1.0/24
```

4. **Step 4**: Configure message filtering.

```
switch# configure terminal
switch(config)# ip pim log-neighbor-changes
```

This example shows how to configure PIM in SSM mode:

```
configure terminal
interface ethernet 2/1
no switchport
ip pim sparse-mode
ip igmp version 3
exit
ip pim ssm range 239.128.1.0/24
ip pim log-neighbor-changes
```

Configuration Example for PIM SSM Over vPC

This example shows how to override the default SSM range of 232.0.0.0/8 to 225.1.1.1/32. No special configuration is required to support PIM SSM over vPC. If you choose to change the default SSM to a different range (for example, to 225.1.1.1), this example shows you how to do it.

```
switch# configure terminal
switch(config)# vrf context Enterprise
switch(config-vrf)# ip pim ssm range 225.1.1.1/32
switch(config-vrf)# show ip pim group-range
PIM Group-Range Configuration for VRF "default"
Group-range Action Mode RP-address Shrd-tree-range Origin
225.1.1.1/32 Accept SSM - - Local

switch1# show vpc (primary vPC) --> Shows vPC-related information. Legend:
(*) - local vPC is down, forwarding via vPC peer-link
vPC domain id: 10
Peer status: peer adjacency formed ok
vPC keep-alive status: peer is alive
Configuration consistency status: success
Per-vlan consistency status: success
Type-2 consistency status: success
vPC role: primary
Number of vPCs configured: 2
Peer Gateway: Disabled
Dual-active excluded VLANs: -
Graceful Consistency Check: Enabled
Auto-recovery status: Disabled
Delay-restore status: Timer is off.(timeout = 30s)
Delay-restore SVI status: Timer is off.(timeout = 10s)

vPC Peer-link status
---------------------------------------------------------------------
id Port Status Active vlans
-- ---- ------ --------------------------------------------------
1 Po1000 up 101-102

vPC status
----------------------------------------------------------------------------
id Port Status Consistency Reason Active vlans
-- ---- ------ ----------- ------ ------------
1 Po1 up success success 102
2 Po2 up success success 101

switch2# show vpc (secondary vPC)
Legend:
(*) - local vPC is down, forwarding via vPC peer-link
vPC domain id: 10
Peer status: peer adjacency formed ok
vPC keep-alive status: peer is alive
Configuration consistency status: success
Per-vlan consistency status: success
Type-2 consistency status: success
vPC role: primary
Number of vPCs configured: 2
Peer Gateway: Disabled
Dual-active excluded VLANs: -
Graceful Consistency Check: Enabled
Auto-recovery status: Disabled
Delay-restore status: Timer is off.(timeout = 30s)
Delay-restore SVI status: Timer is off.(timeout = 10s)

vPC Peer-link status
---------------------------------------------------------------------
id Port Status Active vlans
-- ---- ------ --------------------------------------------------
1 Po1000 up 101-102
vPC status
----------------------------------------------------------------------------
id Port Status Consistency Reason Active vlans
```

```
-- ---- ------ ----------- ------ ------------
1 Po1 up success success 102
2 Po2 up success success 101

switch1# show ip igmp snooping group vlan 101 (primary vPC IGMP snooping states) --> Shows
 if S,G v3 joins are received and on which VLAN. The same VLAN should be OIF in the MRIB
output.
Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port
Vlan Group Address Ver Type Port list
101 */* - R Eth9/5
101 225.1.1.1 v3
100.6.160.20 D Eth9/3

switch2# show ip igmp snooping group vlan 101 (secondary vPC IGMP snooping states)
Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port

Vlan Group Address Ver Type Port list
101 */* - R Eth9/5
101 225.1.1.1 v3
100.6.160.20 D Eth9/3


switch1# show ip pim route (primary vPC PIM route) --> Shows the route information in the
PIM protocol.
PIM Routing Table for VRF "default" - 3 entries
(10.6.159.20/32, 225.1.1.1/32), expires 00:02:37
Incoming interface: Ethernet1/19, RPF nbr 10.6.159.20
Oif-list: (1) 00000000, timeout-list: (0) 00000000
Immediate-list: (1) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 2, JP-holdtime round-up: 3
(100.6.160.20/32, 225.1.1.1/32), expires 00:01:19
Incoming interface: Vlan102, RPF nbr 100.6.160.20
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 2, JP-holdtime round-up: 3
(*, 232.0.0.0/8), expires 00:01:19
Incoming interface: Null0, RPF nbr 0.0.0.0
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 2, JP-holdtime round-up: 3

switch2# show ip pim route (secondary vPC PIM route)
PIM Routing Table for VRF "default" - 3 entries (10.6.159.20/32, 225.1.1.1/32), expires
00:02:51
Incoming interface: Vlan102, RPF nbr 100.6.160.100
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3
(100.6.160.20/32, 225.1.1.1/32), expires 00:02:51
Incoming interface: Vlan102, RPF nbr 100.6.160.20
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000

PIM SSM Over vPC Configuration Example
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3
(*, 232.0.0.0/8), expires 00:02:51
Incoming interface: Null0, RPF nbr 0.0.0.0
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
```

```
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3

switch2# show ip pim route (secondary vPC PIM route)
PIM Routing Table for VRF "default" - 3 entries
(10.6.159.20/32, 225.1.1.1/32), expires 00:02:29
Incoming interface: Vlan102, RPF nbr 100.6.160.100
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3
(100.6.160.20/32, 225.1.1.1/32), expires 00:02:29
Incoming interface: Vlan102, RPF nbr 100.6.160.20
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3
(*, 232.0.0.0/8), expires 00:02:29
Incoming interface: Null0, RPF nbr 0.0.0.0
Oif-list: (0) 00000000, timeout-list: (0) 00000000
Immediate-list: (0) 00000000, timeout-list: (0) 00000000
Sgr-prune-list: (0) 00000000
Timeout-interval: 3, JP-holdtime round-up: 3

switch1# show ip mroute (primary vPC MRIB route) --> Shows the IP multicast routing table.
IP Multicast Routing Table for VRF "default"
(10.6.159.20/32, 225.1.1.1/32), uptime: 03:16:40, pim ip
Incoming interface: Ethernet1/19, RPF nbr: 10.6.159.20
Outgoing interface list: (count: 1)
Vlan102, uptime: 03:16:40, pim
(100.6.160.20/32, 225.1.1.1/32), uptime: 03:48:57, igmp ip pim
Incoming interface: Vlan102, RPF nbr: 100.6.160.20
Outgoing interface list: (count: 1)
Vlan101, uptime: 03:48:57, igmp
(*, 232.0.0.0/8), uptime: 6d06h, pim ip
Incoming interface: Null, RPF nbr: 0.0.0.0
Outgoing interface list: (count: 0)

switch1# show ip mroute detail (primary vPC MRIB route) --> Shows if the (S,G) entries have
 the RPF as the interface toward the source and no *,G states are maintained for the SSM
group range in the MRIB.
IP Multicast Routing Table for VRF "default"
Total number of routes: 3
Total number of (*,G) routes: 0
Total number of (S,G) routes: 2
Total number of (*,G-prefix) routes: 1
(10.6.159.20/32, 225.1.1.1/32), uptime: 03:24:28, pim(1) ip(0)
Data Created: Yes
VPC Flags
RPF-Source Forwarder
Stats: 1/51 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Ethernet1/19, RPF nbr: 10.6.159.20
Outgoing interface list: (count: 1)
Vlan102, uptime: 03:24:28, pim
(100.6.160.20/32, 225.1.1.1/32), uptime: 03:56:45, igmp(1) ip(0) pim(0)
Data Created: Yes
VPC Flags
RPF-Source Forwarder
Stats: 1/51 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Vlan102, RPF nbr: 100.6.160.20
Outgoing interface list: (count: 1)
Vlan101, uptime: 03:56:45, igmp (vpc-svi)
```

```
(*, 232.0.0.0/8), uptime: 6d06h, pim(0) ip(0)
Data Created: No
Stats: 0/0 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Null, RPF nbr: 0.0.0.0
Outgoing interface list: (count: 0)

switch2# show ip mroute detail (secondary vPC MRIB route)
IP Multicast Routing Table for VRF "default"
Total number of routes: 3
Total number of (*,G) routes: 0
Total number of (S,G) routes: 2
Total number of (*,G-prefix) routes: 1
(10.6.159.20/32, 225.1.1.1/32), uptime: 03:26:24, igmp(1) pim(0) ip(0)
Data Created: Yes
Stats: 1/51 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Vlan102, RPF nbr: 100.6.160.100
Outgoing interface list: (count: 1)
Ethernet1/17, uptime: 03:26:24, igmp
(100.6.160.20/32, 225.1.1.1/32), uptime: 04:06:32, igmp(1) ip(0) pim(0)
Data Created: Yes
VPC Flags
RPF-Source Forwarder
Stats: 1/51 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Vlan102, RPF nbr: 100.6.160.20
Outgoing interface list: (count: 1)
Vlan101, uptime: 04:03:24, igmp (vpc-svi)
(*, 232.0.0.0/8), uptime: 6d06h, pim(0) ip(0)
Data Created: No
Stats: 0/0 [Packets/Bytes], 0.000 bps
Stats: Inactive Flow
Incoming interface: Null, RPF nbr: 0.0.0.0
Outgoing interface list: (count: 0)
```

Configuration Example for BSR

To configure PIM in ASM mode using the BSR mechanism, follow these steps for each router in the PIM domain:

1. **Step 1**: Configure PIM sparse mode parameters on the interfaces that you want to participate in the domain. We recommend that you enable PIM on all interfaces.

   ```
   switch# configure terminal
   switch(config)# interface ethernet 2/1
   switch(config-if)# no switchport
   switch(config-if)# ip pim sparse-mode
   ```

2. **Step 2**: Configure whether that router should listen and forward BSR messages.

   ```
   switch# configure terminal
   switch(config)# ip pim bsr forward listen
   ```

3. **Step 3**: Configure the BSR parameters for each router that you want to act as a BSR.

   ```
   switch# configure terminal
   switch(config)# ip pim bsr-candidate ethernet 2/1 hash-len 30
   ```

4. **Step 4**: Configure the RP parameters for each router that you want to act as a candidate RP.

   ```
   switch# configure terminal
   switch(config)# ip pim rp-candidate ethernet 2/1 group-list 239.0.0.0/24
   ```

5. **Step 5**: Configure message filtering.

```
switch# configure terminal
switch(config)# ip pim log-neighbor-changes
```

6. **Step 6**: Verify the BSR operation.

```
switch# show ip pim rp
```

This example shows how to configure PIM ASM mode using the BSR mechanism and how to configure the BSR and RP on the same router:

```
configure terminal
interface ethernet 2/1
no switchport
ip pim sparse-mode
exit
ip pim bsr forward listen
ip pim bsr-candidate ethernet 2/1 hash-len 30
ip pim rp-candidate ethernet 2/1 group-list 239.0.0.0/24
ip pim log-neighbor-changes
```

Configuration Example for PIM Anycast-RP

To configure ASM mode using the PIM Anycast-RP method, follow these steps for each router in the PIM domain:

1. **Step 1**: Configure PIM sparse mode parameters on the interfaces that you want to participate in the domain. We recommend that you enable PIM on all interfaces.

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# no switchport
switch(config-if)# ip pim sparse-mode
```

2. **Step 2**: Configure the RP address that you configure on all routers in the Anycast-RP set.

```
switch# configure terminal
switch(config)# interface loopback 0
switch(config-if)# ip address 192.0.2.3/32
```

3. **Step 3**: Configure a loopback with an address to use in communication between routers in the Anycast-RP set for each router that you want to be in the Anycast-RP set.

```
switch# configure terminal
switch(config)# interface loopback 1
switch(config-if)# ip address 192.0.2.31/32
```

4. **Step 4**: Because the router is also an Anycast-RP peer, configure a unique peer address (which is routable domain wide) on an interface (for example, loopback 2).

```
switch# configure terminal
switch(config)# interface loopback 2
switch(config-if)# ip address 193.0.2.31/32
switch(config-if)# ip pim sparse-mode
```

Note A similar configuration needs to be done on all Anycast peer routers with their uniquely routable addresses.

5. **Step 5**: Add all of the Anycast peers into an RP set.

```
switch# configure terminal
switch(config)# interface loopback 2
switch(config-if)# ip pim anycast-rp 192.0.2.3 193.0.2.31
switch(config-if)# ip pim anycast-rp 192.0.2.3 193.0.2.32
```

Note You can use a similar configuration to create multiple RP sets.

6. **Step 6**: Verify the Anycast-RP operation.

```
switch# show ip pim interface brief
switch# show ip pim rp
```

This example shows how to configure PIM ASM mode using two Anycast-RPs:

```
configure terminal
interface ethernet 2/1
no switchport
ip pim sparse-mode
exit
interface loopback 0
ip address 192.0.2.3/32
exit
ip pim anycast-rp 192.0.2.3 192.0.2.31
ip pim anycast-rp 192.0.2.3 192.0.2.32
```

Where to Go Next

You can configure the following features that work with PIM:

- Configuring IGMP, on page 13
- Configuring IGMP Snooping, on page 67

Additional References

For additional information related to implementing PIM, see the following sections:

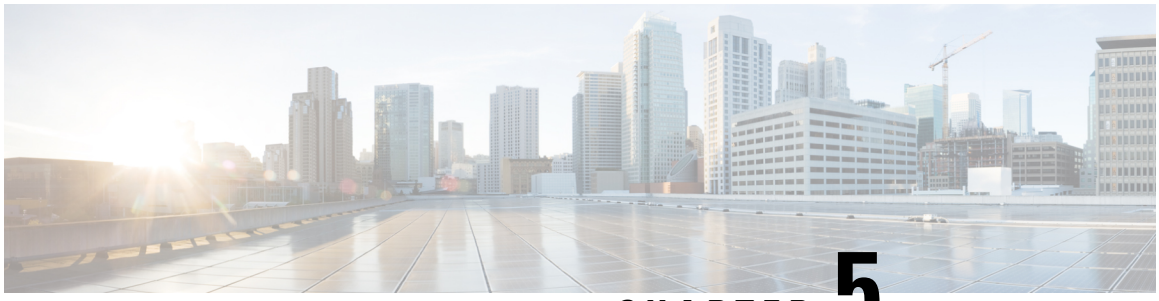
- Related Documents
- MIBs

Related Documents

Related Topic	Document Title
Configuring VRFs	Cisco Nexus 3600 NX-OS Unicast Routing Configuration Guide

MIBs

MIBs	MIBs Link
IPMCAST-MIB	To locate and download MIBs, go to the following URL: http://mibs.cloudapps.cisco.com/ITDIT/MIBS/MainServlet



CHAPTER 5

Configuring IGMP Snooping

This chapter describes how to configure Internet Group Management Protocol (IGMP) snooping on Cisco Nexus 3600 platform switches.

This chapter includes the following sections:

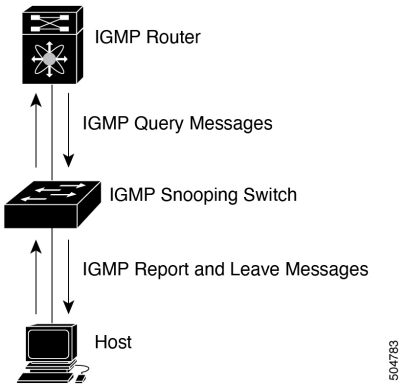
Information About IGMP Snooping

Note We recommend that you do not disable IGMP snooping on the switch. If you disable IGMP snooping, you may see reduced multicast performance because of excessive false flooding within the switch.

The Internet Group Management Protocol (IGMP) snooping software examines Layer 2 IP multicast traffic within a VLAN to discover the ports where interested receivers reside. Using the port information, IGMP snooping can reduce bandwidth consumption in a multi-access LAN environment to avoid flooding the entire VLAN. The IGMP snooping feature tracks which ports are attached to multicast-capable routers to help the routers forward IGMP membership reports. The IGMP snooping software responds to topology change notifications. By default, IGMP snooping is enabled on the switch.

The following figure shows an IGMP snooping switch that sits between the host and the IGMP router. The IGMP snooping switch snoops the IGMP membership reports and Leave messages and forwards them only when necessary to the connected IGMP routers.

Figure 11: IGMP Snooping Switch



The IGMP snooping software operates upon IGMPv1, IGMPv2, and IGMPv3 control plane packets where Layer 3 control plane packets are intercepted and influence the Layer 2 forwarding behavior.

For more information about IGMP, see Configuring IGMP, on page 13.

The Cisco NX-OS IGMP snooping software has the following proprietary features:

- Source filtering that allows forwarding of multicast packets based on destination and source IP.
- Multicast forwarding based on IP address rather than MAC address.
- Optimized multicast flooding (OMF) that forwards unknown traffic to routers only and performs no data driven state creation.

For more information about IGMP snooping, see RFC 4541.

This section includes the following topics:

IGMPv1 and IGMPv2

Both IGMPv1 and IGMPv2 support membership report suppression, which means that if two hosts on the same subnet want to receive multicast data for the same group, then the host that receives a member report from the other host suppresses sending its report. Membership report suppression occurs for hosts that share a port.

If no more than one host is attached to each VLAN switch port, then you can configure the fast leave feature in IGMPv2. The fast leave feature does not send last member query messages to hosts. As soon as the software receives an IGMP leave message, the software stops forwarding multicast data to that port.

IGMPv1 does not provide an explicit IGMP leave message, so the software must rely on the membership message timeout to indicate that no hosts remain that want to receive multicast data for a particular group.

Note The software ignores the configuration of the last member query interval when you enable the fast leave feature because it does not check for remaining hosts.

IGMPv3

The IGMPv3 snooping implementation on Cisco NX-OS supports full IGMPv3 snooping, which provides constrained flooding based on the (S, G) information in the IGMPv3 reports. This source-based filtering enables the switch to constrain multicast traffic to a set of ports based on the source that sends traffic to the multicast group.

By default, the software tracks hosts on each VLAN port. The explicit tracking feature provides a fast leave mechanism. Because every IGMPv3 host sends membership reports, report suppression limits the amount of traffic that the switch sends to other multicast-capable routers. When report suppression is enabled, and no IGMPv1 or IGMPv2 hosts requested the same group, the software provides proxy reporting. The proxy feature builds the group state from membership reports from the downstream hosts and generates membership reports in response to queries from upstream queriers.

Even though the IGMPv3 membership reports provide a full accounting of group members on a LAN segment, when the last host leaves, the software sends a membership query. You can configure the parameter last member query interval. If no host responds before the timeout, the software removes the group state.

IGMP Snooping Querier

When PIM is not enabled on an interface because the multicast traffic does not need to be routed, you must configure an IGMP snooping querier to send membership queries. You define the querier in a VLAN that contains multicast sources and receivers but no other active querier.

When an IGMP snooping querier is enabled, the switch sends out periodic queries (with the source address of the configured querier address). These queries trigger IGMP report messages from hosts that want to receive IP multicast traffic.

IGMP Filtering on Router Ports

IGMP filtering allows users to configure a router port on the switch that leads the switch to a Layer 3 multicast switch. The switch stores all manually configured static router ports in its router port list.

When an IGMP packet is received, the switch forwards the traffic through the router port in the VLAN. The switch recognizes a port as a router port through the PIM hello message or the IGMP query received by the switch.

Guidelines and Limitations for IGMP Snooping

IGMP snooping has the following guidelines and limitations:

- Cisco Nexus 3600 platform switches support IGMP snooping for IPv4 only.
- Cisco Nexus 3600 platform switches support IGMP snooping with vPCs.
- The IGMP snooping configuration must be identical on both vPC peers in a vPC pair. Either enable or disable IGMP snooping on both vPC peers.

Note Enabling or disabling IGMP snooping on both vPC peers also enables the forwarding of IGMP queries from different MVR source VLANs into the same MVR receiver VLAN. The resulting IGMP queries may send out queries with different versions and query interval. If you prefer to maintain the behavior before Cisco NX-OS Release 7.0(3)I3(1), use the **mvr-suppress-query** command. For more information about suppressing IGMP general query forwarding, see Suppressing IGMP Query Forwarding from VLANs, on page 98.

- In releases before Cisco NX-OS Release 7.0(3)I3(1), if you are configuring vPC peers, the differences in the IGMP snooping configuration options between the two devices have the following results:
  - If IGMP snooping is enabled on one device but not on the other, the device on which snooping is disabled floods all multicast traffic.
  - A difference in multicast router or static group configuration can cause traffic loss.
  - The fast leave, explicit tracking, and report suppression options can differ if they are used for forwarding traffic.
  - If a query parameter is different between the devices, one device expires the multicast state faster while the other device continues to forward. This difference results in either traffic loss or forwarding for an extended period.
  - If an IGMP snooping querier is configured on both devices, only one of them will be active because an IGMP snooping querier shuts down if a query is seen in the traffic.

Default Settings for IGMP Snooping

The following table lists the default settings for IGMP snooping parameters.

Table 15: Default IGMP Snooping Parameters

Parameters	Default
IGMP snooping	Enabled
Explicit tracking	Enabled
Fast leave	Disabled
Last member query interval	1 second
Snooping querier	Disabled
Report suppression	Enabled
Link-local groups suppression	Enabled
IGMPv3 report suppression for the entire switch	Disabled

Parameters	Default
IGMPv3 report suppression per VLAN	Enabled

Note

- When a SPAN session is configured with a multicast router port being the source port, the destination port sees all the multicast traffic even when there is no traffic that is actually being forwarded to the source port. This is due to a current limitation of the multicast/SPAN implementation.
- Cisco Nexus 3548 Series switches replicate unknown multicast traffic to multicast router ports of all VLANs, although the multicast traffic is received in one particular VLAN. This is a default behavior and cannot be configured.

Configuring IGMP Snooping Parameters

To affect the operation of the IGMP snooping process, you can configure the optional IGMP snooping parameters described in the following table.

Table 16: IGMP Snooping Parameters

Parameter	Description
IGMP snooping	Enables IGMP snooping on the switch or on a per-VLAN basis. The default is enabled. **Note** If the global setting is disabled, then all VLANs are treated as disabled, whether they are enabled or not.
Access group	Configures a policy to filter IGMP joins per VLAN.
Explicit tracking	Tracks IGMPv3 membership reports from individual hosts for each port on a per-VLAN basis. The default is enabled.
Fast leave	Enables the software to remove the group state when it receives an IGMP Leave report without sending an IGMP query message. This parameter is used for IGMPv2 hosts when no more than one host is present on each VLAN port. The default is disabled.
Last member query interval	Sets the interval that the software waits after sending an IGMP query to verify that no hosts that want to receive a particular multicast group remain on a network segment. If no hosts respond before the last member query interval expires, the software removes the group from the associated VLAN port. Values range from 1 to 25 seconds. The default is 1 second.

Parameter	Description
Proxy leave messages	Changes the destination address of proxy leave messages to the address of the group that is leaving. Normally, IGMP proxy leave messages generated by the IGMP snooping module use the 224.0.0.2 multicast router address when all hosts leave the group. You should implement this configuration if your multicast applications rely on receiving reports and leave messages to start or stop multicast traffic based on the destination address of the packet.
Floods report and leaves	Floods IGMP reports on all active interfaces of the VLAN or only on specific interfaces and leaves. IGMP reports typically are forwarded to multicast router ports as detected by the IGMP snooping module and are not flooded in the VLAN. However, this command forces the switch to send IGMP reports to custom ports belonging to the VLAN in addition to the multicast router ports. You should implement this configuration if your multicast applications require the ability to view IGMP reports in order to transmit traffic.
Snooping querier	Configures a snooping querier on an interface when you do not enable PIM because multicast traffic does not need to be routed.
Report suppression	Limits the membership report traffic sent to multicast-capable routers on the switch or on a per-VLAN basis. When you disable report suppression, all IGMP reports are sent as is to multicast-capable routers. The default is enabled.
Multicast router	Configures a static connection to a multicast router. The interface to the router must be in the selected VLAN.
Static group	Configures a Layer 2 port of a VLAN as a static member of a multicast group.
Link-local groups suppression	Configures link-local groups suppression on the switch or on a per-VLAN basis. The default is enabled.
IGMPv3 report suppression	Configures IGMPv3 report suppression and proxy reporting on the switch or on a per-VLAN basis. The default is disabled for the entire switch and enabled per VLAN

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip igmp snooping** **Example:** `switch(config)# ip igmp snooping`	Enables IGMP snooping for the device. The default is enabled. **Note** If the global setting is disabled with the no form of this command, IGMP snooping on all VLANs is disabled, whether IGMP snooping is enabled on a VLAN or not. If you disable IGMP snooping, Layer 2 multicast frames flood to all modules.

Step 3	**vlan configuration** *vlan-id*
	Example:
	`switch(config)# vlan configuration 100`
	`switch(config-vlan-config)#`
		Configures a VLAN and enters VLAN configuration mode.

Step 4		

Option	Description
Command	Purpose
ip igmp snooping Example: `switch(config-vlan-config)# ip igmp snooping`	Enables IGMP snooping for the current VLAN. The default is enabled.
ip igmp snooping access-group route-map-name Example: `switch(config-vlan-config)# ip igmp snooping access-group rmap`	Configures a policy to filter IGMP joins per VLAN. The default is disabled.
ip igmp snooping explicit-tracking Example: `switch(config-vlan-config)# ip igmp snooping explicit-tracking`	Tracks IGMPv3 membership reports from individual hosts for each port on a per-VLAN basis. The default is enabled on all VLANs.
ip igmp snooping fast-leave Example:	Supports IGMPv2 hosts that cannot be explicitly tracked because of the

Command or Action		Purpose
Option	**Description**	
`switch(config-vlan-config)# ip igmp snooping fast-leave`	host report suppression mechanism of the IGMPv2 protocol. When you enable fast leave, the IGMP software assumes that no more than one host is present on each VLAN port. The default is disabled for all VLANs.	
ip igmp snooping last-member-query-interval *seconds* Example: `switch(config-vlan-config)# ip igmp snooping last-member-query-interval 3`	Removes the group from the associated VLAN port if no hosts respond to an IGMP query message before the last member query interval expires. Values range from 1 to 25 seconds. The default is 1 second.	
[**no**] **ip igmp snooping proxy-leave use-group-address** Example: `switch(config-vlan-config)# ip igmp snooping proxy-leave use-group-address`	Changes the destination address of proxy leave messages to the address of the group that is leaving. Normally, IGMP proxy leave messages generated by the IGMP snooping module use the 224.0.0.2 multicast router address when all hosts leave the group. You should implement this configuration if your multicast applications rely on receiving reports and leave messages to start or stop multicast traffic based on the destination address of the packet.	
[**no**] **ip igmp snooping report-flood** { **all** | **interface ethernet** *slot/port*} Example:	Floods IGMP reports on all active interfaces of the VLAN or only on specific interfaces and leaves.	

Command or Action		Purpose
Option	**Description**	
`switch(config-vlan-config)# ip igmp snooping report-flood interface ethernet 1/2 ip igmp snooping report-flood interface ethernet 1/3`	IGMP reports typically are forwarded to multicast router ports as detected by the IGMP snooping module and are not flooded in the VLAN. However, this command forces the switch to send IGMP reports to custom ports belonging to the VLAN in addition to the multicast router ports. You should implement this configuration if your multicast applications require the ability to view IGMP reports in order to transmit traffic.	
ip igmp snooping querier *ip-address* Example: `switch(config-vlan-config)# ip igmp snooping querier 172.20.52.106`	Configures a snooping querier when you do not enable PIM because multicast traffic does not need to be routed. The IP address is used as the source in messages.	
ip igmp snooping report-suppression Example: `switch(config-vlan-config)# ip igmp snooping report-suppression`	Limits the membership report traffic sent to multicast-capable routers. When you disable report suppression, all IGMP reports are sent as is to multicast-capable routers. The default is enabled. **Note** This command can also be entered in global configuration mode to affect all interfaces.	

Command or Action		Purpose
Option	**Description**	
ip igmp snooping mrouter interface *interface* Example: `switch(config-vlan-config)# ip igmp snooping mrouter interface ethernet 2/1`	Configures a static connection to a multicast router. The interface to the router must be in the selected VLAN. You can specify the interface by the type and the number, such as **ethernet** *slot/port*.	
ip igmp snooping static-group *group-ip-addr* [**source** *source -ip-addr*] **interface** *interface* Example: `switch(config-vlan-config)# ip igmp snooping static-group 230.0.0.1 interface ethernet 2/1`	Configures a Layer 2 port of a VLAN as a static member of a multicast group. You can specify the interface by the type and the number, such as **ethernet** *slot/port*.	
ip igmp snooping link-local-groups-suppression Example: `switch(config-vlan-config)# ip igmp snooping link-local-groups-suppression`	Configures link-local groups suppression. The default is enabled. **Note** This command can also be entered in global configuration mode to affect all interfaces.	
ip igmp snooping v3-report-suppression Example: `switch(config-vlan-config)# ip igmp snooping v3-report-suppression`	Configures IGMPv3 report suppression and proxy reporting. The default is disabled for the global command for the entire switch and enabled per VLAN.	

	Command or Action		Purpose
	Option	Description	
		Note	This command can also be entered in global configuration mode to affect all interfaces.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`		Saves configuration changes.

Verifying the IGMP Snooping Configuration

To display the IGMP snooping configuration information, perform one of the following tasks:

Command	Purpose
show ip igmp snooping [**vlan** *vlan-id*]	Displays the IGMP snooping configuration by VLAN.
show ip igmp snooping groups [*source* [*group*] | *group* [*source*]] [**vlan** *vlan-id*] [**detail**]	Displays IGMP snooping information about groups by VLAN.
show ip igmp snooping querier [**vlan** *vlan-id*]	Displays IGMP snooping queriers by VLAN.
show ip igmp snooping mroute [**vlan** *vlan-id*]	Displays multicast router ports by VLAN.
show ip igmp snooping explicit-tracking [**vlan** *vlan-id*]	Displays IGMP snooping explicit tracking information by VLAN.

Setting the Interval for Multicast Routes

When the switch has high multicast route creation or deletion rates (for example, too many IGMP join or leave requests), the switch cannot program the multicast routes into the hardware as fast as the requests are made. To resolve this problem, you can configure an interval after which multicast routes are programmed into the hardware.

When you have very low multicast route creations or deletions per second, configure a low interval (up to 50 milliseconds). A low interval enables the hardware to be programmed faster than it would be by using the default interval of 1 second.

When you have very high multicast route creations or deletions per second, configure a high interval (up to 2 seconds). A high interval enables the hardware to be programmed over a longer period of time without dropping the requests.

Displaying IGMP Snooping Statistics

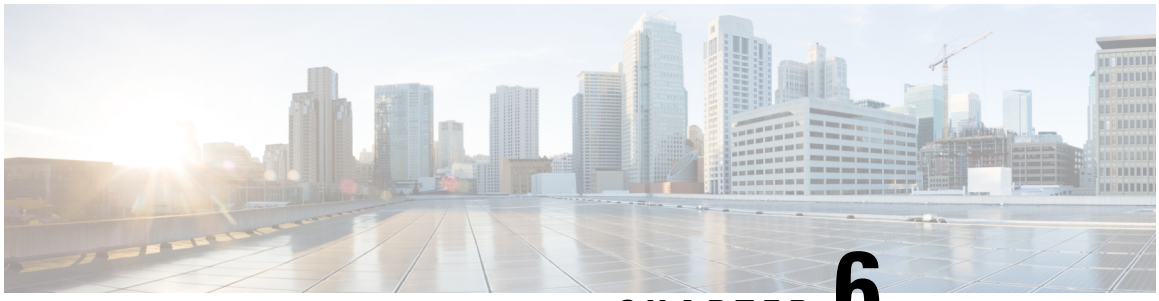
Use the **show ip igmp snooping statistics vlan** command to display IGMP snooping statistics. You can see the virtual port channel (vPC) statistics in this output.

Use the **clear ip igmp snooping statistics vlan** command to clear IGMP snooping statistics.

Configuration Examples for IGMP Snooping

This example shows how to configure the IGMP snooping parameters:

```
configure terminal
ip igmp snooping
vlan 2
ip igmp snooping
ip igmp snooping explicit-tracking
ip igmp snooping fast-leave
ip igmp snooping last-member-query-interval 3
ip igmp snooping querier 172.20.52.106
ip igmp snooping report-suppression
ip igmp snooping mrouter interface ethernet 2/1
ip igmp snooping static-group 230.0.0.1 interface ethernet 2/1
ip igmp snooping link-local-groups-suppression
ip igmp snooping v3-report-suppression
```



CHAPTER 6

Configuring MSDP

This chapter describes how to configure Multicast Source Discovery Protocol (MSDP) on a Cisco NX-OS device.

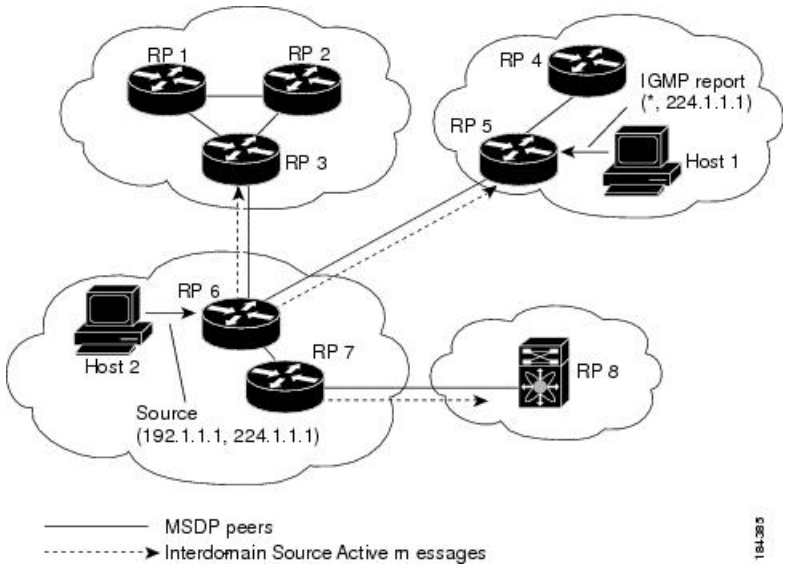
About MSDP

You can use the Multicast Source Discovery Protocol (MSDP) to exchange multicast source information between multiple Border Gateway Protocol (BGP) enabled Protocol Independent Multicast (PIM) sparse-mode domains. In addition, MSDP can be used to create an Anycast-RP configuration to provide RP redundancy and load sharing. For information about BGP, see the *Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide*.

When a receiver joins a group that is transmitted by a source in another domain, the rendezvous point (RP) sends PIM join messages in the direction of the source to build a shortest path tree. The designated router (DR) sends packets on the sourcetree within the source domain, which can travel through the RP in the source domain and along the branches of the sourcetree to other domains. In domains where there are receivers, RPs in those domains can be on the sourcetree. The peering relationship is conducted over a TCP connection.

The following figure shows four PIM domains. The connected RPs (routers) are called MSDP peers because they are exchanging active source information with each other. Each MSDP peer advertises its own set of multicast source information to the other peers. Source Host 2 sends the multicast data to group 224.1.1.1. On RP 6, the MSDP process learns about the source through PIM register messages and generates Source-Active (SA) messages to its MSDP peers that contain information about the sources in its domain. When RP 3 and RP 5 receive the SA messages, they forward them to their MSDP peers. When RP 5 receives the request from Host 1 for the multicast data on group 224.1.1.1, it builds a shortest path tree to the source by sending a PIM join message in the direction of Host 2 at 192.1.1.1.

Figure 12: MSDP Peering Between RPs in Different PIM Domains



When you configure MSDP peering between each RP, you create a full mesh. Full MSDP meshing is typically done within an autonomous system, as shown between RPs 1, 2, and 3, but not across autonomous systems. You use BGP to do a loop suppression and MSDP peer-RPF to suppress looping SA messages.

Note You do not need to configure BGP in order to use Anycast-RP (a set of RPs that can perform load balancing and failover) within a PIM domain.

Note You can use PIM Anycast (RFC 4610) to provide the Anycast-RP function instead of MSDP.

For detailed information about MSDP, see RFC 3618

SA Messages and Caching

MSDP peers exchange Source-Active (SA) messages to propagate information about active sources. SA messages contain the following information:

- Source address of the data source
- Group address that the data source uses
- IP address of the RP or the configured originator ID

When a PIM register message advertises a new source, the MSDP process reencapsulates the message in an SA message that is immediately forwarded to all MSDP peers.

The SA cache holds the information for all sources learned through SA messages. Caching reduces the join latency for new receivers of a group because the information for all known groups can be found in the cache. You can limit the number of cached source entries by configuring the SA limit peer parameter. You can limit

the number of cached source entries for a specific group prefix by configuring the group limit global parameter. The SA cache is enabled by default and cannot be disabled.

The MSDP software sends SA messages for each group in the SA cache every 60 seconds or at the configured SA interval global parameter. An entry in the SA cache is removed if an SA message for that source and group is not received within the SA interval plus 3 seconds.

MSDP Peer-RPF Forwarding

MSDP peers forward the SA messages that they receive away from the originating RP. This action is called peer-RPF flooding. The router examines the BGP or MBGP routing table to determine which peer is the next hop in the direction of the originating RP of the SA message. This peer is called a reverse path forwarding (RPF) peer.

If the MSDP peer receives the same SA message from a non-RPF peer in the direction of the originating RP, it drops the message. Otherwise, it forwards the message to all its MSDP peers.

MSDP Mesh Groups

You can use MSDP mesh groups to reduce the number of SA messages that are generated by peer-RPF flooding. By configuring a peering relationship between all the routers in a mesh and then configuring a mesh group of these routers, the SA messages that originate at a peer are sent by that peer to all other peers. SA messages received by peers in the mesh are not forwarded.

A router can participate in multiple mesh groups. By default, no mesh groups are configured.

Prerequisites for MSDP

MSDP has the following prerequisites:

- You are logged onto the device.
- For global commands, you are in the correct virtual routing and forwarding (VRF) mode. The default configuration mode shown in the examples in this chapter applies to the default VRF.
- You configured PIM for the networks where you want to configure MSDP.

Default Settings

This table lists the default settings for MSDP parameters.

Table 17: Default MSDP Parameters

Parameters	Default
Description	Peer has no description
Administrative shutdown	Peer is enabled when it is defined
MD5 password	No MD5 password is enabled

Parameters	Default
SA policy IN	All SA messages are received
SA policy OUT	All registered sources are sent in SA messages
SA limit	No limit is defined
Originator interface name	RP address of the local system
Group limit	No group limit is defined
SA interval	60 seconds

Configuring MSDP

You can establish MSDP peering by configuring the MSDP peers within each PIM domain as follows:

1. Select the routers to act as MSDP peers.
2. Enable the MSDP feature.
3. Configure the MSDP peers for each router identified in Step 1.
4. Configure the optional MSDP peer parameters for each MSDP peer.
5. Configure the optional global parameters for each MSDP peer.
6. Configure the optional mesh groups for each MSDP peer.

Note The MSDP commands that you enter before you enable MSDP are cached and then run when MSDP is enabled. Use the **ip msdp peer** or **ip msdp originator-id** command to enable MSDP.

Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Enabling the MSDP Feature

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

	Command or Action	Purpose
Step 2	**feature msdp** **Example:** `switch# feature msdp`	Enables the MSDP feature so that you can enter MSDP commands. By default, the MSDP feature is disabled.
Step 3	(Optional) **show running-configuration msdp** **Example:** `switch# show running-configuration msdp`	Shows the running-configuration information for MSDP.
Step 4	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring MSDP Peers

You can configure an MSDP peer when you configure a peering relationship with each MSDP peer that resides either within the current PIM domain or in another PIM domain. MSDP is enabled on the router when you configure the first MSDP peering relationship.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM and MSDP.

Ensure that you configured PIM in the domains of the routers that you will configure as MSDP peers.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip msdp peer** *peer-ip-address* **connect-source** *interface* [**remote-as** *as-number*] **Example:** `switch(config)# ip msdp peer 192.168.1.10 connect-source ethernet 2/1 remote-as 8`	Configures an MSDP peer with the specified peer IP address. The software uses the source IP address of the interface for the TCP connection with the peer. The interface can take the form of *type slot/port*. If the AS number is the same as the local AS, then the peer is within the PIM domain; otherwise, this peer is external to the PIM domain. By default, MSDP peering is disabled. MSDP peering is enabled when you use this command.

	Command or Action	Purpose
Step 3	Repeat Step 2 for each MSDP peering relationship by changing the peer IP address, the interface, and the AS number as appropriate.	—
Step 4	(Optional) **show ip msdp summary** [**vrf** [*vrf-name* | **all**]] **Example:** `switch# show ip msdp summary`	Displays a summary of MDSP peers.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring MSDP Peer Parameters

You can configure the optional MSDP peer parameters described in this table. You configure these parameters in global configuration mode for each peer based on its IP address.

Table 18: MSDP Peer Parameters

Parameter	Description
Description	Description string for the peer. By default, the peer has no description.
Administrative shutdown	Method to shut down the MSDP peer. The configuration settings are not affected by this command. You can use this parameter to allow configuration of multiple parameters to occur before making the peer active. The TCP connection with other peers is terminated by the shutdown. By default, a peer is enabled when it is defined.
MD5 password	MD5-shared password key used for authenticating the peer. By default, no MD5 password is enabled.
SA policy IN	Route-map policy for incoming SA messages. By default, all SA messages are received. **Note** To configure route-map policies, see the *Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide*.

Parameter	Description
SA policy OUT	Route-map policy for outgoing SA messages. By default, all registered sources are sent in SA messages. **Note** To configure route-map policies, see the *Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide*.
SA limit	Number of (S, G) entries accepted from the peer and stored in the SA cache. By default, there is no limit.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM and MSDP.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.
		Note Use the commands listed from step-2 to configure the MSDP peer parameters.

Step 2	**ip msdp description** *peer-ip-address description* **Example:** `switch(config)# ip msdp description 192.168.1.10 peer in Engineering network`	Sets a description string for the peer. By default, the peer has no description.
Step 3	**ip msdp shutdown** *peer-ip-address* **Example:** `switch(config)# ip msdp shutdown 192.168.1.10`	Shuts down the peer. By default, the peer is enabled when it is defined.
Step 4	**ip msdp password** *peer-ip-address password* **Example:** `switch(config)# ip msdp password 192.168.1.10 my_md5_password`	Enables an MD5 password for the peer. By default, no MD5 password is enabled.
Step 5	**ip msdp sa-policy** *peer-ip-address policy-name* **in** **Example:** `switch(config)# ip msdp sa-policy 192.168.1.10 my_incoming_sa_policy in`	Enables a route-map policy for incoming SA messages. By default, all SA messages are received.

	Command or Action	Purpose
Step 6	**ip msdp sa-policy** *peer-ip-address policy-name* **out** **Example:** `switch(config)# ip msdp sa-policy 192.168.1.10 my_outgoing_sa_policy out`	Enables a route-map policy for outgoing SA messages. By default, all registered sources are sent in SA messages.
Step 7	**ip msdp sa-limit** *peer-ip-address limit* **Example:** `switch(config)# ip msdp sa-limit 192.168.1.10 5000`	Sets a limit on the number of (S, G) entries accepted from the peer. By default, there is no limit.
Step 8	(Optional) **show ip msdp peer** [*peer-address*] [**vrf** [*vrf-name* | **all**]] **Example:** `switch(config)# show ip msdp peer 192.168.1.10`	Displays detailed MDSP peer information.
Step 9	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring MSDP Global Parameters

You can configure the optional MSDP global parameters described in this table.

Table 19: MSDP Global Parameters

Parameter	Description
Originator interface name	IP address used in the RP field of an SA message entry. When Anycast RPs are used, all RPs use the same IP address. You can use this parameter to define a unique IP address for the RP of each MSDP peer. By default, the software uses the RP address of the local system. **Note** We recommend that you use a loopback interface for the RP address.
Group limit	Maximum number of (S, G) entries that the software creates for the specified prefix. The software ignores groups when the group limit is exceeded and logs a violation. By default, no group limit is defined.

Parameter	Description
SA interval	Interval at which the software transmits Source-Active (SA) messages. The range is from 60 to 65,535 seconds. The default is 60 seconds.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM and MSDP.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip msdp originator-id** *interface* **Example:** `switch(config)# ip msdp originator-id loopback0`	Sets a description string for the peer. By default, the peer has no description. Sets the IP address used in the RP field of an SA message entry. By default, the software uses the RP address of the local system. **Note** We recommend that you use a loopback interface for the RP address.
Step 3	**ip msdp group-limit** *limit* **source** *source-prefix* **Example:** `switch(config)# ip msdp group-limit 1000 source 192.168.1.0/24`	Maximum number of (S, G) entries that the software creates for the specified prefix. The software ignores groups when the group limit is exceeded and logs a violation. By default, no group limit is defined.
Step 4	**ip msdp sa-interval** *seconds* **Example:** `switch(config)# ip msdp sa-interval 80`	Interval at which the software transmits Source-Active (SA) messages. The range is from 60 to 65,535 seconds. The default is 60 seconds.
Step 5	(Optional) **show ip msdp summary** [**vrf** [*vrf-name* | **all**]] **Example:** `switch(config)# show ip msdp summary`	Displays a summary of the MDSP configuration.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring MSDP Mesh Groups

You can configure optional MDSP mesh groups in global configuration mode by specifying each peer in the mesh. You can configure multiple mesh groups on the same router and multiple peers per mesh group.

Before you begin

Ensure that you have installed the Enterprise Services license and enabled PIM and MSDP.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip msdp mesh-group** *peer-ip-addr mesh-name* **Example:** `switch(config)# ip msdp mesh-group 192.168.1.10 my_mesh_1`	Configures an MSDP mesh with the peer IP address specified. You can configure multiple meshes on the same router and multiple peers per mesh group. By default, no mesh groups are configured.
Step 3	Repeat Step 2 for each MSDP peer in the mesh by changing the peer IP address.	—
Step 4	(Optional) **show ip msdp mesh-group** [*mesh-group*] [**vrf** [*vrf-name* | **all**]] **Example:** `switch# show ip msdp mesh-group`	Displays information about the MDSP mesh group configuration.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Restarting the MSDP Process

Before you begin

You can restart the MSDP process and optionally flush all routes.

Procedure

	Command or Action	Purpose
Step 1	**restart msdp** **Example:** `switch# restart msdp`	Restarts the MSDP process.

	Command or Action	Purpose

Step 2	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 3	**ip msdp flush-routes** **Example:** `switch(config)# ip msdp flush-routes`	Removes routes when the MSDP process is restarted. By default, routes are not flushed.
Step 4	(Optional) **show running-configuration | include flush-routes** **Example:** `switch(config)# show running-configuration | include flush-routes`	Displays flush-routes configuration lines in the running configuration.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Verifying the MSDP Configuration

To display the MSDP configuration information, perform one of the following tasks.

Command	Description
show ip msdp count [*as-number*] [**vrf** [*vrf-name* | **all**]]	Displays MSDP (S, G) entry and group counts by the autonomous system (AS) number.
show ip msdp mesh-group [*mesh-group*] [**vrf** [*vrf-name* | **all**]]	Displays the MSDP mesh group configuration.
show ip msdp peer [*peer-address*] [**vrf** [*vrf-name* | **all**]]	Displays MSDP information for the MSDP peer.
show ip msdp rpf [*rp-address*] [**vrf** [*vrf-name* | **all**]]	Displays the next-hop AS on the BGP path to an RP address.
show ip msdp sources [**vrf** [*vrf-name* | **all**]]	Displays the MSDP-learned sources and violations of configured group limits.
show ip msdp summary [**vrf** [*vrf-name* | **all**]]	Displays a summary of the MSDP peer configuration.

Monitoring MSDP

You can display and clear MSDP statistics by using the features in this section.

Displaying Statistics

You can display MSDP statistics using these commands.

Command	Description
show ip msdp policy statistics sa-policy *peer-address* {**in** | **out**} [**vrf** [*vrf-name* | **all**]]	Displays the MSDP policy statistics for the MSDP peer.
show ip msdp {**sa-cache** | **route**} [*source-address*] [*group-address*] [**vrf** [*vrf-name* | **all**]] [*asn-number*] [**peer** *peer-address*]	Displays the MSDP SA route cache. If you specify the source address, all groups for that source are displayed. If you specify a group address, all sources for that group are displayed.

Clearing Statistics

You can clear the MSDP statistics using these commands.

Command	Description
clear ip msdp peer [*peer-address*] [**vrf** *vrf-name*]	Clears the TCP connection to an MSDP peer.
clear ip msdp policy statistics sa-policy *peer-address* {**in** | **out**} [**vrf** *vrf-name*]	Clears statistics counters for MSDP peer SA policies.
clear ip msdp statistics [*peer-address*] [**vrf** *vrf-name*]	Clears statistics for MSDP peers.
clear ip msdp {**sa-cache** | **route**} [*group-address*] [**vrf** [*vrf-name* | **all**]]	Clears the group entries in the SA cache.

-

Configuration Examples for MSDP

To configure MSDP peers, some of the optional parameters, and a mesh group, follow these steps for each MSDP peer:

1. Configure the MSDP peering relationship with other routers.

```
switch# configure terminal
switch(config)# ip msdp peer 192.168.1.10 connect-source ethernet 1/0 remote-as 8
```

2. Configure the optional peer parameters.

```
switch# configure terminal
switch(config)# ip msdp password 192.168.1.10 my_peer_password_AB
```

3. Configure the optional global parameters.

```
switch# configure terminal
switch(config)# ip msdp sa-interval 80
```

4. Configure the peers in each mesh group.

```
switch# configure terminal
switch(config)# ip msdp mesh-group 192.168.1.10 mesh_group_1
```

The following example shows how to configure a subset of the MSDP peering.

RP 3: 192.168.3.10 (AS 7)

```
configure terminal
  ip msdp peer 192.168.1.10 connect-source ethernet 1/1
  ip msdp peer 192.168.2.10 connect-source ethernet 1/2
  ip msdp peer 192.168.6.10 connect-source ethernet 1/3 remote-as 9
  ip msdp password 192.168.6.10 my_peer_password_36
  ip msdp sa-interval 80
  ip msdp mesh-group 192.168.1.10 mesh_group_123
  ip msdp mesh-group 192.168.2.10 mesh_group_123
  ip msdp mesh-group 192.168.3.10 mesh_group_123
```

RP 5: 192.168.5.10 (AS 8)

```
configure terminal
  ip msdp peer 192.168.4.10 connect-source ethernet 1/1
  ip msdp peer 192.168.6.10 connect-source ethernet 1/2 remote-as 9
  ip msdp password 192.168.6.10 my_peer_password_56
  ip msdp sa-interval 80
```

RP 6: 192.168.6.10 (AS 9)

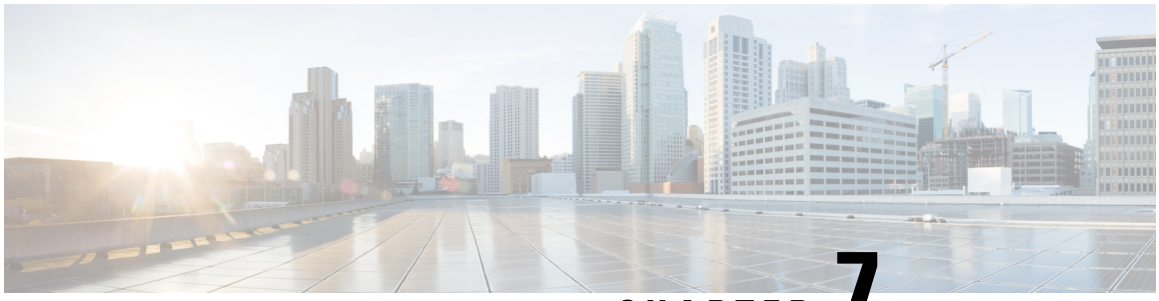
```
configure terminal
  ip msdp peer 192.168.7.10 connect-source ethernet 1/1
  ip msdp peer 192.168.3.10 connect-source ethernet 1/2 remote-as 7
  ip msdp peer 192.168.5.10 connect-source ethernet 1/3 remote-as 8
  ip msdp password 192.168.3.10 my_peer_password_36
  ip msdp password 192.168.5.10 my_peer_password_56
  ip msdp sa-interval 80
```

Related Documents

Related Topic	Document Title
Configuring MBGP	*Cisco Nexus 3600 Series NX-OS Unicast Routing Configu*

Standards

Standards	Title
RFC 4624	Multicast Source Discovery Protocol (MSDP) MIB



CHAPTER 7

Configuring MVR

This chapter describes how to configure Multicast VLAN registration (MVR) on Cisco Nexus 3600 platform switches.

This chapter includes the following sections:

About MVR

In a typical Layer 2 multi-VLAN network, subscribers to a multicast group can be on multiple VLANs. To maintain data isolation between these VLANs, the multicast stream on the source VLAN must be passed to a router, which replicates the stream on all subscriber VLANs, wasting upstream bandwidth.

Multicast VLAN registration (MVR) allows a Layer 2 switch to forward the multicast data from a source on a common assigned VLAN to the subscriber VLANs, conserving upstream bandwidth by bypassing the router. The switch forwards multicast data for MVR IP multicast streams only to MVR ports on which hosts have joined, either by IGMP reports or by MVR static configuration. The switch forwards IGMP reports received from MVR hosts only to the source port. For other traffic, VLAN isolation is preserved.

MVR requires at least one VLAN to be designated as the common VLAN to carry the multicast stream from the source. More than one such multicast VLAN (MVR VLAN) can be configured in the system, and you can configure a global default MVR VLAN as well as interface-specific default MVR VLANs. Each multicast group using MVR is assigned to an MVR VLAN.

MVR allows a subscriber on a port to subscribe and unsubscribe to a multicast stream on the MVR VLAN by sending IGMP join and leave messages. IGMP leave messages from an MVR group are handled according to the IGMP configuration of the VLAN on which the leave message is received. If IGMP fast leave is enabled on the VLAN, the port is removed immediately; otherwise, an IGMP query is sent to the group to determine whether other hosts are present on the port.

MVR Interoperation with Other Features

MVR and IGMP Snooping

Although MVR operates on the underlying mechanism of IGMP snooping, the two features operate independently of each other. One feature can be enabled or disabled without affecting the operation of the other feature. If IGMP snooping is disabled globally or on a VLAN and MVR is enabled on the VLAN, IGMP snooping is internally enabled on the VLAN. Joins received for MVR groups on non-MVR receiver ports or joins received for non-MVR groups on MVR receiver ports are processed by IGMP snooping.

MVR and vPCs

- As with IGMP snooping, IGMP control messages received by virtual port channel (vPC) peer switches are exchanged between the peers, allowing synchronization of MVR group information.
- MVR configuration must be consistent between the peers.
- The no ip igmp snooping mrouter vpc-peer-link command applies to MVR. With this command, multicast traffic is not sent to a peer link for the source VLAN and receiver VLAN unless an orphan port is in the VLAN.
- The show mvr member command shows the multicast group on the vPC peer switch. However, the vPC peer switch does not show the multicast groups if it does not receive the IGMP membership report of the groups.

MVR and vPCs

- As with IGMP snooping, IGMP control messages received by virtual port channel (vPC) peer switches are exchanged between the peers, allowing synchronization of MVR group information.
- MVR configuration must be consistent between the peers.
- The no ip igmp snooping mrouter vpc-peer-link command applies to MVR. With this command, multicast traffic is not sent to a peer link for the source VLAN and receiver VLAN unless an orphan port is in the VLAN.
- The show mvr member command shows the multicast group on the vPC peer switch. However, the vPC peer switch does not show the multicast groups if it does not receive the IGMP membership report of the groups.

Guidelines and Limitations for MVR

MVR has the following guidelines and limitations:

- MVR is supported on Cisco Nexus 3600 platform switches with N3K-C36180YC-R and N3K-C3636C-R line cards.
- MVR is supported only on Layer 2 Ethernet ports, such as individual ports, port channels, and virtual Ethernet (vEth) ports.

- MVR receiver ports can only be access ports; they cannot be trunk ports. MVR source ports can be either access or trunk ports.
- MVR configuration on Flex Link ports is not supported.
- Priority tagging is not supported on MVR receiver ports.
- The total number of MVR VLANs cannot exceed 250.

Default Settings for MVR

Following table lists the default settings for MVR parameters.

Table 20: Default MVR Parameters

Parameter	Default
MVR	Disabled globally and per interface
Global MVR VLAN	None configured
Interface (per port)	Neither a receiver nor a source port

Configuring MVR

You can configure the MVR global and interface parameters to affect the operation of the MVR process.

Configuring MVR Global Parameters

You can globally enable MVR and various configuration parameters.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **mvr**
	Example:
	`switch(config)# mvr`
	`switch(config-mvr)#`
		Globally enables MVR. The default is disabled.
		Use the no form of the command to disable MVR.

Step 3	[**no**] **mvr-vlan** *vlan-id* **Example:**	Specifies the global default MVR VLAN. The MVR VLAN is the source of the multicast

	Command or Action	Purpose
	`switch(config-mvr)# mvr-vlan 7`	message that subsequent receivers subscribe to. The range is from 1 to 4094. Use the no form of the command to clear the MVR VLAN.
Step 4	[**no**] **mvr-group** *addr* [*/mask*] [*count groups*] [**vlan** *vlan-id*] **Example:** `switch(config-mvr)# mvr-group 230.1.1.1 count 4`	Adds a multicast group at the specified IPv4 address (and optional netmask length) to the global default MVR VLAN. You can repeat this command to add additional groups to the MVR VLAN. The IP address is entered in the format a.b.c.d/m, where m is the number of bits in the netmask, from 1 to 31. You can optionally specify a number of MVR groups using contiguous multicast IP addresses starting with the specified IP address. Use the count keyword followed by a number from 1 to 64. You can optionally specify an MVR VLAN for the group by using the vlan keyword. Otherwise, the group is assigned to the default MVR VLAN. Use the no form of the command to clear the group configuration.
Step 5	(Optional) **clear mvr counters** [**source-ports** | **receiver-ports**] **Example:** `switch(config-mvr)# clear mvr counters`	Clears MVR IGMP packet counters.
Step 6	(Optional) **show mvr** **Example:** `switch(config-mvr)# show mvr`	Displays the global MVR configuration.
Step 7	(Optional) **copy running-config startup-config** **Example:** `switch(config-mvr)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring MVR Interfaces

You can configure MVR interfaces on your Cisco NX-OS device.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**mvr**
	Example:
	`switch(config)# mvr`
	`switch(config-mvr)#`
		Globally enables MVR. The default is disabled.
		Note If MVR is enabled globally, this command is not required.

Step 3	**interface** {**ethernet slot/port** | **port-channel channel-number** | **ethernet** *number*}
	Example:
	`switch(config-mvr)# interface ethernet 2/2`
	`switch(config-mvr-if)#`
		Specifies the Layer 2 port to configure and enters interface configuration mode.

Step 4	[**no**] **mvr-type** {**source** | **receiver**}
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Configures an MVR port as one of these types of ports:
		• source—An uplink port that sends and receives multicast data is configured as an MVR source. The port automatically becomes a static receiver of MVR multicast groups. A source port should be a member of the MVR VLAN.
		• receiver—An access port that is connected to a host that wants to subscribe to an MVR multicast group is configured as an MVR receiver. A receiver port receives data only when it becomes a member of the multicast group by using IGMP leave and join messages.
		If you attempt to configure a non-MVR port with MVR characteristics, the configuration is cached and does not take effect until the port becomes an MVR port. The default port mode is non-MVR.

Step 5	(Optional) [**no**] **mvr-vlan** {**vlan-id**} **Example:** `switch(config-mvr-if)# mvr-vlan 7`	Specifies an interface default MVR VLAN that overrides the global default MVR VLAN for joins received on the interface. The MVR VLAN is the source of the multicast message that subsequent receivers subscribe to. The range is from 1 to 4094.

	Command or Action	Purpose
Step 6	[**no**] **mvr-group addr** [**/mask**] {**vlan** *vlan-id*} **Example:** `switch(config-mvr-if)# mvr-group 225.1.3.1 vlan 100`	Adds a multicast group at the specified IPv4 address (and optional netmask length) to the interface MVR VLAN, overriding the global MVR group configuration. You can repeat this command to add additional groups to the MVR. The IP address is entered in the format a.b.c.d/m, where m is the number of bits in the netmask, from 1 to 31. You can optionally specify an MVR VLAN for the group by using the vlan keyword; otherwise, the group is assigned to the interface default (if specified) or the global default MVR VLAN. Use the no form of the command to clear the IPv4 address and netmask.
Step 7	**copy running-config startup-config** **Example:** `switch(config-mvr-if)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Suppressing IGMP Query Forwarding from VLANs

To suppress the IGMP general query from the source VLAN to the receiver VLAN perform the following steps.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal switch(config)#`	Enters global configuration mode.
Step 2	**mvr-config** **Example:** `switch# mvr-config switch(config-mvr)#`	Enters global MVR configuration mode.
Step 3	**mvr-suppress-query vlan** *vlan-ID* **Example:** `switch(config-mvr)# mvr-suppress-query vlan 1-5 switch(config-mvr)#`	Displays the MVR ID or source VLAN range from where the general queries need to be suppressed. The VLAN ID value is 1 to 3967. The VLAN ID may also be expressed as a range 1-5, 10 or 2-5, 7-19.

Verifying the MVR Configuration

To display the MVR configuration information, perform one of the following tasks:

Command	Purpose
show mvr	Displays the MVR subsystem configuration and status.
show mvr groups	Displays the MVR group configuration.
show ip igmp snooping [**vlan** *vlan-id*]	Displays information about IGMP snooping on the specified VLAN.
show mvr interface {*ethernet slot/port* | **port-channel number**}	Displays the MVR configuration on the specified interface.
show mvr members [**count**]	Displays the number and details of all MVR receiver members.
show mvr members interface {**ethernet slot/port** | **port-channel number**}	Displays details of MVR members on the specified interface.
show mvr members vlan *vlan-id*	Displays details of MVR members on the specified VLAN.
show mvr receiver-ports [**ethernet slot/port** | **port-channel number**]	Displays all MVR receiver ports on all interfaces or on the specified interface.
show mvr source-ports [**ethernet slot/port** | **port-channel number**]	Displays all MVR source ports on all interfaces or on the specified interface.

This example shows how to verify the MVR parameters:

```
switch# show mvr
MVR Status : enabled
Global MVR VLAN : 100
Number of MVR VLANs : 4
```

This example shows how to verify the MVR group configuration:

```
switch# show mvr groups
* - Global default MVR VLAN.
Group start Group end Count MVR-VLAN Interface
Mask
------------ --------------- ------ -------- -----------
228.1.2.240 228.1.2.255 /28 101
230.1.1.1 230.1.1.4 4 *100
235.1.1.6 235.1.1.6 1 340
225.1.3.1 225.1.3.1 1 *100 Eth1/10
```

This example shows how to verify the MVR interface configuration and status:

```
switch# show mvr interface
Port VLAN Type Status MVR-VLAN
---- ---- ---- ------ --------
Po10 100 SOURCE ACTIVE 100-101
Po201 201 RECEIVER ACTIVE 100-101,340
Po202 202 RECEIVER ACTIVE 100-101,340
```

```
Po203 203 RECEIVER ACTIVE 100-101,340
Po204 204 RECEIVER INACTIVE 100-101,340
Po205 205 RECEIVER ACTIVE 100-101,340
Po206 206 RECEIVER ACTIVE 100-101,340
Po207 207 RECEIVER ACTIVE 100-101,340
Po208 208 RECEIVER ACTIVE 2000-2001
Eth1/9 340 SOURCE ACTIVE 340
Eth1/10 20 RECEIVER ACTIVE 100-101,340
Eth2/2 20 RECEIVER ACTIVE 100-101,340
Eth102/1/1 102 RECEIVER ACTIVE 100-101,340
Eth102/1/2 102 RECEIVER INACTIVE 100-101,340
Eth103/1/1 103 RECEIVER ACTIVE 100-101,340
Eth103/1/2 103 RECEIVER ACTIVE 100-101,340
Status INVALID indicates one of the following misconfiguration:
a) Interface is not a switchport.
b) MVR receiver is not in access.
c) MVR source is in fex-fabric mode.
```

This example shows how to display all MVR members:

```
switch# show mvr members
MVR-VLAN Group Address Status Members
-------- ------------- ------- -------
100 230.1.1.1 ACTIVE Po201 Po202 Po203 Po205 Po206
100 230.1.1.2 ACTIVE Po205 Po206 Po207 Po208
340 235.1.1.6 ACTIVE Eth102/1/1
101 225.1.3.1 ACTIVE Eth1/10 Eth2/2
101 228.1.2.241 ACTIVE Eth103/1/1 Eth103/1/2
```

This example shows how to display all MVR receiver ports on all interfaces:

```
switch# show mvr receiver-ports
Port MVR-VLAN Status Joins Leaves
(v1,v2,v3)
------------ -------- -------- ------------ ------------
Po201 100 ACTIVE 8 2
Po202 100 ACTIVE 8 2
Po203 100 ACTIVE 8 2
Po204 100 INACTIVE 0 0
Po205 100 ACTIVE 10 6
Po206 100 ACTIVE 10 6
Po207 100 ACTIVE 5 0
Po208 100 ACTIVE 6 0
Eth1/10 101 ACTIVE 12 2
Eth2/2 101 ACTIVE 12 2
Eth102/1/1 340 ACTIVE 16 15
Eth102/1/2 340 INACTIVE 16 16
Eth103/1/1 101 ACTIVE 33 0
Eth103/1/2 101 ACTIVE 33 0
```

This example shows how to display all MVR source ports on all interfaces:

```
switch# show mvr source-ports
Port MVR-VLAN Status
------------ -------- --------
Po10 100 ACTIVE
Eth1/9 340 ACTIVE
```

Configuration Examples for MVR

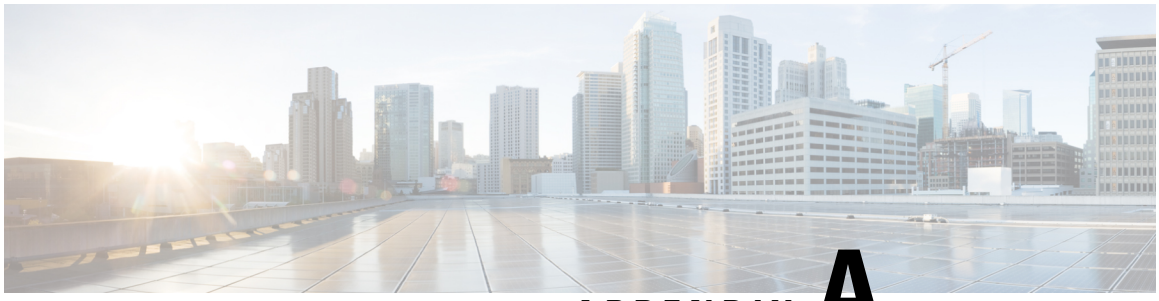
The following example shows how to globally enable MVR and configure the global parameters:

```
switch# configure terminal
switch(config)# mvr
switch(config-mvr)# mvr-vlan 100
switch(config-mvr)# mvr-group 230.1.1.1 count 4
switch(config-mvr)# mvr-group 228.1.2.240/28 vlan 101
switch(config-mvr)# mvr-group 235.1.1.6 vlan 340

switch# show mvr
MVR Status : enabled
Global MVR VLAN : 100
Number of MVR VLANs : 3
```

The following example shows how to configure an Ethernet port as an MVR receiver port:

```
switch# configure terminal
switch(config)# mvr
switch(config-mvr)# interface ethernet 1/10
switch(config-mvr-if)# mvr-group 225.1.3.1 vlan 100
switch(config-mvr-if)# mvr-type receiver
```



APPENDIX A

IETF RFCs for IP Multicast

This appendix contains Internet Engineering Task Force (IETF) RFCs related to IP multicast. For information about IETF RFCs, see http://www.ietf.org/rfc.html.

IETF RFCs for IP Multicast

RFCs	Title
RFC 2236	*Internet Group Management Protocol, Version 2*
RFC 2365	*Administratively Scoped IP Multicast*
RFC 2858	*Multiprotocol Extensions for BGP-4*
RFC 3376	*Internet Group Management Protocol, Version 3*
RFC 3446	*Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)*
RFC 3569	*An Overview of Source-Specific Multicast (SSM)*
RFC 4541	*Considerations for Internet Group Management Protocol (IGMP) Snooping Switches*
RFC 4601	*Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)*
RFC 4610	*Anycast-RP Using Protocol Independent Multicast (PIM)*
RFC 5132	*IP Multicast MIB*

IETF RFCs for IP Multicast