



## Configuring Multicast Routing

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This chapter describes how to configure multicast routing. This section includes the following topics:

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### Multicast Routing Overview

The security appliance supports both stub multicast routing and PIM multicast routing. However, you cannot configure both concurrently on a single security appliance.

Stub multicast routing provides dynamic host registration and facilitates multicast routing. When configured for stub multicast routing, the security appliance acts as an IGMP proxy agent. Instead of fully participating in multicast routing, the security appliance forwards IGMP messages to an upstream multicast router, which sets up delivery of the multicast data. When configured for stub multicast routing, the security appliance cannot be configured for PIM.

The security appliance supports both PIM-SM and bi-directional PIM. PIM-SM is a multicast routing protocol that uses the underlying unicast routing information base or a separate multicast-capable routing information base. It builds unidirectional shared trees rooted at a single Rendezvous Point per multicast group and optionally creates shortest-path trees per multicast source.

Bi-directional PIM is a variant of PIM-SM that builds bi-directional shared trees connecting multicast sources and receivers. Bi-directional trees are built using a DF election process operating on each link of the multicast topology. With the assistance of the DF, multicast data is forwarded from sources to the Rendezvous Point, and therefore along the shared tree to receivers, without requiring source-specific state. The DF election takes place during Rendezvous Point discovery and provides a default route to the Rendezvous Point.



**Note**

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If the security appliance is the PIM RP, use the untranslated outside address of the security appliance as the RP address.

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## Enabling Multicast Routing

Enabling multicast routing lets the security appliance forward multicast packets. Enabling multicast routing automatically enables PIM and IGMP on all interfaces. To enable multicast routing, enter the following command:

```
hostname(config)# multicast-routing
```

The number of entries in the multicast routing tables are limited by the amount of RAM on the system. [Table 11-1](#) lists the maximum number of entries for specific multicast tables based on the amount of RAM on the security appliance. Once these limits are reached, any new entries are discarded.

**Table 11-1**      *Entry Limits for Multicast Tables*

Table	16 MB	128 MB	128+ MB
<b>MFIB</b>	1000	3000	5000
<b>IGMP Groups</b>	1000	3000	5000
<b>PIM Routes</b>	3000	7000	12000

## Configuring IGMP Features

IP hosts use IGMP to report their group memberships to directly connected multicast routers. IGMP uses group addresses (Class D IP address) as group identifiers. Host group address can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is never assigned to any group. The address 224.0.0.1 is assigned to all systems on a subnet. The address 224.0.0.2 is assigned to all routers on a subnet.

When you enable multicast routing on the security appliance, IGMP Version 2 is automatically enabled on all interfaces.



### Note

Only the **no igmp** command appears in the interface configuration when you use the **show run** command. If the **multicast-routing** command appears in the device configuration, then IGMP is automatically enabled on all interfaces.

This section describes how to configure optional IGMP setting on a per-interface basis. This section includes the following topics:

- [Disabling IGMP on an Interface, page 11-15](#)
- [Configuring Group Membership, page 11-15](#)
- [Configuring a Statically Joined Group, page 11-15](#)
- [Controlling Access to Multicast Groups, page 11-15](#)
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- [Modifying the Query Interval and Query Timeout, page 11-16](#)
- [Changing the Query Response Time, page 11-17](#)
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## Disabling IGMP on an Interface

You can disable IGMP on specific interfaces. This is useful if you know that you do not have any multicast hosts on a specific interface and you want to prevent the security appliance from sending host query messages on that interface.

To disable IGMP on an interface, enter the following command:

```
hostname(config-if)# no igmp
```

To reenable IGMP on an interface, enter the following command:

```
hostname(config-if)# igmp
```

**Note**

Only the **no igmp** command appears in the interface configuration.

## Configuring Group Membership

You can configure the security appliance to be a member of a multicast group. Configuring the security appliance to join a multicast group causes upstream routers to maintain multicast routing table information for that group and keep the paths for that group active.

To have the security appliance join a multicast group, enter the following command:

```
hostname(config-if)# igmp join-group group-address
```

## Configuring a Statically Joined Group

Sometimes a group member cannot report its membership in the group, or there may be no members of a group on the network segment, but you still want multicast traffic for that group to be sent to that network segment. You can have multicast traffic for that group sent to the segment in one of two ways:

- Using the **igmp join-group** command (see [Configuring Group Membership, page 11-15](#)). This causes the security appliance to accept and to forward the multicast packets.
- Using the **igmp static-group** command. The security appliance does not accept the multicast packets but rather forwards them to the specified interface.

To configure a statically joined multicast group on an interface, enter the following command:

```
hostname(config-if)# igmp static-group group-address
```

## Controlling Access to Multicast Groups

To control the multicast groups that hosts on the security appliance interface can join, perform the following steps:

**Step 1** Create an access list for the multicast traffic. You can create more than one entry for a single access list. You can use extended or standard access lists.

- To create a standard access list, enter the following command:

```
hostname(config)# access-list name standard [permit | deny] ip_addr mask
```

The *ip\_addr* argument is the IP address of the multicast group being permitted or denied.

- To create an extended access list, enter the following command:

```
hostname(config)# access-list name extended [permit | deny] protocol src_ip_addr
src_mask dst_ip_addr dst_mask
```

The *dst\_ip\_addr* argument is the IP address of the multicast group being permitted or denied.

**Step 2** Apply the access list to an interface by entering the following command:

```
hostname(config-if)# igmp access-group acl
```

The *acl* argument is the name of a standard or extended IP access list.

## Limiting the Number of IGMP States on an Interface

You can limit the number of IGMP states resulting from IGMP membership reports on a per-interface basis. Membership reports exceeding the configured limits are not entered in the IGMP cache and traffic for the excess membership reports is not forwarded.

To limit the number of IGMP states on an interface, enter the following command:

```
hostname(config-if)# igmp limit number
```

Valid values range from 0 to 500, with 500 being the default value. Setting this value to 0 prevents learned groups from being added, but manually defined memberships (using the **igmp join-group** and **igmp static-group** commands) are still permitted. The **no** form of this command restores the default value.

## Modifying the Query Interval and Query Timeout

The security appliance sends query messages to discover which multicast groups have members on the networks attached to the interfaces. Members respond with IGMP report messages indicating that they want to receive multicast packets for specific groups. Query messages are addressed to the all-systems multicast group, which has an address of 224.0.0.1, with a time-to-live value of 1.

These messages are sent periodically to refresh the membership information stored on the security appliance. If the security appliance discovers that there are no local members of a multicast group still attached to an interface, it stops forwarding multicast packet for that group to the attached network and it sends a prune message back to the source of the packets.

By default, the PIM designated router on the subnet is responsible for sending the query messages. By default, they are sent once every 125 seconds. To change this interval, enter the following command:

```
hostname(config-if)# igmp query-interval seconds
```

If the security appliance does not hear a query message on an interface for the specified timeout value (by default, 255 seconds), then the security appliance becomes the designated router and starts sending the query messages. To change this timeout value, enter the following command:

```
hostname(config-if)# igmp query-timeout seconds
```

**Note**

The `igmp query-timeout` and `igmp query-interval` commands require IGMP Version 2.

## Changing the Query Response Time

By default, the maximum query response time advertised in IGMP queries is 10 seconds. If the security appliance does not receive a response to a host query within this amount of time, it deletes the group.

To change the maximum query response time, enter the following command:

```
hostname(config-if)# igmp query-max-response-time seconds
```

## Changing the IGMP Version

By default, the security appliance runs IGMP Version 2, which enables several additional features such as the `igmp query-timeout` and `igmp query-interval` commands.

All multicast routers on a subnet must support the same version of IGMP. The security appliance does not automatically detect version 1 routers and switch to version 1. However, a mix of IGMP Version 1 and 2 hosts on the subnet works; the security appliance running IGMP Version 2 works correctly when IGMP Version 1 hosts are present.

To control which version of IGMP is running on an interface, enter the following command:

```
hostname(config-if)# igmp version {1 | 2}
```

## Configuring Stub Multicast Routing

A security appliance acting as the gateway to the stub area does not need to participate in PIM. Instead, you can configure it to act as an IGMP proxy agent and forward IGMP messages from hosts connected on one interface to an upstream multicast router on another. To configure the security appliance as an IGMP proxy agent, forward the host join and leave messages from the stub area interface to an upstream interface.

To forward the host join and leave messages, enter the following command from the interface attached to the stub area:

```
hostname(config-if)# igmp forward interface if_name
```

**Note**

Stub Multicast Routing and PIM are not supported concurrently.

The UDP and non-UDP transports are both supported for multicast routing. However, the non-UDP transport has no FastPath optimization.

## Configuring a Static Multicast Route

When using PIM, the security appliance expects to receive packets on the same interface where it sends unicast packets back to the source. In some cases, such as bypassing a route that does not support multicast routing, you may want unicast packets to take one path and multicast packets to take another.

Static multicast routes are not advertised or redistributed.

To configure a static multicast route for PIM, enter the following command:

```
hostname(config)# mroute src_ip src_mask {input_if_name | rpf_addr} [distance]
```

To configure a static multicast route for a stub area, enter the following command:

```
hostname(config)# mroute src_ip src_mask input_if_name [dense output_if_name] [distance]
```



### Note

The **dense** *output\_if\_name* keyword and argument pair is only supported for stub multicast routing.

## Configuring PIM Features

Routers use PIM to maintain forwarding tables for forwarding multicast diagrams. When you enable multicast routing on the security appliance, PIM and IGMP are automatically enabled on all interfaces.



### Note

PIM is not supported with PAT. The PIM protocol does not use ports and PAT only works with protocols that use ports.

This section describes how to configure optional PIM settings. This section includes the following topics:

- [Disabling PIM on an Interface, page 11-18](#)
- [Configuring a Static Rendezvous Point Address, page 11-19](#)
- [Configuring the Designated Router Priority, page 11-19](#)
- [Filtering PIM Register Messages, page 11-19](#)
- [Configuring PIM Message Intervals, page 11-20](#)
- [Configuring a Multicast Boundary, page 11-20](#)
- [Filtering PIM Neighbors, page 11-20](#)
- [Supporting Mixed Bidirectional/Sparse-Mode PIM Networks, page 11-21](#)

## Disabling PIM on an Interface

You can disable PIM on specific interfaces. To disable PIM on an interface, enter the following command:

```
hostname(config-if)# no pim
```

To reenable PIM on an interface, enter the following command:

```
hostname(config-if)# pim
```

**Note**

Only the **no pim** command appears in the interface configuration.

## Configuring a Static Rendezvous Point Address

All routers within a common PIM sparse mode or bidir domain require knowledge of the PIM RP address. The address is statically configured using the **pim rp-address** command.

**Note**

The security appliance does not support Auto-RP or PIM BSR; you must use the **pim rp-address** command to specify the RP address.

You can configure the security appliance to serve as RP to more than one group. The group range specified in the access list determines the PIM RP group mapping. If an access list is not specified, then the RP for the group is applied to the entire multicast group range (224.0.0.0/4).

To configure the address of the PIM RP, enter the following command:

```
hostname(config)# pim rp-address ip_address [acl] [bidir]
```

The *ip\_address* argument is the unicast IP address of the router to be a PIM RP. The *acl* argument is the name or number of a standard access list that defines which multicast groups the RP should be used with. Do not use a host ACL with this command. Excluding the **bidir** keyword causes the groups to operate in PIM sparse mode.

**Note**

The security appliance always advertises the bidir capability in the PIM hello messages regardless of the actual bidir configuration.

## Configuring the Designated Router Priority

The DR is responsible for sending PIM register, join, and prune messages to the RP. When there is more than one multicast router on a network segment, there is an election process to select the DR based on DR priority. If multiple devices have the same DR priority, then the device with the highest IP address becomes the DR.

By default, the security appliance has a DR priority of 1. You can change this value by entering the following command:

```
hostname(config-if)# pim dr-priority num
```

The *num* argument can be any number from 1 to 4294967294.

## Filtering PIM Register Messages

You can configure the security appliance to filter PIM register messages. To filter PIM register messages, enter the following command:

```
hostname(config)# pim accept-register {list acl | route-map map-name}
```

## Configuring PIM Message Intervals

Router query messages are used to elect the PIM DR. The PIM DR is responsible for sending router query messages. By default, router query messages are sent every 30 seconds. You can change this value by entering the following command:

```
hostname(config-if)# pim hello-interval seconds
```

Valid values for the *seconds* argument range from 1 to 3600 seconds.

Every 60 seconds, the security appliance sends PIM join/prune messages. To change this value, enter the following command:

```
hostname(config-if)# pim join-prune-interval seconds
```

Valid values for the *seconds* argument range from 10 to 600 seconds.

## Configuring a Multicast Boundary

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

You can set up an administratively scoped boundary on an interface for multicast group addresses using the **multicast boundary** command. IANA has designated the multicast address range 239.0.0.0 to 239.255.255.255 as the administratively scoped addresses. This range of addresses can be reused in domains administered by different organizations. They would be considered local, not globally unique.

To configure a multicast boundary, enter the following command:

```
hostname(config-if)# multicast boundary acl [filter-autorp]
```

A standard ACL defines the range of addresses affected. When a boundary is set up, no multicast data packets are allowed to flow across the boundary from either direction. The boundary allows the same multicast group address to be reused in different administrative domains.

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

## Filtering PIM Neighbors

You can define the routers that can become PIM neighbors with the **pim neighbor-filter** command. By filtering the routers that can become PIM neighbors, you can:

- Prevent unauthorized routers from becoming PIM neighbors.
- Prevent attached stub routers from participating in PIM.

To define the neighbors that can become a PIM neighbor, perform the following steps:



---

**Step 1** Use the **access-list** command to define a standard access list defines the routers you want to participate in PIM.

For example the following access list, when used with the **pim neighbor-filter** command, prevents the 10.1.1.1 router from becoming a PIM neighbor:

```
hostname(config)# access-list pim_nbr deny 10.1.1.1 255.255.255.255
```

**Step 2** Use the **pim neighbor-filter** command on an interface to filter the neighbor routers.

For example, the following commands prevent the 10.1.1.1 router from becoming a PIM neighbor on interface GigabitEthernet0/3:

```
hostname(config)# interface GigabitEthernet0/3  
hostname(config-if)# pim neighbor-filter pim_nbr
```

---

## Supporting Mixed Bidirectional/Sparse-Mode PIM Networks

Bidirectional PIM allows multicast routers to keep reduced state information. All of the multicast routers in a segment must be bidirectionally enabled in order for bidir to elect a DF.

The **pim bidir-neighbor-filter** command enables the transition from a sparse-mode-only network to a bidir network by letting you specify the routers that should participate in DF election while still allowing all routers to participate in the sparse-mode domain. The bidir-enabled routers can elect a DF from among themselves, even when there are non-bidir routers on the segment. Multicast boundaries on the non-bidir routers prevent PIM messages and data from the bidir groups from leaking in or out of the bidir subset cloud.

When the **pim bidir-neighbor-filter** command is enabled, the routers that are permitted by the ACL are considered to be bidir-capable. Therefore:

- If a permitted neighbor does not support bidir, the DF election does not occur.
- If a denied neighbor supports bidir, then DF election does not occur.
- If a denied neighbor does not support bidir, the DF election occurs.

To control which neighbors can participate in the DF election, perform the following steps:

---

**Step 1** Use the **access-list** command to define a standard access list that permits the routers you want to participate in the DF election and denies all others.

For example, the following access list permits the routers at 10.1.1.1 and 10.2.2.2 to participate in the DF election and denies all others:

```
hostname(config)# access-list pim_bidir permit 10.1.1.1 255.255.255.255  
hostname(config)# access-list pim_bidir permit 10.1.1.2 255.255.255.255  
hostname(config)# access-list pim_bidir deny any
```

**Step 2** Enable the **pim bidir-neighbor-filter** command on an interface.

The following example applies the access list created previous step to the interface GigabitEthernet0/3.

```
hostname(config)# interface GigabitEthernet0/3  
hostname(config-if)# pim bidir-neighbor-filter pim_bidir
```

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## For More Information about Multicast Routing

The following RFCs from the IETF provide technical details about the IGMP and multicast routing standards used for implementing the SMR feature:

- RFC 2236 IGMPv2
- RFC 2362 PIM-SM
- RFC 2588 IP Multicast and Firewalls
- RFC 2113 IP Router Alert Option
- IETF draft-ietf-idmr-igmp-proxy-01.txt