Customizing IGMP

Internet Group Management Protocol (IGMP) is used to dynamically register individual hosts in a multicast group on a particular LAN segment. Enabling Protocol Independent Multicast (PIM) on an interface also enables IGMP operation on that interface.

This module describes ways to customize IGMP, including how to:

- Configure the router to forward multicast traffic in the absence of directly connected IGMP hosts.
- Enable an IGMP Version 3 (IGMPv3) host stack so that the router can function as a multicast network endpoint or host.
- Enable routers to track each individual host that is joined to a particular group or channel in an IGMPv3 environment.
- Control access to an SSM network using IGMP extended access lists.
- Configure an IGMP proxy that enables hosts that are not directly connected to a downstream router to join a multicast group sourced from an upstream network.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

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

Prerequisites for IGMP

- Before performing the tasks in this module, you should be familiar with the concepts explained in the "IP Multicast Routing Technology Overview" module.
- The tasks in this module assume that IP multicast has been enabled and that the Protocol Independent Multicast (PIM) interfaces have been configured using the tasks described in the "Configuring IP Multicast Routing” module.

Restrictions for Customizing IGMP

Traffic Filtering with Multicast Groups That Are Not Configured in SSM Mode

IGMPv3 membership reports are not utilized by the software to filter or restrict traffic for multicast groups that are not configured in Source Specific Multicast (SSM) mode. Effectively, Cisco IOS software interprets all IGMPv3 membership reports for groups configured in dense, sparse, or bidirectional mode to be group membership reports and forwards traffic from all active sources onto the network.

Interoperability with IGMP Snooping

You must be careful when using IGMPv3 with switches that support and are enabled for IGMP snooping, because IGMPv3 messages are different from the messages used in IGMP Version 1 (IGMPv1) and Version 2 (IGMPv2). If a switch does not recognize IGMPv3 messages, then hosts will not correctly receive traffic if IGMPv3 is being used. In this case, either IGMP snooping may be disabled on the switch or the router may be configured for IGMPv2 on the interface, which would remove the ability to use SSM for host applications that cannot resort to URL Rendezvous Directory (URD) or IGMP v3lite.

Interoperability with CGMP

Networks using Cisco Group Management Protocol (CGMP) will have better group leave behavior if they are configured with IGMPv2 than IGMPv3. If CGMP is used with IGMPv2 and the switch is enabled for the CGMP leave functionality, then traffic to a port joined to a multicast group will be removed from the port shortly after the last member on that port has dropped membership to that group. This fast-leave mechanism is part of IGMPv2 and is specifically supported by the CGMP fast-leave enabled switch.

With IGMPv3, there is currently no CGMP switch support of fast leave. If IGMPv3 is used in a network, CGMP will continue to work, but CGMP fast-leave support is ineffective and the following conditions apply:

- Each time a host on a new port of the CGMP switch joins a multicast group, that port is added to the list of ports to which the traffic of this group is sent.
- If all hosts on a particular port leave the multicast group, but there are still hosts on other ports (in the same virtual LAN) joined to the group, then nothing happens. In other words, the port continues to receive traffic from that multicast group.
- Only when the last host in a virtual LAN (VLAN) has left the multicast group does forwarding of the traffic of this group into the VLAN revert to no ports on the forwarding switch.

This join behavior only applies to multicast groups that actually operate in IGMPv3 mode. If legacy hosts only supporting IGMPv2 are present in the network, then groups will revert to IGMPv2 and fast leave will work for these groups.

If fast leave is needed with CGMP-enabled switches, we recommend that you not enable IGMPv3 but configure IGMPv2 on that interface.

If you want to use SSM, you need IGMPv3 and you have two configuration alternatives, as follows:

- Configure only the interface for IGMPv2 and use IGMP v3lite and URD.
- Enable IGMPv3 and accept the higher leave latencies through the CGMP switch.

Information About Customizing IGMP

Role of the Internet Group Management Protocol

IGMP is used to dynamically register individual hosts in a multicast group on a particular LAN. Enabling PIM on an interface also enables IGMP. IGMP provides a means to automatically control and limit the flow of multicast traffic throughout your network with the use of special multicast queriers and hosts.

- A querier is a network device, such as a router, that sends query messages to discover which network devices are members of a given multicast group.
- A host is a receiver, including routers, that sends report messages (in response to query messages) to inform the querier of a host membership. Hosts use IGMP messages to join and leave multicast groups.

Hosts identify group memberships by sending IGMP messages to their local multicast device. Under IGMP, devices listen to IGMP messages and periodically send out queries to discover which groups are active or inactive on a particular subnet.

IGMP Versions Differences

There are three versions of IGMP, as defined by Request for Comments (RFC) documents of the Internet Engineering Task Force (IETF). IGMPv2 improves over IGMPv1 by adding the ability for a host to signal desire to leave a multicast group and IGMPv3 improves over IGMPv2 mainly by adding the ability to listen to multicast originating from a set of source IP addresses only.

Table 1: IGMP Versions

IGMP Version	Description
IGMPv1	Provides the basic query-response mechanism that allows the multicast device to determine which multicast groups are active and other processes that enable hosts to join and leave a multicast group. RFC 1112 defines the IGMPv1 host extensions for IP multicasting.

IGMP Version	Description
IGMPv2	Extends IGMP, allowing such capabilities as the IGMP leave process, group-specific queries, and an explicit maximum response time field. IGMPv2 also adds the capability for devices to elect the IGMP querier without dependence on the multicast protocol to perform this task. RFC 2236 defines IGMPv2.

Note By default, enabling a PIM on an interface enables IGMPv2 on that device. IGMPv2 was designed to be as backward compatible with IGMPv1 as possible. To accomplish this backward compatibility, RFC 2236 defined special interoperability rules. If your network contains legacy IGMPv1 hosts, you should be familiar with these operability rules. For more information about IGMPv1 and IGMPv2 interoperability, see RFC 2236, Internet Group Management Protocol, Version 2 .

Devices That Run IGMPv1

IGMPv1 devices send IGMP queries to the “all-hosts” multicast address of 224.0.0.1 to solicit multicast groups with active multicast receivers. The multicast receivers also can send IGMP reports to the device to notify it that they are interested in receiving a particular multicast stream. Hosts can send the report asynchronously or in response to the IGMP queries sent by the device. If more than one multicast receiver exists for the same multicast group, only one of these hosts sends an IGMP report message; the other hosts suppress their report messages.

In IGMPv1, there is no election of an IGMP querier. If more than one device on the segment exists, all the devices send periodic IGMP queries. IGMPv1 has no special mechanism by which the hosts can leave the group. If the hosts are no longer interested in receiving multicast packets for a particular group, they simply do not reply to the IGMP query packets sent from the device. The device continues sending query packets. If the device does not hear a response in three IGMP queries, the group times out and the device stops sending multicast packets on the segment for the group. If the host later wants to receive multicast packets after the timeout period, the host simply sends a new IGMP join to the device, and the device begins to forward the multicast packet again.

If there are multiple devices on a LAN, a designated router (DR) must be elected to avoid duplicating multicast traffic for connected hosts. PIM devices follow an election process to select a DR. The PIM device with the highest IP address becomes the DR.

The DR is responsible for the following tasks:

- Sending PIM register and PIM Join and Prune messages toward the rendezvous point (RP) to inform it about host group membership.
- Sending IGMP host-query messages.
- Sending host-query messages by default every 60 seconds in order to keep the IGMP overhead on hosts and networks very low.

Devices That Run IGMPv2

IGMPv2 improves the query messaging capabilities of IGMPv1.

The query and membership report messages in IGMPv2 are identical to the IGMPv1 messages with two exceptions:

- IGMPv2 query messages are broken into two categories: general queries (identical to IGMPv1 queries) and group-specific queries.
- IGMPv1 membership reports and IGMPv2 membership reports have different IGMP type codes.

IGMPv2 also enhances IGMP by providing support for the following capabilities:

- Querier election process--Provides the capability for IGMPv2 devices to elect the IGMP querier without having to rely on the multicast routing protocol to perform the process.
- Maximum Response Time field--A new field in query messages permits the IGMP querier to specify the maximum query-response time. This field permits the tuning of the query-response process to control response burstiness and to fine-tune leave latencies.
- Group-Specific Query messages--Permits the IGMP querier to perform the query operation on a specific group instead of all groups.
- Leave-Group messages--Provides hosts with a method of notifying devices on the network that they wish to leave the group.

Unlike IGMPv1, in which the DR and the IGMP querier are typically the same device, in IGMPv2 the two functions are decoupled. The DR and the IGMP querier are selected based on different criteria and may be different devices on the same subnet. The DR is the device with the highest IP address on the subnet, whereas the IGMP querier is the device with the lowest IP address.

Query messages are used to elect the IGMP querier as follows:

1. When IGMPv2 devices start, they each multicast a general query message to the all-systems group address of 224.0.0.1 with their interface address in the source IP address field of the message.
2. When an IGMPv2 device receives a general query message, the device compares the source IP address in the message with its own interface address. The device with the lowest IP address on the subnet is elected the IGMP querier.
3. All devices (excluding the querier) start the query timer, which is reset whenever a general query message is received from the IGMP querier. If the query timer expires, it is assumed that the IGMP querier has gone down, and the election process is performed again to elect a new IGMP querier.

By default, the timer is two times the query interval.

IGMP Join Process

When a host wants to join a multicast group, the host sends one or more unsolicited membership reports for the multicast group it wants to join. The IGMP join process is the same for IGMPv1 and IGMPv2 hosts.

In IGMPv3, the join process for hosts proceeds as follows:

- When a hosts wants to join a group, it sends an IGMPv3 membership report to 224.0.0.22 with an empty EXCLUDE list.
- When a host wants to join a specific channel, it sends an IGMPv3 membership report to 224.0.0.22 with the address of the specific source included in the INCLUDE list.
- When a host wants to join a group excluding particular sources, it sends an IGMPv3 membership report to 224.0.0.22 excluding those sources in the EXCLUDE list.

Note If some IGMPv3 hosts on a LAN wish to exclude a source and others wish to include the source, then the device will send traffic for the source on the LAN (that is, inclusion trumps exclusion in this situation).

IGMP Leave Process

The method that hosts use to leave a group varies depending on the version of IGMP in operation.

IGMPv1 Leave Process

There is no leave-group message in IGMPv1 to notify the devices on the subnet that a host no longer wants to receive the multicast traffic from a specific group. The host simply stops processing traffic for the multicast group and ceases responding to IGMP queries with IGMP membership reports for the group. As a result, the only way IGMPv1 devices know that there are no longer any active receivers for a particular multicast group on a subnet is when the devices stop receiving membership reports. To facilitate this process, IGMPv1 devices associate a countdown timer with an IGMP group on a subnet. When a membership report is received for the group on the subnet, the timer is reset. For IGMPv1 devices, this timeout interval is typically three times the query interval (3 minutes). This timeout interval means that the device may continue to forward multicast traffic onto the subnet for up to 3 minutes after all hosts have left the multicast group.

IGMPv2 Leave Process

IGMPv2 incorporates a leave-group message that provides the means for a host to indicate that it wishes to stop receiving multicast traffic for a specific group. When an IGMPv2 host leaves a multicast group, if it was the last host to respond to a query with a membership report for that group, it sends a leave-group message to the all-devices multicast group (224.0.0.2).

IGMPv3 Leave Process

IGMPv3 enhances the leave process by introducing the capability for a host to stop receiving traffic from a particular group, source, or channel in IGMP by including or excluding sources, groups, or channels in IGMPv3 membership reports.

IGMP Multicast Addresses

IP multicast traffic uses group addresses, which are Class D IP addresses. The high-order four bits of a Class D address are 1110. Therefore, host group addresses can be in the range 224.0.0.0 to 239.255.255.255.

Multicast addresses in the range 224.0.0.0 to 224.0.0.255 are reserved for use by routing protocols and other network control traffic. The address 224.0.0.0 is guaranteed not to be assigned to any group.

IGMP packets are transmitted using IP multicast group addresses as follows:

- IGMP general queries are destined to the address 224.0.0.1 (all systems on a subnet).
- IGMP group-specific queries are destined to the group IP address for which the device is querying.
- IGMP group membership reports are destined to the group IP address for which the device is reporting.
- IGMPv2 leave-group messages are destined to the address 224.0.0.2 (all devices on a subnet).

- IGMPv3 membership reports are destined to the address 224.0.0.22; all IGMPv3-capable multicast devices must listen to this address.

Extended ACL Support for IGMP to Support SSM in IPv4

The Extended ACL Support for IGMP to Support SSM in IPv4 feature enables IGMPv3 to accommodate extended access lists. IGMPv3 support of extended access lists allows you to leverage an important advantage of SSM in IPv4, that of filtering IGMPv3 reports based on source address, group address, or both.

Benefits of Extended Access List Support for IGMP to Support SSM in IPv4

IGMPv3 accommodates extended access lists, which allow you to leverage an important advantage of SSM in IPv4, that of basing access on source IP address. Prior to this feature, an IGMP access list accepted only a standard access list, allowing membership reports to be filtered based only on multicast group addresses.

IGMPv3 allows multicast receivers not only to join to groups, but to groups including or excluding sources. For appropriate access control, it is therefore necessary to allow filtering of IGMPv3 messages not only by group addresses reported, but by group and source addresses. IGMP extended access lists introduce this functionality. Using SSM with an IGMP extended access list (ACL) allows you to permit or deny source S and group G (S, G) in IGMPv3 reports, thereby filtering IGMPv3 reports based on source address, group address, or source and group address.

Source Addresses in IGMPv3 Reports for ASM Groups

IGMP extended access lists also can be used to permit or filter (deny) traffic based on (0.0.0.0, G), that is, (*, G) in IGMP reports that are non-SSM, such as Any Source Multicast (ASM).

Note The permit and deny statements equivalent to (*, G) are **permit host 0.0.0.0 host** *group-address* and **deny host 0.0.0.0 host group** *group-address*, respectively.

Filtering applies to IGMPv3 reports for both ASM and SSM groups, but it is most important for SSM groups because IP multicast routing ignores source addresses in IGMPv3 reports for ASM groups. Source addresses in IGMPv3 membership reports for ASM groups are stored in the IGMP cache (as displayed with the **show ip igmp membership** command), but PIM-based IP multicast routing considers only the ASM groups reported. Therefore, adding filtering for source addresses for ASM groups impacts only the IGMP cache for ASM groups.

How IGMP Checks an Extended Access List

When an IGMP extended access list is referenced in the **ip igmp access-group** command on an interface, the (S, G) pairs in the **permit** and **deny** statements of the extended access list are matched against the (S, G) pair of the IGMP reports received on the interface. For example, if an IGMP report with (S1, S2...Sn, G) is received, first the group (0.0.0.0, G) is checked against the access list statements. The convention (0.0.0.0, G) means (*, G), which is a wildcard source with a multicast group number. If the group is denied, the entire IGMP report is denied. If the group is permitted, each individual (S, G) pair is checked against the access list. Denied sources are taken out of the IGMP report, thereby denying the sources access to the multicast traffic.

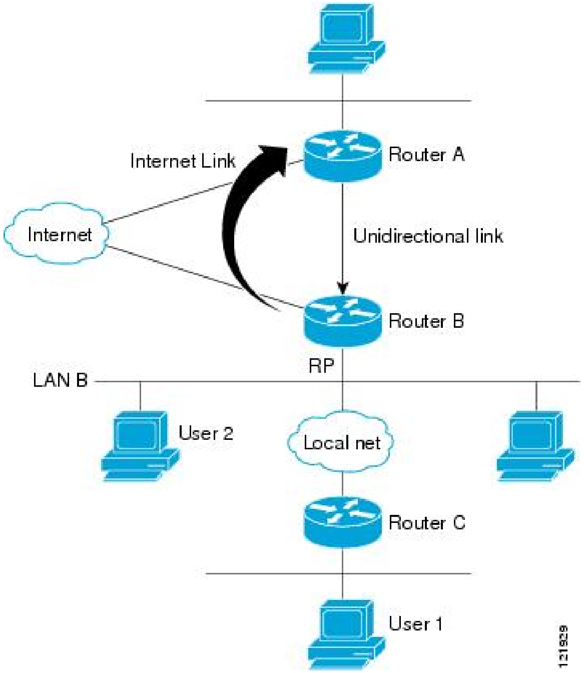
IGMP Proxy

An IGMP proxy enables hosts in a unidirectional link routing (UDLR) environment that are not directly connected to a downstream router to join a multicast group sourced from an upstream network.

The figure below illustrates a sample topology that shows two UDLR scenarios:

- Traditional UDL routing scenario--A UDL device with directly connected receivers.
- IGMP proxy scenario--UDL device without directly connected receivers.

Note IGMP UDLs are needed on the upstream and downstream devices.



Scenario 1--Traditional UDLR Scenario (UDL Device with Directly Connected Receivers)

For scenario 1, no IGMP proxy mechanism is needed. In this scenario, the following sequence of events occurs:

1. User 2 sends an IGMP membership report requesting interest in group G.
2. Router B receives the IGMP membership report, adds a forwarding entry for group G on LAN B, and proxies the IGMP report to Router A, which is the UDLR upstream device.
3. The IGMP report is then proxied across the Internet link.
4. Router A receives the IGMP proxy and maintains a forwarding entry on the unidirectional link.

Scenario 2--IGMP Proxy Scenario (UDL Device without Directly Connected Receivers)

For scenario 2, the IGMP proxy mechanism is needed to enable hosts that are not directly connected to a downstream device to join a multicast group sourced from an upstream network. In this scenario, the following sequence of events occurs:

1. User 1 sends an IGMP membership report requesting interest in group G.
2. Router C sends a PIM Join message hop-by-hop to the RP (Router B).
3. Router B receives the PIM Join message and adds a forwarding entry for group G on LAN B.
4. Router B periodically checks its mroute table and proxies the IGMP membership report to its upstream UDL device across the Internet link.
5. Router A creates and maintains a forwarding entry on the unidirectional link (UDL).

In an enterprise network, it is desirable to be able to receive IP multicast traffic via satellite and forward the traffic throughout the network. With unidirectional link routing (UDLR) alone, scenario 2 would not be possible because receiving hosts must be directly connected to the downstream device, Router B. The IGMP proxy mechanism overcomes this limitation by creating an IGMP report for (*, G) entries in the multicast forwarding table. To make this scenario functional, therefore, you must enable IGMP report forwarding of proxied (*, G) multicast static route (mroute) entries (using the **ip igmp mroute-proxy** command) and enable the mroute proxy service (using the **ip igmp proxy-service** command) on interfaces leading to PIM-enabled networks with potential members.

Note Because PIM messages are not forwarded upstream, each downstream network and the upstream network have a separate domain.

How to Customize IGMP

Configuring the Device to Forward Multicast Traffic in the Absence of Directly Connected IGMP Hosts

Perform this optional task to configure the device to forward multicast traffic in the absence of directly connected IGMP hosts.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
    - **ip igmp join-group** *group-address*
    - **ip igmp static-group** {***** | *group-address* [**source** *source-address*]}
5. **end**
6. **show ip igmp interface** [*interface-type interface-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `> enable`	Enables privileged EXEC mode. - Enter your password if prompted.
Step 2	**configure terminal** **Example:** `device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `device(config)# interface gigabitethernet 1`	Enters interface configuration mode. - For the *type* and *number* arguments, specify an interface that is connected to hosts.

Step 4	Do one of the following:
	- **ip igmp join-group** *group-address*
	- **ip igmp static-group** {***** | *group-address* [**source** *source-address*]}
	Example:
	`device(config-if)# ip igmp join-group 225.2.2.2`
	Example:
	`device(config-if)# ip igmp static-group 225.2.2.2`
		The first sample shows how to configure an interface on the device to join the specified group.
		With this method, the device accepts the multicast packets in addition to forwarding them. Accepting the multicast packets prevents the device from fast switching.
		The second example shows how to configure static group membership entries on an interface. With this method, the device does not accept the packets itself, but only forwards them. Hence, this method allows fast switching. The outgoing interface appears in the IGMP cache, but the device itself is not a member, as evidenced by lack of an “L” (local) flag in the multicast route entry

Step 5	**end**
	Example:
	`device#(config-if)# end`
		Returns to privileged EXEC mode.

Step 6	**show ip igmp interface** [*interface-type interface-number*] **Example:** `device# show ip igmp interface`	(Optional) Displays multicast-related information about an interface.

Controlling Access to an SSM Network Using IGMP Extended Access Lists

Perform this optional task to control access to an SSM network by using an IGMP extended access list that filters SSM traffic based on source address, group address, or both.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing** [**distributed**]
4. **ip pim ssm** {**default** | **range** *access-list*}
5. **ip access-list extended** *access-list* -name
6. **deny igmp** *source source-wildcard destination destination-wildcard* [*igmp-type*] [**precedence** *precedence*] [**tos** *tos*] [**log**] [**time-range** *time-range-name*] [**fragments**]
7. **permit igmp** *source source-wildcard destination destination-wildcard* [*igmp-type*] [**precedence** *precedence*] [**tos** *tos*] [**log**] [**time-range** *time-range-name*] [**fragments**]
8. **exit**
9. interface type number
10. **ip igmp access-group** *access-list*
11. **ip pim sparse-mode**
12. Repeat Steps 1 through 11 on all interfaces that require access control of SSM channel membership.
13. **ip igmp version 3**
14. Repeat Step 13 on all host-facing interfaces.
15. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip multicast-routing** [**distributed**] **Example:** `Device(config)# ip multicast-routing distributed`	Enables IP multicast routing. • The **distributed** keyword is required for IPv4 multicast..

Step 4	**ip pim ssm** {**default** | **range** *access-list*}
	Example:
	`Device(config)# ip pim ssm default`
		Configures SSM service.
		• The **default** keyword defines the SSM range access list as 232/8.
		• The **range** keyword specifies the standard IP access list number or name that defines the SSM range.

Step 5	**ip access-list extended** *access-list* -name **Example:**	Specifies an extended named IP access list.

	Command or Action	Purpose
	`Device(config)# ip access-list extended mygroup`	
Step 6	**deny igmp** *source source-wildcard destination destination-wildcard* [*igmp-type*] [**precedence** *precedence*] [**tos** *tos*] [**log**] [**time-range** *time-range-name*] [**fragments**] **Example:** `Device(config-ext-nacl)# deny igmp host 10.1.2.3 any`	(Optional) Filters the specified source address or group address from the IGMP report, thereby restricting hosts on a subnet from membership to the (S, G) channel. • Repeat this step to restrict hosts on a subnet membership to other (S, G) channels. (These sources should be more specific than a subsequent **permit** statement because any sources or groups not specifically permitted are denied.) • Remember that the access list ends in an implicit **deny** statement. • This example shows how to create a deny statement that filters all groups for source 10.1.2.3, which effectively denies the source.
Step 7	**permit igmp** *source source-wildcard destination destination-wildcard* [*igmp-type*] [**precedence** *precedence*] [**tos** *tos*] [**log**] [**time-range** *time-range-name*] [**fragments**] **Example:** `Device(config-ext-nacl)# permit igmp any any`	Allows a source address or group address in an IGMP report to pass the IP access list. • You must have at least one **permit** statement in an access list. • Repeat this step to allow other sources to pass the IP access list. • This example shows how to allow group membership to sources and groups not denied by prior **deny** statements.
Step 8	**exit** **Example:** `Device(config-ext-nacl)# exit`	Exits the current configuration session and returns to global configuration mode.
Step 9	interface type number **Example:** `Device(config)# interface ethernet 0`	Selects an interface that is connected to hosts on which IGMPv3 can be enabled.
Step 10	**ip igmp access-group** *access-list* **Example:** `Device(config-if)# ip igmp access-group mygroup`	Applies the specified access list to IGMP reports.
Step 11	**ip pim sparse-mode** **Example:**	Enables PIM-SM on the interface. **Note** You must use sparse mode.

	Command or Action	Purpose
	`Device(config-if)# ip pim sparse-mode`	
Step 12	Repeat Steps 1 through 11 on all interfaces that require access control of SSM channel membership.	--
Step 13	**ip igmp version 3** **Example:** `Device(config-if)# ip igmp version 3`	Enables IGMPv3 on this interface. The default version of IGMP is IGMP version 2. Version 3 is required by SSM.
Step 14	Repeat Step 13 on all host-facing interfaces.	--

Step 15	**end**
	Example:
	`Device(config-if)# end`
		Returns to privileged EXEC mode.

Configuring an IGMP Proxy

Perform this optional task to configure unidirectional link (UDL) routers to use the IGMP proxy mechanism. An IGMP proxy enables hosts in a unidirectional link routing (UDLR) environment that are not directly connected to a downstream router to join a multicast group sourced from an upstream network.

To configure an IGMP proxy, you will need to perform the following tasks:

Prerequisites for IGMP Proxy

Before configuring an IGMP proxy, ensure that the following conditions exist:

- All routers on the IGMP UDL have the same subnet address. If all routers on the UDL cannot have the same subnet address, the upstream router must be configured with secondary addresses to match all the subnets that the downstream routers are attached to.
- This task assumes that IP multicast has been enabled and that the PIM interfaces have been configured.

When enabling PIM on the interfaces for the IGMP proxy scenario, keep in mind the following guidelines:

- - Use PIM sparse mode (PIM-SM) when the interface is operating in a sparse-mode region and you are running static RP, bootstrap (BSR), or Auto-RP with the Auto-RP listener capability.
  - Use PIM sparse-dense mode when the interface is running in a sparse-dense mode region and you are running Auto-RP without the Auto-RP listener capability.
  - Use PIM dense mode (PIM-DM) for this step when the interface is operating in dense mode and is, thus, participating in a dense-mode region.
  - Use PIM-DM with the proxy-register capability when the interface is receiving source traffic from a dense-mode region that needs to reach receivers that are in a sparse-mode region.

Configuring the Upstream UDL Device for IGMP UDLR

Perform this task to configure the upstream UDL device for IGMP UDLR.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip igmp unidirectional-link**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 1/0/0`	Enters interface configuration mode. • For the *type* and *number* arguments, specify the interface to be used as the UDL on the upstream device.
Step 4	**ip igmp unidirectional-link** **Example:** `Device(config-if)# ip igmp unidirectional-link`	Configures IGMP on the interface to be unidirectional for IGMP UDLR.

Step 5	**end**
	Example:
	`Device(config-if)# end`
		Ends the current configuration session and returns to privileged EXEC mode.

Configuring the Downstream UDL Device for IGMP UDLR with IGMP Proxy Support

Perform this task to configure the downstream UDL device for IGMP UDLR with IGMP proxy support.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip igmp unidirectional-link**
5. **exit**
6. **interface** *type number*

7. **ip igmp mroute-proxy** *type number*
8. **exit**
9. **interface** *type number*
10. **ip igmp helper-address udl** *interface-type interface-number*
11. **ip igmp proxy-service**
12. **end**
13. **show ip igmp interface**
14. **show ip igmp udlr**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 0/0/0`	Enters interface configuration mode. • For the *type* and *number* arguments, specify the interface to be used as the UDL on the downstream device for IGMP UDLR.
Step 4	**ip igmp unidirectional-link** **Example:** `Device(config-if)# ip igmp unidirectional-link`	Configures IGMP on the interface to be unidirectional for IGMP UDLR.
Step 5	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 6	**interface** *type number* **Example:** `Device(config)# interface gigabitethernet 1/0/0`	Enters interface configuration mode. • For the *type* and *number* arguments, select an interface that is facing the nondirectly connected hosts.
Step 7	**ip igmp mroute-proxy** *type number* **Example:** `Device(config-if)# ip igmp mroute-proxy loopback 0`	Enables IGMP report forwarding of proxied (*, G) multicast static route (mroute) entries. • This step is performed to enable the forwarding of IGMP reports to a proxy service interface for all (*,

	Command or Action	Purpose
		G) forwarding entries in the multicast forwarding table. • In this example, the **ip igmp mroute-proxy** command is configured on Gigabit Ethernet interface 1/0/0 to request that IGMP reports be sent to loopback interface 0 for all groups in the mroute table that are forwarded to Gigabit Ethernet interface 1/0/0.
Step 8	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 9	**interface** *type number* **Example:** `Device(config)# interface loopback 0`	Enters interface configuration mode for the specified interface. • In this example, loopback interface 0 is specified.
Step 10	**ip igmp helper-address udl** *interface-type interface-number* **Example:** `Device(config-if)# ip igmp helper-address udl gigabitethernet 0/0/0`	Configures IGMP helpering for UDLR. • This step allows the downstream device to helper IGMP reports received from hosts to an upstream device connected to a UDL associated with the interface specified for the *interface-type* and *interface-number* arguments. • In the example topology, IGMP helpering is configured over loopback interface 0 on the downstream device. Loopback interface 0, thus, is configured to helper IGMP reports from hosts to an upstream device connected to Gigabit Ethernet interface 0/0/0.
Step 11	**ip igmp proxy-service** **Example:** `Device(config-if)# ip igmp proxy-service`	Enables the mroute proxy service. • When the mroute proxy service is enabled, the device periodically checks the static mroute table for (*, G) forwarding entries that match interfaces configured with the **ip igmp mroute-proxy** command (see Step 7) based on the IGMP query interval. Where there is a match, one IGMP report is created and received on this interface. **Note** The **ip igmp proxy-service** command is intended to be used with the **ip igmp helper-address** (UDL) command. • In this example, the **ip igmp proxy-service** command is configured on loopback interface 0 to enable the

	Command or Action	Purpose
		forwarding of IGMP reports out the interface for all groups on interfaces registered through the **ip igmp mroute-proxy** command (see Step 7).

Step 12	**end**
	Example:
	`Device(config-if)# end`
		Ends the current configuration session and returns to privileged EXEC mode.

Step 13	**show ip igmp interface** **Example:** `Device# show ip igmp interface`	(Optional) Displays multicast-related information about an interface.
Step 14	**show ip igmp udlr** **Example:** `Device# show ip igmp udlr`	(Optional) Displays UDLR information for directly connected multicast groups on interfaces that have a UDL helper address configured.

Configuration Examples for Customizing IGMP

Example: Configuring the Device to Forward Multicast Traffic in the Absence of Directly Connected IGMP Hosts

The following example shows how to configure a device to forward multicast traffic in the absence of directly connected IGMP hosts using the **ip igmp join-group** command. With this method, the device accepts the multicast packets in addition to forwarding them. Accepting the multicast packets prevents the device from fast switching.

In this example, Fast Ethernet interface 0/0/0 on the device is configured to join the group 225.2.2.2:

```
interface FastEthernet0/0/0
 ip igmp join-group 225.2.2.2
```

The following example shows how to configure a device to forward multicast traffic in the absence of directly connected IGMP hosts using the **ip igmp static-group** command. With this method, the device does not accept the packets itself, but only forwards them. Hence, this method allows fast switching. The outgoing interface appears in the IGMP cache, but the device itself is not a member, as evidenced by lack of an “L” (local) flag in the multicast route entry.

In this example, static group membership entries for group 225.2.2.2 are configured on Fast Ethernet interface 0/1/0:

```
interface FastEthernet0/1/0
 ip igmp static-group 225.2.2.2
```

Controlling Access to an SSM Network Using IGMP Extended Access Lists

This section contains the following configuration examples for controlling access to an SSM network using IGMP extended access lists:

Note Keep in mind that access lists are very flexible: there are many combinations of permit and deny statements one could use in an access list to filter multicast traffic. The examples in this section simply provide a few examples of how it can be done.

Example: Denying All States for a Group G

The following example shows how to deny all states for a group G. In this example, Fast Ethernet interface 0/0/0 is configured to filter all sources for SSM group 232.2.2.2 in IGMPv3 reports, which effectively denies this group.

```
ip access-list extended test1
 deny igmp any host 232.2.2.2
 permit igmp any any
!
interface FastEthernet0/0/0
 ip igmp access-group test1
```

Example: Denying All States for a Source S

The following example shows how to deny all states for a source S. In this example, Gigabit Ethernet interface 1/1/0 is configured to filter all groups for source 10.2.1.32 in IGMPv3 reports, which effectively denies this source.

```
ip access-list extended test2
 deny igmp host 10.2.1.32 any
 permit igmp any any
!
interface GigabitEthernet1/1/0
 ip igmp access-group test2
```

Example: Permitting All States for a Group G

The following example shows how to permit all states for a group G. In this example, Gigabit Ethernet interface 1/2/0 is configured to accept all sources for SSM group 232.1.1.10 in IGMPv3 reports, which effectively accepts this group altogether.

```
ip access-list extended test3
 permit igmp any host 232.1.1.10
!
interface GigabitEthernet1/2/0
 ip igmp access-group test3
```

Example: Permitting All States for a Source S

The following example shows how to permit all states for a source S. In this example, Gigabit Ethernet interface 1/2 is configured to accept all groups for source 10.6.23.32 in IGMPv3 reports, which effectively accepts this source altogether.

```
ip access-list extended test4
 permit igmp host 10.6.23.32 any
!
interface GigabitEthernet1/2/0
 ip igmp access-group test4
```

Example: Filtering a Source S for a Group G

The following example shows how to filter a particular source S for a group G. In this example, Gigabit Ethernet interface 0/3/0 is configured to filter source 232.2.2.2 for SSM group 232.2.30.30 in IGMPv3 reports.

```
ip access-list extended test5
 deny igmp host 10.4.4.4 host 232.2.30.30
 permit igmp any any
!
interface GigabitEthernet0/3/0
 ip igmp access-group test5
```

Example: IGMP Proxy Configuration

The following example shows how to configure the upstream UDL device for IGMP UDLR and the downstream UDL device for IGMP UDLR with IGMP proxy support.

Upstream Device Configuration

```
interface gigabitethernet 0/0/0
ip address 10.1.1.1 255.255.255.0
ip pim sparse-mode
!
interface gigabitethernet 1/0/0
ip address 10.2.1.1 255.255.255.0
ip pim sparse-mode
ip igmp unidirectional-link
!
interface gigabitethernet 2/0/0
ip address 10.3.1.1 255.255.255.0
```

Downstream Device Configuration

```
ip pim rp-address 10.5.1.1 5
access-list 5 permit 239.0.0.0 0.255.255.255
!
interface loopback 0
ip address 10.7.1.1 255.255.255.0
ip pim sparse-mode
ip igmp helper-address udl ethernet 0
ip igmp proxy-service
!
interface gigabitethernet 0/0/0
ip address 10.2.1.2 255.255.255.0
ip pim sparse-mode
ip igmp unidirectional-link
!
interface gigabitethernet 1/0/0
ip address 10.5.1.1 255.255.255.0
ip pim sparse-mode
ip igmp mroute-proxy loopback 0
```

```
!
interface gigabitethernet 2/0/0
ip address 10.6.1.1 255.255.255.0
```

Additional References

The following sections provide references related to customizing IGMP.

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Cisco IOS IP SLAs commands	Cisco IOS IP Multicast Command Reference
Overview of the IP multicast technology area	“ IP Multicast Technology Overview ” module
Basic IP multicast concepts, configuration tasks, and examples	“ Configuring Basic IP Multicast ” or “Configuring IP Multicast in IPv6 Networks” module

Standards and RFCs

Standard/RFC	Title
RFC 1112	*Host extensions for IP multicasting*
RFC 2236	*Internet Group Management Protocol, Version 2*
RFC 3376	*Internet Group Management Protocol, Version 3*

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by these features, and support for existing MIBs has not been modified by these features.	To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

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

Feature Information for Customizing IGMP

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

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

Table 2: Feature Information for Customizing IGMP

Feature Name	Releases	Feature Information
IGMP Version 3 - Explicit Tracking of Hosts, Groups, and Channels	Cisco IOS XE Release 3.8S	IGMPv3 provides for source filtering, which enables a multicast receiver host to signal to a device which groups it wants to receive multicast traffic from, and from which sources this traffic is expected. In addition, IGMPv3 supports the link local address 224.0.0.22, which is the destination IP address for IGMPv3 membership reports; all IGMPv3-capable multicast devices must listen to this address. RFC 3376 defines IGMPv3.
UDLR Tunnel ARP and IGMP Proxy	Cisco IOS XE Release 3.8S	This feature enables ARP over a unidirectional link, and overcomes the existing limitation of requiring downstream multicast receivers to be directly connected to the unidirectional link downstream router.