Protocol Independent Multicast

Protocol Independent Multicast (PIM) distributes multicast data using routes gathered by other protocols. Arista switches support two types of PIM: PIM Sparse Mode (PIM-SM) and Bidirectional PIM (Bidir-PIM).

These sections describe the Arista PIM implementation:

- Section 40.1: Introduction
- Section 40.2: Overview
- Section 40.3: Configuring PIM
- Section 40.4: Multicast Example
- Section 40.5: PIM Commands

40.1 Introduction

Protocol Independent Multicast (PIM) distributes multicast data using routes gathered by other protocols. PIM Sparse Mode (PIM-SM), defined in RFC 4601, is a multicast routing protocol intended for networks where multicast group recipients are sparsely distributed, including wide-area and inter-domain networks. Bidirectional PIM (Bidir-PIM), defined in RFC 5015, is a variant of PIM-SM designed for cases in which the receivers of multicast traffic are also sources and where scalability could affect optimization.

Arista switches support both PIM Sparse-Mode (PIM-SM) and Bidirectional PIM (Bidir-PIM).
40.2 Overview

PIM builds and maintains multicast routing trees using reverse path forwarding (RPF) on a unicast routing table. PIM is protocol-independent, and can use routing tables consisting of OSPF, BGP, RIP, and static routes. All sources send traffic to multicast groups through shared trees that have a common root node called the rendezvous point (RP).

PIM uses a multicast routing information base (MRIB) that is populated from the unicast table. The MRIB provides the next-hop router for each multicast destination subnet. This determines the next-hop neighbor for sending PIM join or prune messages.

40.2.1 PIM Sparse Mode

In PIM-SM, each host (sender or receiver) is associated with a designated router (DR) that acts for all directly connected hosts in PIM-SM transactions, and trees are unidirectional. Once sufficient traffic is flowing on a route it usually does not pass through the RP.

PIM-SM establishes multicast routes through three phases:

- Establishing the RP Tree
- Eliminating Encapsulation
- Establishing the Shortest Path Tree (SPT)

40.2.1.1 Establishing the RP Tree (Phase 1)

The RP tree is a distribution network that all sources share to deliver multicast data. The root of the RP tree is the Rendezvous Point.

The process starts when a receiver requests multicast data from a group (G). The receiver’s DR sends a PIM (*,G) Join message toward the multicast group’s RP. As the message travels towards the RP, it instantiates the multicast (*,G) state in each router on the path. Join messages converge on the RP to form the RP tree.

The DR resends Join messages periodically, while it has a receiver in the group, to prevent state timeout expiry in the routers along the path. When all receivers on a DR’s subnet leave a group, the DR sends a (*,G) Prune message towards the RP to remove the state from the routers.

A multicast sender transmits multicast data to the RP through its DR. The DR encapsulates the multicast packets and sends them as unicast packets. The RP extracts the native multicast packet and sends it to the RP tree towards the group members.

40.2.1.2 Eliminating Multicast Encapsulation (Phase 2)

Data encapsulation, while initially required before the multicast path is established, is inefficient because it requires the transmission of data that is extraneous to multicast. Phase 2 establishes states in the routers that support the transmission of native multicast packets.

When the RP receives an encapsulated packet from source S on group G, it sends an (S,G) join message toward the source. As the message travels towards S, it instantiates the (S,G) state on each router in the path which is used to forward packets from source S destined for group G. Data packets on the (S,G) path are also routed into the RP tree when they encounter an (*,G) router.

When the RP starts receiving native packets from the sources, it sends a Register-Stop message to the source’s DR, halting packet encapsulation. At this time, traffic flows natively from the source along a source-specific tree to the RP, then along the shared RP tree to the receivers.
40.2.1.3 Establishing the Shortest Path Tree (Phase 3)

The third phase establishes the shortest path from the multicast source to all receivers. When a multicast packet arrives at the receiver, its router (typically the DR) sends a Join message towards the source to instantiate the (S,G) state in all routers along its path. The message eventually reaches either the source’s subnet or a router that already has an (S,G) state. This causes data to flow from the source to the receiver following the (S,G) path. At this time, the receiver is receiving data from the shortest path tree (SPT) and the RP tree (RPT).

The DR (or upstream router) eliminates the data transmission along the RPT by sending a prune message (S,G,rpt) towards the RP. The message instantiates the state on each router in the path, continuing until it reaches the RP or a router that needs traffic from the same source for other receivers.

40.2.2 Bidirectional PIM

Bidirectional PIM (Bidir-PIM) builds shared trees, rooted at the rendezvous point (RP), for each multicast group. Because the trees are based only on (*,G) routes, they can accommodate a much larger number of sources without overfilling the MFIB.

In Bidir-PIM, there is no multicast encapsulation or SPT establishment. All packets are natively forwarded toward the RP along shared, bidirectional trees. There are also no designated routers. Instead, a single designated forwarder (DF) is elected on each link to each RP, usually during the RP discovery process. The DF is the router with the shortest route to the RP based on the unicast routing table. It is responsible for forwarding upstream traffic to the RP and forwarding downstream traffic toward the groups on its link. All routes pass through the RP, and multicast packets are sent from sources toward the RP and to receivers at each hop along the route.

Bidir-PIM elects DFs when a new RP is discovered, when the DF fails, or when there is a change that affects the topology of the link.

40.2.3 Rendezvous Points (RP)

In PIM-SM, an RP is a router that is configured as the root of multicast group’s distribution tree. These distribution trees are not source-specific. The RP is the destination for both join messages from receivers and data from senders, allowing receivers discover sender identity and begin receiving group traffic. In PIM-SM, paths through RP routers are temporary; when traffic volume reaches a sufficient level, the receiver joins a source-specific tree and the path through the RP is dropped. In Bidir-PIM, all paths pass through the RP, and all packets destined for a given multicast group are forwarded to the RP for that group.

RP addresses in Bidir-PIM must be routable from all sources in the domain, but do not have to correspond to any specific physical interface. Multiple groups can use the same RP for distribution.

The switch supports two methods of mapping RPs to multicast groups:

- **Static**: RPs are statically configured through a CLI statement.
- **Dynamic**: RPs are dynamically selected by a bootstrap router from a set of candidate RPs.

While dynamic RP mappings have priority over static maps by default, a static RP can be configured to override dynamic mappings.

Section 40.3.4 describes the configuration of rendezvous points.
40.3 Configuring PIM

This section describes the following configuration tasks:

- Section 40.3.1: Enabling PIM Sparse Mode
- Section 40.3.2: Enabling the S, G Expiry Timer Interval
- Section 40.3.3: Enabling PIM Bidirectional
- Section 40.3.4: Rendezvous Points (RPs)
- Section 40.3.5: Hello Messages
- Section 40.3.6: Hello Hold Time
- Section 40.3.7: Designated Router Election
- Section 40.3.8: Designated Forwarder Election
- Section 40.3.9: Join-Prune Messages
- Section 40.3.10: Legacy PIM Configuration in Global Configuration Mode
- Section 40.3.11: Configuring PIM in a Non-default VRF

40.3.1 Enabling PIM Sparse Mode

By default, PIM is disabled on an interface. The `pim ipv4 sparse-mode` command enables PIM Sparse Mode (PIM-SM) on the configuration mode interface. Enabling PIM on an interface enables IGMP on the interface as well.

**Example**

- This command enables PIM-SM and IGMP on VLAN interface 8.
  
  ```
  switch(config)#interface vlan 8
  switch(config-if-Vl8)#pim IPv4 sparse-mode
  switch(config-if-Vl8)#
  ```

40.3.2 Enabling the S, G Expiry Timer Interval

The `sg-expiry-timer` command enables expiry timer interval for the PIM-SM multicast routes. By default, the `sg-expiry-timer` command applies to the default VRF when the command is issued in the Router-Multicast Configuration mode. During the time of interval, there is no multicast traffic activity on the route.

**Example**

- This command configures 150 seconds as the (S,G) expiry timer interval in the default VRF.
  
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#sg-expiry-timer 150
  switch(config-router-pim-sparse-ipv4)#
  ```

40.3.3 Enabling PIM Bidirectional

By default, PIM is disabled on an interface. The `pim ipv4 bidirectional` command enables Bidirectional PIM (Bidir-PIM) on the configuration mode interface. Enabling PIM on an interface also enables IGMP on that interface.
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Configuring PIM

Example

- These commands enable Bidir-PIM and IGMP on VLAN interface 9.

```
switch(config)#interface vlan 9
switch(config-if-Vl9)#pim ipv4 bidirectional
```

40.3.4 Rendezvous Points (RPs)

The switch supports dynamic RPs, static RPs, and anycast RPs.

Configuring Static RPs

The `rp address` command configures a static RP, providing an option to override dynamic RPs.

Examples

- This command creates a static RP at 10.17.255.83 in the default VRF that maps to all multicast groups (224/4) and overrides dynamic RPs.

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#rp address 10.17.255.83 override
```

- This command creates a static RP at 10.21.18.23 in the default VRF that maps to the multicast groups at 238.1.12.0/24.

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#rp address 10.21.18.23 238.1.12.0/24
```

Configuring Dynamic RPs

Dynamic RP selection is implemented through a bootstrap router (BSR), which is a PIM router within the PIM domain that selects RPs from a list of candidates. A subset of PIM routers within the domain are configured as candidate bootstrap routers (C-BSRs). Through the exchange of bootstrap messages (BSMs), the C-BSRs elect the BSR, which then uses BSMs to inform all domain routers of its status.

The BSR holdtime defines the timeout period that an elected BSR remains valid after the receipt of a BSM and is also used in dynamic RP configuration. Holdtime is designated by the BSR router and communicated to other routers through BSMs.

Another subset of domain PIM routers are configured as candidate RPs (C-RPs). The BSR creates a set of qualifying RPs from the list of C-RPs, then distributes the group-to RP mapping set to all domain routers through BSMs. Each PIM router, after receiving this set, uses a standard algorithm defined in RFC 6226 to select one RP per multicast group.

The `candidate` command configures the switch as a candidate BSR router (C-BSR). Command parameters specify the switch’s BSR address, the interval between BSM transmissions, and the switch’s BSR priority rating. Priority ratings range from 0 to 255 with a default of 64. Higher numbers denote higher priority during BSR elections.
Example

- These commands configure the switch as a BSR candidate in the default VRF, using the IP address assigned to VLAN interface 24 as its BSR address. The BSM transmission interval is set to 30 seconds and the priority is set to 192.

```
switch(config)#router pim bsr
switch(config-router-pim-bsr)#ipv4
switch(config-router-pim-bsr-ipv4)#candidate vlan 24 priority 192 interval 30
switch(config-router-pim-bsr-ipv4)#
```

The `holdtime` command specifies the value the switch inserts in the `holdtime` field of bootstrap messages (BSMs) that it sends. This value becomes the holdtime for the PIM domain if the switch is elected as the BSR.

Example

- These commands specify 75 seconds as the value that the switch inserts into BSM holdtime fields in the default VRF.

```
switch(config)#router pim bsr
switch(config-router-pim-bsr)#ipv4
switch(config-router-pim-bsr-ipv4)#holdtime 75
switch(config-router-pim-bsr-ipv4)#
```

The `rp candidate` command configures the switch as a candidate rendezvous point (C-RP). The BSR selects a multicast group’s dynamic RP set from the list of C-RPs. Command parameters specify the switch’s RP address, C-RP advertisement interval, and priority rating. The priority rating is used by the BSR when selecting RPs. The C-RP advertisement interval specifies the period between successive C-RP advertisement message transmissions to the BSR.

**Running-config** may contain multiple `rp candidate` statements to support multiple multicast groups:

- All commands must specify the same interface. Issuing a command with an interface that differs from existing commands removes all existing commands from **running-config**.
- **Running-config** stores the `interval` setting in a separate statement that applies to all `rp candidate` statements. Commands that specify an interval that differs from the previously configured value place the new value in **running-config**. This new value applies to all `rp candidate` statements.

Example

- These commands configure a switch as a candidate RP for the multicast group 235.1.1.0/24, with a priority of 48 and a RP advertisement interval of 45 seconds, in the default VRF.

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#rp candidate vlan 24 235.1.1.0/24 priority 48 interval 45
switch(config-router-pim-sparse-ipv4)#
```

By default, the switch transmits bootstrap router messages (BSMs) over all PIM-enabled interfaces. The `pim bsr ipv4 border` command prevents the switch from transmitting BSMs over the configuration mode interface.

Example

- This command prevents the switch from sending BSMs from VLAN interface 10

```
switch(config)#interface vlan 10
switch(config-if-Vl10)#pim bsr ipv4 border
switch(config-if-Vl10)#
```
**Anycast Rendezvous Points**

A PIM anycast rendezvous point (anycast RP) defines a single RP address that exists on multiple devices. An anycast-RP set consists of the routers configured with the same anycast-RP address. An anycast RP provides redundancy protection and load balancing. The anycast-RP set supports all multicast groups.

The `anycast-rp` command configures the switch as a member of an anycast-RP set and establishes a communication link with another member of the set.

**Example**

- These commands configure a switch (IP address 10.1.1.14) into an anycast-RP set with an RP address of 10.17.255.2 in the default VRF. The anycast-RP set contains three other routers, located at 10.1.2.14, 10.1.3.14, and 10.1.4.14. It sets the number of unacknowledged register messages it sends to each router at 15.

  ```plaintext
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.1.14
  register-count 15
  switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.2.14
  register-count 15
  switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.3.14
  register-count 15
  switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.4.14
  register-count 15
  switch(config-router-pim-sparse-ipv4)#
  ```

**40.3.5 Hello Messages**

PIM-SM multicast routers send PIM router query messages (hello messages) to elect a designated router (DR) for each subnet. The DR then sends registration messages to the RP.

The `pim ipv4 hello interval` command specifies the transmission interval between PIM hello messages originating from the specified VLAN interface.

**Example**

- This command configures 45 second intervals between hello messages originating from VLAN interface 4.

  ```plaintext
  switch(config)#interface vlan 4
  switch(config-if-Vl4)#pim ipv4 hello interval 45
  switch(config-if-Vl4)#
  ```

**40.3.6 Hello Hold Time**

A PIM interface maintains a hold timer for each of its neighbors. The timer is reset whenever a hello message is received from the neighbor. When the timer expires, the neighbor is considered DOWN. The PIM interface can advertise its neighbor to use a higher hold time by modifying the hello interval, or by setting a higher hello count using the `pim ipv4 hello count` command. The hello count specifies how many hello messages can be missed before the neighbor is considered down; the hold time is therefore the hello interval multiplied by the hello count.
Example

- This command configures the PIM hold time on VLAN 2925 to 225 seconds (7.5 times the 30-second hello interval).

  ```
  switch(config)#interface vlan2925
  switch(config-if-Vl2925)#ip pim query-count 7.5
  ```

- This command displays the hold time on VLAN 2925.

  ```
  switch#show ip pim interface vlan2925 details
  Interface Vlan2925 address is 1.0.1.1
  Vif number is 0
  PIM: enabled
  PIM version: 2, mode: sparse
  PIM neighbor count: 0
  PIM Effective DR: 1.0.1.1 (this system)
  PIM Effective DR Priority: 1
  PIM Effective Propagation Delay: 500 milliseconds
  PIM Effective Override Interval: 2500 milliseconds
  PIM Effective Tracking Support: disabled
  PIM Hello Interval: 30 seconds
  PIM Hello Hold Time: 225 seconds <= New Hold Time ( = 7.5 * 30 )
  PIM Hello Priority: 1 seconds
  PIM Hello Lan Delay: 500 milliseconds
  PIM Assert Override Interval: 3 seconds
  ```

40.3.7 Designated Router Election

PIM-SM uses these criteria for electing a designated router (DR):

- If at least one router does not advertise a DR priority value, then PIM-SM elects the router with the highest IP address as the DR.

- If all routers advertise a DR priority value, then PIM-SM elects the router with the highest DR priority value as the DR.

The `group-expiry-timer` command sets the DR priority value that the switch advertises. If `running-config` does not contain a `pim ipv4 dr-priority` statement, the switch does not advertise a DR priority value.

Examples

- This command configures a DR priority value of 15 on VLAN interface 4.

  ```
  switch(config-if-Vl4)#pim ipv4 dr-priority 15
  switch(config-if-Vl4)#
  ```

- This command removes the DR priority from VLAN interface 4.

  ```
  switch(config-if-Vl4)#no pim ipv4 dr-priority
  switch(config-if-Vl4)#
  ```

40.3.8 Designated Forwarder Election

Designated forwarders (DFs) are elected based on route metrics in the unicast routing table; there are no configuration options that affect the selection of DFs.
40.3.9 Join-Prune Messages

Join/prune messages are sent by the PIM-SM designated router (DR) or the Bidir-PIM designated forwarder (DF) toward the rendezvous point (RP). These messages inform other PIM routers about clients that want to become receivers (join) or stop being receivers (prune) for the groups.

The `pim ipv4 join-prune interval` command specifies the period between join/prune messages that the switch originates from the specified VLAN interface and sends to the upstream RPF neighbor.

**Example**
- This command configures 75 second intervals between join/prune messages originating from VLAN interface 4.
  ```
  switch(config-if-Vl4)#pim ipv4 join-prune interval 75
  switch(config-if-Vl4)#
  ```

40.3.10 Legacy PIM Configuration in Global Configuration Mode

Earlier versions of the EOS managed all non-interface-specific PIM configuration from Global Configuration Mode. Legacy configurations retain these global commands in `running-config` after upgrading to a newer version of the EOS, and the configurations are applied unchanged to the default VRF. PIM configuration commands entered in Global Configuration Mode which can be applied to either PIM-SM or Bidir-PIM will be applied to PIM-SM. If any commands are added to `running-config` using the new configuration modes, all legacy commands will be converted to the new modal commands and applied in the default VRF.

**Note**
- Multicast configuration commands issued in Global Configuration Mode are now deprecated, and Arista recommends configuring all multicast parameters in the appropriate configuration mode (i.e., Router-Multicast Configuration, Router-PIM Sparse-mode Configuration, Router-PIM Bidirectional Configuration, Router-PIM BSR Configuration, or Router-MSDP Configuration).

40.3.11 Configuring PIM in a Non-default VRF

For PIM to function in a non-default VRF, the VRF must be created and configured for multicast traffic, and routed ports must be added to the VRF. Once this is accomplished, configure VRF-global PIM parameters by using the `vrf` command within a PIM configuration mode to place the switch in a PIM VRF configuration submode.

Interface-specific PIM parameters are configured in the interface-configuration mode for VRF-member interface.

Legacy multicast routing commands issued in Global Configuration Mode are applied to the default VRF, but are now deprecated and are available only for backward compatibility. If any PIM commands are issued in the new format, all legacy commands remaining in `running-config` will be replaced with their updated equivalents and applied to the default VRF.

40.3.11.1 Preparing the VRF for PIM Configuration

The following steps prepare a non-default VRF to use PIM:

**Step 1** Enable unicast routing in the default VRF.
  ```
  switch(config)#ip routing vrf default
  ```

**Step 2** Create the non-default VRF if not already created.
  ```
  switch(config)#vrf instance purple
  ```
**Step 3**  Enable unicast routing on the new VRF.

```
switch(config-vrf-purple)#exit
switch(config)#ip routing vrf purple
```

**Step 4**  Add participating routed ports to the new VRF.

```
switch(config)#interface ethernet 9/2-9/4
switch(config-if-Et9/2-4)#no switchport
switch(config-if-Et9/2-4)#vrf purple
switch(config-if-Et9/2-4)#exit
```

**Step 5**  Enable multicast routing on the new VRF.

```
switch(config)#router multicast
switch(config-router-multicast)#vrf purple
switch(config-router-multicast-vrf-purple)#ip multicast routing
```

### 40.3.11.2 Configuring Global PIM Parameters in a Non-default VRF

Global PIM parameters for non-default VRFs are configured in the VRF submode of the appropriate PIM configuration mode.

**Examples**

- These commands configure a switch as a candidate RP for the multicast group 235.1.1.0/24, with a priority of 48 and a RP advertisement interval of 45 seconds, in VRF “purple.”

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#vrf purple
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-vrf-purple-ipv4)#rp candidate vlan 24 235.1.1.0/24 priority 48 interval 45
switch(config-router-pim-sparse-vrf-purple-ipv4)#
```

### 40.3.11.3 Configuring Interface-specific PIM Parameters in a Non-default VRF

Interface-specific PIM parameters for member interfaces of a non-default VRF are configured just as they are for the default VRF: in the interface-configuration mode for the interface.
40.4 Multicast Example

This section provides an example network that implements multicast (PIM-SM) in the default VRF and includes the required commands.

40.4.1 Diagram

Figure 40-1 displays the multicast network example. The network contains four routers. Multicast routing (PIM-SM) is enabled on two switches. One switch has its IGMP Snooping Querier enabled.

The example multicast network implements these multicast parameters:

**Rendezvous Point Address:** 10.25.10.15

**Switch Clara**
- IGMP Snooping: disabled
- Subnet Summary:
  - 10.40.10.0/24: VLAN 11
  - 10.15.10.0/24: VLAN 12
  - 10.15.11.0/24: VLAN 13
  - 10.15.12.0/24: VLAN 14
  - 10.5.1.0/20: VLAN 10

**Switch Mateo**
- IGMP Snooping: disabled
- Subnet Summary:
  - 10.20.13.0/24: VLAN 18
  - 10.20.10.0/24: VLAN 15
  - 10.20.11.0/24: VLAN 16
- 10.20.12.0/24: VLAN 17
- 10.15.10.0/24: VLAN 12
- 10.15.11.0/24: VLAN 13
- 10.15.12.0/24: VLAN 14
- 10.25.10.12/30: VLAN 19
- 10.5.1.0/20: VLAN 10

**Switch Allie**
- IGMP Snooping: enabled
- Multicast Routing: enabled
- Querier: enabled
- Rendezvous Point Address: 10.25.10.15
- MFIB activity polling interval: 5 second
- Subnet Summary:
  - 10.30.13.0/24: VLAN 23
  - 10.30.10.0/24: VLAN 20 – PIM-SM enabled
  - 10.30.11.0/24: VLAN 21 – PIM-SM enabled
  - 10.30.12.0/24: VLAN 22
  - 10.25.10.12/30: VLAN 19
  - 10.35.10.0/30: VLAN 24 – PIM-SM enabled
  - 10.5.1.0/20: VLAN 10 – PIM-SM enabled

**Switch Francis**
- IGMP Snooping: enabled
- Multicast Routing: enabled
- Subnet Summary:
  - 10.40.10.0/24: VLAN 25 – PIM-SM enabled
  - 10.35.10.0/30: VLAN 24 – PIM-SM enabled
  - 10.5.1.0/20: VLAN 10
40.4.2 Example

This example configures PIM-SM.

Step 1 Configure the interface addresses

a Router Clara interfaces

Clara(config)#interface vlan 11
Clara(config-if-vl11)#ip address 10.40.10.1/24
Clara(config-if-vl11)#interface vlan 12
Clara(config-if-vl12)#ip address 10.15.10.42/24
Clara(config-if-vl12)#interface vlan 13
Clara(config-if-vl13)#ip address 10.15.11.21/24
Clara(config-if-vl13)#interface vlan 14
Clara(config-if-vl14)#ip address 10.15.12.50/24
Clara(config-if-vl14)#interface vlan 10
Clara(config-if-vl10)#ip address 10.5.1.33/20
Clara(config-if-vl10)#router ospf 1
Clara(config-router-ospf)#redistribute static

b Router Mateo interfaces

Mateo(config)#interface vlan 18
Mateo(config-if-vl18)#ip address 10.20.13.1/24
Mateo(config-if-vl18)#interface vlan 15
Mateo(config-if-vl15)#ip address 10.20.10.1/24
Mateo(config-if-vl15)#interface vlan 16
Mateo(config-if-vl16)#ip address 10.20.11.1/24
Mateo(config-if-vl16)#interface vlan 17
Mateo(config-if-vl17)#ip address 10.20.12.16/24
Mateo(config-if-vl17)#interface vlan 12
Mateo(config-if-vl12)#ip address 10.15.10.41/24
Mateo(config-if-vl12)#interface vlan 13
Mateo(config-if-vl13)#ip address 10.15.11.17/24
Mateo(config-if-vl13)#interface vlan 14
Mateo(config-if-vl14)#ip address 10.15.12.49/24
Mateo(config-if-vl14)#interface vlan 19
Mateo(config-if-vl19)#ip address 10.25.10.13/30
Mateo(config-if-vl19)#interface vlan 10
Mateo(config-if-vl10)#ip address 10.5.1.1/20
Mateo(config-if-vl10)#router ospf 1
Mateo(config-router-ospf)#redistribute static

c Router Allie interfaces

Allie(config)#interface vlan 23
Allie(config-if-vl23)#ip address 10.30.13.34/24
Allie(config-if-vl23)#interface vlan 20
Allie(config-if-vl20)#ip address 10.30.10.1/24
Allie(config-if-vl20)#interface vlan 21
Allie(config-if-vl21)#ip address 10.30.11.25/24
Allie(config-if-vl21)#interface vlan 22
Allie(config-if-vl22)#ip address 10.30.12.254/24
Allie(config-if-vl22)#interface vlan 19
Allie(config-if-vl19)#ip address 10.25.10.14/30
Allie(config-if-vl19)#interface vlan 24
Allie(config-if-vl24)#ip address 10.35.10.29/30
Allie(config-if-vl24)#interface vlan 10
Allie(config-if-vl10)#ip address 10.5.1.1/20
Allie(config-if-vl10)#router ospf 1
Allie(config-router-ospf)#redistribute static
Step 2 Configure the interface multicast parameters

a Router Allie interfaces

```
Allie(config-router-ospf)#interface vlan 20
Allie(config-if-vl20)#pim ipv4 sparse-mode
Allie(config-if-vl20)#interface vlan 21
Allie(config-if-vl21)#pim ipv4 sparse-mode
Allie(config-if-vl21)#interface vlan 24
Allie(config-if-vl24)#pim ipv4 sparse-mode
Allie(config-if-vl24)#interface vlan 10
Allie(config-if-vl10)#pim ipv4 sparse-mode
```

b Router Francis interfaces

```
Francis(config-router-ospf)#interface vlan 25
Francis(config-if-vl25)#pim ipv4 sparse-mode
Francis(config-if-vl25)#interface vlan 24
Francis(config-if-vl24)#pim ipv4 sparse-mode
```

Step 3 Configure the router multicast parameters

a Router Clara parameters

```
Clara(config-router-ospf)#exit
Clara(config)#no ip igmp snooping
```

b Router Mateo router

```
Mateo(config-router-ospf)#exit
Mateo(config)#no ip igmp snooping
```

c Router Allie router

```
Allie(config-if-vl10)#exit
Allie(config)#router multicast
Allie(config-router-multicast)#ipv4
Allie(config-router-multicast-ipv4)#routing
Allie(config-router-multicast-ipv4)#activity polling-interval 5
Allie(config-router-multicast-ipv4)#router pim sparse-mode
Allie(config-router-pim-sparse-ipv4)#ipv4
Allie(config-router-pim-sparse-ipv4)#rp address 10.25.10.15
```

d Router Francis router

```
Francis(config-if-vl24)#exit
Francis(config)#router multicast
Francis(config-router-multicast)#ipv4
Francis(config-router-multicast-ipv4)#routing
Francis(config-router-multicast-ipv4)#router pim sparse-mode
Francis(config-router-pim-sparse-ipv4)#ipv4
Francis(config-router-pim-sparse-ipv4)#rp address 10.25.10.15
```
40.5 PIM Commands

PIM Configuration Commands (Global)

- anycast-rp
- candidate
- group-expiry-timer
- holdtime
- ip pim dr-notify-delay
- log neighbors
- register local-interface
- router pim bidirectional
- router pim bsr
- router pim sparse-mode
- rp address
- rp candidate
- rp hash algorithm modulo
- sg-expiry-timer
- spt threshold
- ssm range

PIM Configuration Commands (Interface)

- ipv4
- pim bsr ipv4 border
- pim ipv4 bidirectional
- pim ipv4 border-router
- pim ipv4 dr-priority
- pim ipv4 hello count
- pim ipv4 hello interval
- pim ipv4 join-prune interval
- pim ipv4 neighbor-filter
- pim ipv4 sparse-mode

PIM Display Commands

- show ip pim bsr
- show ip pim config-sanity
- show ip pim interface
- show ip pim neighbor
- show ip pim protocol counters
- show ip pim register-source
- show ip pim rp
- show ip pim rp-candidate
- show ip pim rp-hash
- show ip pim upstream joins
anycast-rp

The **anycast-rp** command configures the switch as a member of an anycast-RP set and establishes a communication link with another member of the set.

When the command is issued in Router-Multicast IPv4 Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-Multicast VRF IPv4 Configuration Mode.

The **no anycast-rp** and **default anycast-rp** commands remove the corresponding **anycast-rp** command from **running-config**. When the **no** and **default** commands do not include a peer address, all commands for the specified RP address are removed.

**Command Mode**
- Router-Multicast IPv4 Configuration
- Router-Multicast VRF IPv4 Configuration

**Command Syntax**

```
anycast-rp rp_addr peer_addr [REGISTER]
no anycast-rp rp_addr [peer_addr]
default anycast-rp rp_addr [peer_addr]
```

**Parameters**
- **rp_addr**  Rendezvous point IP address (dotted decimal notation).
- **peer_addr**  IP address of another anycast-RP set member (dotted decimal notation).
- **REGISTER**  Number of unacknowledged register messages the switch sends to the peer router.
  - <no parameter>  register count is set to default value of 10.
  - **register-count r_num**  where *r_num* is an integer that ranges from 1 to 4294967295.
  - **register-count infinity**

**Example**
- These commands configure a switch (IP address 10.1.1.14) into an anycast-RP set with an RP address of 10.17.255.2 in the default VRF. The anycast-RP set contains three other routers, located at 10.1.2.14, 10.1.3.14, and 10.1.4.14. It sets the number of unacknowledged register messages it sends to each router at 15.

```
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.1.14
    register-count 15
switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.2.14
    register-count 15
switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.3.14
    register-count 15
switch(config-router-pim-sparse-ipv4)#anycast-rp 10.17.255.2 10.1.4.14
    register-count 15
switch(config-router-pim-sparse-ipv4)#
```
**pim ipv4 bidirectional**

The **pim ipv4 bidirectional** command enables PIM bidirectional and IGMP (router mode) on the configuration mode interface.

**Important!** PIM and multicast border router (MBR) must be mutually exclusive on an interface. If the interface is configured as an MBR, do not enable PIM on the interface.

The **no pim ipv4 bidirectional**, **no pim ipv4**, **default pim ipv4 bidirectional**, and **default pim ipv4** commands restore the default PIM and IGMP (router mode) settings of **disabled** on the configuration mode interface by removing the **pim ipv4 bidirectional** statement from **running-config**.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- **pim ipv4 bidirectional**
- **no pim ipv4**
- **no pim ipv4 bidirectional**
- **default pim ipv4**
- **default pim ipv4 bidirectional**

**Example**
- This command enables PIM bidirectional on VLAN 4 interface.

```bash
switch(config)#interface vlan 4
switch(config-if-Vl4)#pim ipv4 bidirectional
switch(config-if-Vl4)#
```
**pim ipv4 border-router**

The **pim ipv4 border-router** command configures the configuration mode interface as a PIM multicast border router (MBR). A PIM MBR interface allows multicast traffic from sources that are outside of the PIM domain.

This command does not control the transmission or reception of PIM protocol packets by the interface. Sources learned through an MBR interface are treated as local sources (directly connected to the switch). The border-bit is set in all PIM register messages sent for these sources.

**Important!** Configuration as an MBR and configuration in PIM sparse mode must be mutually exclusive. Ensure that PIM sparse mode is not configured by issuing the **no pim ipv4 sparse-mode** command on the interface before issuing this command.

The **no pim ipv4 border-router** and **default pim ipv4 border-router** commands removes the PIM MBR configuration for the configuration mode interface by removing the corresponding **pim ipv4 border-router** statement from **running-config**.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `pim ipv4 border-router`
- `no pim ipv4 border-router`
- `default pim ipv4 border-router`

**Example**

- These commands configure VLAN interface 200 as a PIM MBR, then display its status.

  ```
  switch(config)#interface vlan 200
  switch(config-if-VL200)#ip address 10.44.2.1/24
  switch(config-if-VL200)#no pim ipv4 sparse-mode
  switch(config-if-VL200)#pim ipv4 border-router
  switch(config-if-VL200)#show active
  interface Vlan200
    ip address 10.44.2.1/24
    pim ipv4 border-router
  switch(config-if-VL200)#exit
  switch(config)#show ip pim interface
  Address     Interface   Mode    Neighbor   Hello DR   DR Address    PktsQed  PktsDropped
  Count       Intvl Pri
  10.44.2.1 Vlan200     mbr     0          30    1    10.44.2.1   0        0
  ```

  ```
  switch(config)#
  ```
**pim bsr ipv4 border**

The `pim bsr ipv4 border` command prevents the switch from sending bootstrap router messages (BSMs) over the configuration mode interface. By default, BSMs are transmitted over all PIM-enabled interfaces.

The `no pim bsr ipv4 border` and `default pim bsr ipv4 border` commands restore the transmission of BSMs over the configuration mode interface by removing the corresponding `pim bsr ipv4 border` statement from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**
- `pim bsr ipv4 border`
- `no pim bsr ipv4 border`
- `default pim bsr ipv4 border`

**Example**
- This command prevents the switch from sending BSMs from VLAN interface 10.
  ```
  switch(config)#interface vlan 10
  switch(config-if-Vl10)#pim bsr ipv4 border
  switch(config-if-Vl10)#
  ```
candidate

The candidate command configures the switch as a candidate BSR router (C-BSR). A BSR is a PIM router within the PIM domain through which dynamic RP selection is implemented. The BSR selects RPs from a list of candidate RPs and exchange bootstrap messages (BSM) with all routers in the domain. The BSR is elected from one of the C-BSRs through an exchange of BSMs.

A subset of PIM routers within the domain are configured as candidate bootstrap routers (C-BSRs). Through the exchange of bootstrap messages (BSMs), the C-BSRs elect the BSR, which then uses BSMs to inform all domain routers of its status.

Command parameters specify the switch’s BSR address, the interval between BSM transmissions, the length of the hash mask, and the priority assigned to the switch when electing a BSR.

Entering an candidate command replaces any previously configured candidate command. If the new command does not specify a priority, hash mask length, or interval, the previously configured values persist in running-config.

When the command is issued in Router-PIM BSR IPv4 Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-PIM BSR VRF IPv4 Configuration Mode for the appropriate VRF.

The no candidate and default candidate commands remove the corresponding candidate commands from running-config. The no and default commands restore the priority, hash mask length, and interval parameters to their default values.

Command Mode
Router-PIM BSR IPv4 Configuration
Router-PIM BSR VRF IPv4 Configuration

Command Syntax
candidate INTERFACE [HASHMASK_LENGTH] [INTERVAL_PERIOD] [PRIORITY_NUM]
no candidate [priority] [interval]
default candidate [priority] [interval]

Parameters
- **INTERFACE**  Switch uses IP address of specified interface as its BSR address. Options include:
  - ethernet e_num  Ethernet interface specified by e_num.
  - loopback l_num  Loopback interface specified by l_num.
  - management m_num  Management interface specified by m_num.
  - port-channel p_num  Port-Channel Interface specified by p_num.
  - vlan v_num  VLAN interface specified by v_num.
- **HASHMASK_LENGTH**  Length (in bits) of the hash mask.
  - <no parameter>  hash mask remains unchanged from previous setting.
  - hashmask <0 - 32>  hash mask length (in bits). Default value is 30.
- **INTERVAL_PERIOD**  Period between the transmission of BSMs (seconds). Default value is 60.
  - <no parameter>  interval remains unchanged from previous setting.
  - interval <10 - 536870906>  transmission interval in seconds.
- **PRIORITY_NUM**  BSR election priority rating. Larger numbers denote higher priority. Default value is 64.
  - <no parameter>  priority remains unchanged from previous setting.
  - priority <0 - 255>  priority rating.
Example

- These commands configure the switch as a BSR candidate in the default VRF, using the IP address assigned to VLAN interface 24 as its BSR address. The BSM transmission interval is set to 30 seconds and the priority is set to 192.

  switch(config)#router pim bsr
  switch(config-router-pim-bsr)#ipv4
  switch(config-router-pim-bsr-ipv4)#candidate vlan 24 priority 192 interval 30
  switch(config-router-pim-bsr-ipv4)#
holdtime

The **holdtime** command specifies the value the switch inserts in the *holdtime* parameter field in bootstrap messages (BSM) that it sends. The BSR *holdtime* defines the timeout period that an elected BSR remains valid after the receipt of a BSM and is also used in dynamic RP configuration. BSR *holdtime* is designated by the BSR router and communicating to other routers through BSMS.

When the command is issued in Router-PIM BSR IPv4 Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-PIM BSR VRF IPv4 Configuration Mode for the appropriate VRF.

The **no holdtime** and **default holdtime** commands restore the default holdtime parameter field insertion value of 130 seconds by removing the **holdtime** statement from **running-config**.

**Command Mode**
- Router-PIM BSR IPv4 Configuration
- Router-PIM BSR VRF IPv4 Configuration

**Command Syntax**

```
holdtime period
no holdtime
default holdtime
```

**Parameters**
- **period**  BSR *holdtime* (seconds). Value ranges from 12 to 1073741823 (1.073 billion seconds, approximately 34 years). Default is 130.

**Example**
- These commands specify 75 seconds as the value that the switch inserts into BSM *holdtime* fields in the default VRF.

```
switch(config)#router pim bsr
switch(config-router-pim-bsr)#ipv4
switch(config-router-pim-bsr-ipv4)#holdtime 75
switch(config-router-pim-bsr-ipv4)#
```
**ip pim dr-notify-delay**

The **ip pim dr-notify-delay** command configures the designated router’s (DR) notification delay time. The command is more effective when all PIM routers on the LAN segment have PIM DR priority that is greater than 1.

When the command is issued in Router-Multicast Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-Multicast VRF Configuration Mode.

The **no ip pim dr-notify-delay** command removes the previously configured DR notification delay time.

**Command Mode**
- Router-Multicast Configuration
- Router-Multicast VRF Configuration

**Command Syntax**

```
ip pim dr-notify-delay notify_delay_time
no ip pim dr-notify-delay
```

**Parameters**
- `notify_delay_time` the PIM-designated router notify delay time in seconds. The value ranges from -32767 to 32768.

**Guidelines**

The notification delay time is configured with a positive or negative value. The timer influences DR election timing when a router with the highest DR priority on a LAN segment is reloaded. In an MLAG configuration, the notification delay time begins shortly after the MLAG reload delay expires (before which the PIM hello messages are sent with a priority of 1). In a non-MLAG configuration, the notification delay time begins as soon as the PIM is configured first on the interface.

Positive values for notify delay time cause the device to send PIM hello messages with a priority of 1 until the time the notify delay time expires. During this time, DR responsibilities of the device will continue according to configured DR priority. Negative values configured for the notification delay time will not modify the priority sent in PIM hello messages, but the device will not perform any DR responsibility until the notify delay time expires. Positive values are used to avoid loss of multicast packets, but they may create a few duplicate packets from multiple PIM routers forwarding traffic for the same S,G. Negative values are used to avoid duplicate packets, but they may cause packet loss when there are no PIM routers forwarding traffic for an S,G.

**Example**

- These commands configure a DR notification delay time of 2 seconds.

```
switch (config)#router multicast
switch (config-router-multicast)#ip pim dr-notify-delay 2
switch (config-router-multicast)#
```
**pim ipv4 dr-priority**

PIM-SM uses these criteria for electing a designated router (DR):

- If at least one router does not advertise a DR priority value, then PIM-SM elects the router with the highest IP address as the DR.
- If all routers advertise a DR priority value, then PIM-SM elects the router with the highest DR priority value as the DR.

The `pim ipv4 dr-priority` command sets the DR priority value that the configuration mode interface advertises. By default, the interface does not advertise a DR priority value.

The `no pim ipv4 dr-priority` and `default pim ipv4 dr-priority` commands force the use of IP addresses to elect the designated router by removing the corresponding `pim ipv4 dr-priority` statement from *running-config*.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
pim ipv4 dr-priority level
no pim ipv4 dr-priority [level]
default pim ipv4 dr-priority [level]
```

**Parameters**

- `level`  DR selection priority rating. Value ranges from 0 to 4294967295.

**Examples**

- This command configures the dr-priority value of 15 on VLAN interface 4.
  
  ```
  switch(config)#interface vlan 4
  switch(config-if-Vl4)#pim ipv4 dr-priority 15
  switch(config-if-Vl4)#
  ```

- This command force the use of IP addresses to elect the designated router.
  
  ```
  switch(config-if-Vl4)#no pim ipv4 dr-priority
  switch(config-if-Vl4)#
  ```
**group-expiry-timer**

The *group-expiry-timer* command sets the group-expiry-timer in seconds after which a group with no activity gets deleted from the PIM rendezvous point (RP) tree.

When the command is configured in Global Configuration Mode, the configuration is applied globally on the switch. To apply the configuration only in Bidir-PIM mode, the command is configured in Router-PIM Bidirectional Configuration Mode. To apply the configuration for a specific VRF, the command is configured in the VRF sub-mode of the Router-PIM Bidirectional Configuration Mode. Use the `router pim bidirectional` command to enter Router-PIM Bidirectional Configuration Mode.

The `no group-expiry-timer` and `default group-expiry-timer` applies the system default configuration and removes the corresponding *group-expiry-timer* command from *running-config*.

**Command Mode**
- Router-PIM Bidirectional IPv4 Configuration
- Router-PIM Bidirectional VRF IPv4 Configuration

**Command Syntax**

```plaintext
  group-expiry-timer value
  no group-expiry-timer value
  default group-expiry-timer value
```

**Parameter**

*value* specifies the time in seconds after which a group with no activity expires from the PIM RP. Values range from 1 to 210. There is no default value.

**Examples**

- This command configures PIM expiry-timer of 40 seconds in PIM-bidirectional sub-mode.

```
switch(config)#router pim bidirectional
switch(config-router-pim-bidir)#ipv4
switch(config-router-pim-bidir-ipv4)#group-expiry-timer 40
```

- This command configures PIM expiry-timer of 120 seconds for VRF v1.

```
switch(config)#router pim bidirectional
switch(config-router-pim-bidir)#vrf v1
switch(config-router-pim-bidir-vrf-v1)#ipv4
switch(config-router-pim-bidir-vrf-v1-ipv4)#group-expiry-timer 120
```
pim ipv4 join-prune interval

The **pim ipv4 join-prune interval** command specifies the period between join or prune messages that the configuration mode interface originates and sends to the upstream RPF neighbor.

The **no pim ipv4 join-prune interval** and **default pim ipv4 join-prune interval** commands restore the default join or prune interval of 60 seconds for the configuration mode interface by removing the corresponding **pim ipv4 join-prune interval** command from **running-config**.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
pim ipv4 join-prune interval period
no pim ipv4 join-prune interval [period]
default pim ipv4 join-prune interval [period]
```

**Parameters**
- **period** join or prune interval (seconds). Value ranges from 1 to 18724. Default is 60.

**Example**
- This command configures 75-second intervals between join or prune messages originating from VLAN interface 4.

```
switch(config)#interface vlan 4
switch(config-if-Vl4)#pim ipv4 join-prune interval 75
switch(config-if-Vl4)#
```
pim ipv4 hello count

The pim ipv4 hello count command sets the PIM hello count for the interface being configured. PIM hold time is calculated by multiplying the configured hello interval by the hello count, ensuring that the PIM neighbor stays up for the specified time after which the neighbor expires.

The no pim ipv4 hello count command removes the corresponding pim ipv4 hello count command from running-config.

Command Mode

Interface-Ethernet Configuration
Interface-Port-Channel Configuration
Interface-VLAN Configuration

Command Syntax

```
pim ipv4 hello count [multiple]
no pim ipv4 hello count [multiple]
```

Parameters

- **multiple** hello count multiplier. Value ranges from 1.5 to 65535. The hello hold time is the configured hello interval multiplied by the hello count.

Examples

- This command configures a hold time interval of 225 seconds on VLAN interface 2925 by multiplying the default 30-second hello interval by a hello count of 7.5.

```
switch(config)#interface vlan2925
switch(config-if-Vl2925)#pim ipv4 hello count 7.5
```

- This show command displays the hold time and other configuration details on VLAN 2925.

```
switch(config-if-Vl2925)#show ip pim interface vlan2925 details
Interface Vlan2925 address is 1.0.1.1
Vif number is 0
PIM: enabled
PIM version: 2, mode: sparse
PIM neighbor count: 0
PIM Effective DR: 1.0.1.1 (this system)
PIM Effective DR Priority: 1
PIM Effective Propagation Delay: 500 milliseconds
PIM Effective Override Interval: 2500 milliseconds
PIM Effective Tracking Support: disabled
PIM Hello Interval: 30 seconds
PIM Hello Hold Time: 225 seconds \[\textbf{\textless==\text{New Hold Time} \(= 7.5 \times 30\)}\]
PIM Hello Priority: 1 seconds
PIM Hello Lan Delay: 500 milliseconds
PIM Assert Override Interval: 3 seconds
```

mrtr1#
**pim ipv4 sparse-mode**

The `pim ipv4 sparse-mode` command enables PIM Sparse Mode (PIM-SM) and IGMP (router mode) on the configuration mode interface.

**Important!** PIM and multicast border router (MBR) must be mutually exclusive on an interface. If the interface is configured as an MBR, do not enable PIM on the interface.

The `no pim ipv4 sparse-mode`, `no pim ipv4`, `default pim ipv4 sparse-mode`, and `default pim ipv4` commands restore the default PIM and IGMP (router mode) settings of `disabled` on the configuration mode interface by removing the `pim ipv4 sparse-mode` statement from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `pim ipv4 sparse-mode`
- `no pim ipv4`
- `no pim ipv4 sparse-mode`
- `default pim ipv4`
- `default pim ipv4 sparse-mode`

**Example**

- This command enables PIM sparse mode on VLAN 4 interface.

```plaintext
switch(config)#interface vlan 4
switch(config-if-Vl4)#pim ipv4 sparse-mode
switch(config-if-Vl4)#
```
The `rp address` command configures the address of a Protocol Independent Multicast (PIM) static rendezvous point (RP) for a specified multicast subnet. If the command does not specify a subnet, the static RP maps to all multicast groups (224/4). Dynamic RPs override static RPs unless the static RP is given priority by using the `override` option of this command.

Multicast groups use RPs to connect sources and receivers. A PIM domain requires that all routers have consistently configured RP addresses.

The switch uses multiple `rp address` commands to configure multiple RPs or to assign multiple subnets to an RP. When the address of a multicast group falls within multicast subnets configured by multiple `rp address` commands, the group’s RP address is selected by comparing the commands’ multicast subnet size.

- Different size subnets: group uses command with the largest subnet.
- Same size subnets: group uses command as determined by hash algorithm.

When the command is issued in Router-Multicast Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-Multicast VRF Configuration Mode.

The `no rp address` and `default rp address` commands remove the corresponding `rp address` command from `running-config`.

**Command Mode**
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration

**Command Syntax**
```plaintext
rp address rp_addr [MULTICAST_SUBNET] [HASHMASK_LENGTH] [BSR_OVERRIDE] [PRIORITY_NUM]
no rp address rp_addr [MULTICAST_SUBNET]
default rp address rp_addr [MULTICAST_SUBNET]
```

**Parameters**
- `rp_addr` Rendezvous point IP address (dotted decimal notation).
- `MULTICAST_SUBNET` Multicast IP address space (CIDR or address-mask).
  - `<no parameter>` Default multicast group IP address of 224/4.
  - `gp_addr` Multicast group IP address (CIDR or address-mask).
  - `access-list acl_name` Standard access control list that specifies the multicast group address.
  - `acl_name` Standard access control list that specifies the multicast group address.
- `HASHMASK_LENGTH` Length (in bits) of the hash mask.
  - `<no parameter>` hash mask remains unchanged from previous setting.
  - `hashmask <0 - 32>` hash mask length (in bits). Default value is 30.
- `BSR_OVERRIDE` Configures priority relative to dynamic RPs selected by BSR.
  - `<no parameter>` Dynamic RPs have priority over specified RP.
  - `override` RP has priority over dynamic RPs.
- `PRIORITY_NUM` BSR election priority rating. Larger numbers denote higher priority. Default value is 0.
  - `<no parameter>` priority remains unchanged from previous setting.
  - `priority <0 - 255>` priority rating.
Example

- These commands configure 10.17.255.2 as a static RP for all multicast groups in the default VRF.

```plaintext
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#rp address 10.17.255.2
switch(config-router-pim-sparse-ipv4)#
```
rp candidate

The rp candidate command configures the switch as a candidate rendezvous point (C-RP). The BSR selects a multicast group’s dynamic RP set from the list of C-RPs in the PIM domain. The command specifies the interface (used to derive the RP address), C-RP advertisement interval, and priority rating. The BSR selects the RP set by comparing C-RP priority ratings. The C-RP advertisement interval specifies the period between successive C-RP advertisement message transmissions to the BSR.

Running-config supports multiple multicast groups through multiple rp candidate statements:

- All commands must specify the same interface. Issuing a command with an interface that differs from existing commands removes all existing commands from running-config.
- Running-config stores the interval setting in a separate statement that applies to all rp candidate statements. When a command specifies an interval that differs from the previously configured value, the new value replaces the old value and applies to all configured rp candidate statements. The default interval value is 60 seconds.

When the command is issued in Router-Multicast Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-Multicast VRF Configuration Mode.

The no rp candidate and default rp candidate commands remove rp candidate from running-config for the specified group. When these commands do not specify a multicast group, all rp candidate statements are removed from running-config.

The no rp candidate interval and default rp candidate interval commands restore the interval setting to the default value of 60 seconds. The no rp candidate priority and default rp candidate priority commands restore the priority setting to the default value of 0.

Command Mode

- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration
- Router-PIM Bidirectional IPv4 Configuration
- Router-PIM Bidirectional VRF IPv4 Configuration

Command Syntax

The INTERFACE parameter is always listed first. All other parameters can be placed in any order.

```
rp candidate INTERFACE [GROUP_ADDR] [PRIORITY_NUM] [INTERVAL_PERIOD]
no rp candidate [INTERFACE] [GROUP_ADDR]
no rp candidate [INTERFACE] interval
no rp candidate [INTERFACE] priority
default rp candidate [INTERFACE] [GROUP_ADDR]
default rp candidate [INTERFACE] interval
default rp candidate [INTERFACE] priority
```

Parameters

- **INTERFACE** Switch uses IP address of specified interface as its C-RP address. Options include:
  - ethernet e_num Ethernet interface specified by e_num.
  - loopback l_num Loopback interface specified by l_num.
  - management m_num Management interface specified by m_num.
  - port-channel p_num Port-Channel Interface specified by p_num.
  - vlan v_num VLAN interface specified by v_num.
  - vxlan vx_num VXLAN interface specified by vx_num.
- **GROUP_ADDR** address of multicast group for which candidate is configured. Options include:
- `<no parameter>` default multicast group (224.0.0.0/4).
- `net_addr` multicast IPv4 subnet address (CIDR or address mask).
- `access-list acl_name` standard access control list that specifies the multicast group address.

- `PRIORITY_NUM` RP selection priority rating. Smaller numbers denote higher priority.
  - `<no parameter>` priority rating is set to the default value of 0.
  - `priority <0 - 255>` priority rating.

- `INTERVAL_NUM` Period between consecutive RP-advertisement message transmissions (seconds). Value also applies to previously configured `rp candidate` statements.
  - `<no parameter>` interval remains unchanged from previous setting.
  - `interval <10 - 16383>` transmission interval.

**Example**

- These commands configure a switch as a candidate RP for the multicast group 235.1.1.0/24 with a priority of 48 and an RP advertisement interval of 45 seconds in the default VRF. The switch advertises the IP address assigned to VLAN 24 as its RP address.

  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#rp candidate vlan 24 235.1.1.0/24 priority
  48 interval 45
  switch(config-router-pim-sparse-ipv4)#
rp hash algorithm modulo

The **rp hash algorithm modulo** command configures the load-balancing scheme across available rendezvous points (RP).

The configuration results in a round robin-based load balancing across available RPs, achieved by module operation of the destination group address with the number of RPs available.

The **no rp hash algorithm modulo** and **default rp hash algorithm modulo** commands result in the default load-balancing scheme which is to use a hash function to get a group-RP mapping.

**Command Mode**
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration
- Router-PIM Sparse-mode IPv6 Configuration
- Router-PIM Sparse-mode VRF IPv6 Configuration
- Router-PIM Bidirectional VRF IPv4 Configuration

**Command Syntax**
- `rp hash algorithm modulo`
- `no rp hash algorithm modulo`
- `default rp hash algorithm modulo`

**Example**
- These commands configures the hash algorithm module for a VRF named `blue` in the Router-PIM sparse-mode IPv4 configuration mode.
  
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#vrf red
  switch(config-router-pim-sparse-vrf-red-ipv4)#rp hash algorithm modulo
  ```
  
- These commands configures the hash algorithm module for a VRF named `blue` in the Router-PIM bidirectional-mode VRF IPv4 configuration mode.
  
  ```
  switch(config)#router pim bidirectional
  switch(config-router-pim-bidir)#ipv4
  switch(config-router-pim-bidir-ipv4)#vrf red
  switch(config-router-pim-bidir-vrf-red-ipv4)#rp hash algorithm modulo
  ```
sg-expiry-timer

The `sg-expiry-timer` command configures the (S, G) expiry timer interval for PIM-SM (S, G) multicast routes. The command does not apply to (*, G) mroutes.

When the command is issued in Router-Multicast Configuration mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-Multicast VRF Configuration mode.

The `no sg-expiry-timer` and `default sg-expiry-timer` commands restore the default setting of 210 seconds by removing the `sg-expiry-timer` statement from `running-config`.

**Command Mode**
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration

**Command Syntax**
```
sg-expiry-timer period
no sg-expiry-timer
default sg-expiry-timer
```

**Parameters**
- `period` expiry timer interval (seconds). Value ranges from 120 to 65535 seconds. The default value is 210 seconds.

**Example**
- These commands configure 150 seconds as the (S,G) expiry timer interval is in the default VRF.
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#sg-expiry-timer 150
  switch(config-router-pim-sparse-ipv4)#
  ```
ipv4

The `ipv4` command places the switch in the IPv4 submode for the PIM configuration mode in which it is entered.

**Command Mode**
- Router Multicast Configuration
- Router-PIM Bidirectional Configuration
- Router-PIM BSR Configuration
- Router-PIM Sparse-mode Configuration

**Command Syntax**

```
ipv4
```

**Examples**

- These commands place the switch in Router Multicast IPv4 Configuration Mode.
  ```
  switch(config)#router multicast
  switch(config-router-multicast)#ipv4
  switch(config-router-multicast-ipv4)#
  ```

- These commands place the switch in Router-PIM Bidirectional IPv4 Configuration Mode.
  ```
  switch(config)#router pim bidirectional
  switch(config-router-pim-bidir)#ipv4
  switch(config-router-pim-bidir-ipv4)#
  ```

- These commands place the switch in Router-PIM BSR IPv4 Configuration Mode.
  ```
  switch(config)#router pim bsr
  switch(config-router-pim-bsr)#ipv4
  switch(config-router-pim-bsr-ipv4)#
  ```

- These commands place the switch in Router-PIM Sparse-mode IPv4 Configuration Mode.
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#
  ```
log neighbors

The log neighbors command configures the switch to generate a log message when a neighbor entry is added or removed from the PIM Neighbor table. This function is enabled by default.

The no log neighbors command disables log message generation based on changes to the PIM Neighbor table; this command is stored in the running-config. The log neighbors and default log neighbors commands restore the default setting of generating log messages by deleting the no log neighbors statement from running-config.

Command Mode
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration
- Router-PIM Bidirectional IPv4 Configuration
- Router-PIM Bidirectional VRF IPv4 Configuration

Command Syntax
- log neighbors
- no log neighbors
- default log neighbors

Examples
- These commands configure the switch to stop generating log messages based on PIM Neighbor table changes in the default VRF.
  
  switch (config)#router pim sparse-mode
  switch (config-router-pim-sparse)#ipv4
  switch (config-router-pim-sparse-ipv4)#no log neighbors
  switch (config-router-pim-sparse-ipv4)#

- These commands configure the switch to generate log messages when a neighbor entry is added or removed from the PIM Neighbor table in the default VRF.
  
  switch (config)#router pim sparse-mode
  switch (config-router-pim-sparse)#ipv4
  switch (config-router-pim-sparse-ipv4)#log neighbors
  switch (config-router-pim-sparse-ipv4)#
pim ipv4 hello interval

The `pim ipv4 hello interval` command specifies the transmission interval between PIM hello messages originating from the configuration mode interface.

The `no pim ipv4 hello interval` and `default pim ipv4 hello interval` commands restore the default query interval of 30 seconds for the configuration mode interface by removing the corresponding `pim ipv4 hello interval` command from `running-config`.

**Command Mode**
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

```
pim ipv4 hello interval period
no pim ipv4 hello interval [period]
default pim ipv4 hello interval [period]
```

**Parameters**
- `period` query interval (seconds). Value ranges from 1 to 1000000 (1 million). Default is 30.

**Example**
- This command configures 45 second intervals between hello messages originating from VLAN interface 4.

```
switch(config)#interface vlan 4
switch(config-if-Vl4)#pim ipv4 hello interval 45
switch(config-if-Vl4)#
```
pim ipv4 neighbor-filter

The `pim ipv4 neighbor-filter` command configures the configuration mode interface to filter PIM control packets on the basis of neighbor addresses listed in a specified standard access list.

The `no pim ipv4 neighbor-filter` and `default pim ipv4 neighbor-filter` commands disable the configuration mode interface from filtering PIM control packets by removing the corresponding `ip pim ipv4 neighbor-filter` command from `running-config`.

Command Mode
- Interface-Ethernet Configuration
- Interface-Port-Channel Configuration
- Interface-VLAN Configuration

Command Syntax
- `pim ipv4 neighbor-filter access_list`
- `no pim ipv4 neighbor-filter`
- `default pim ipv4 neighbor-filter`

Parameters
- `access_list` name of the standard IP access list.

Example
- This command configures the IP access list named filter_1 to filter neighbor PIM control messages for VLAN 4.

```
switch(config)#ip access-list standard filter_1
switch(config-standard-acl-filter_1)#permit 10.13.24.9/24
switch(config-standard-acl-filter_1)#exit
switch(config)#interface vlan 4
switch(config-if-Vl4)#pim ipv4 neighbor-filter filter_1
    switch(config-if-Vl4)#
```
register local-interface

The register local-interface command programs the switch to fill the source field in all outbound PIM SM register packets with the IP address of a specified interface or the incoming interface of the group specified by the message. By default, the source field is filled with the IP address from the interface associated with the best route to the RP.

When the command is issued in Router-PIM Sparse-mode IPv4 Configuration mode, it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-PIM Sparse-mode VRF IPv4 Configuration.

The no register local-interface and default register local-interface commands restore the default method of filling the register packet source field by removing the ip register local-interface statement from running-config.

Command Mode
- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration

Command Syntax
- register local-interface INT_NAME
- no register local-interface
- default register local-interface

Parameters
- INT_NAME Interface type and number. Values include:
  - ethernet e_num Ethernet interface specified by e_num.
  - loopback l_num Loopback interface specified by l_num.
  - management m_num Management interface specified by m_num.
  - port-channel p_num Port channel interface specified by p_num.
  - vlan v_num VLAN interface specified by v_num.

Example
- These commands program the switch to fill the source field of outbound PIM SM register packets in the default VRF with the IPv4 address of loopback interface 2.
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#ipv4
  switch(config-router-pim-sparse-ipv4)#register local-interface loopback 2
  switch(config-router-pim-sparse-ipv4)#
**router pim bidirectional**

The `router pim bidirectional` command places the switch in Router-PIM Bidirectional Configuration Mode.

**Command Mode**
- Global Configuration

**Command Syntax**
```
router pim bidirectional
```

**Example**
- This command places the switch in Router-PIM Bidirectional Configuration Mode.
```
switch(config)#router pim bidirectional
switch(config-router-pim-bidir)#
```
**router pim bsr**

The `router pim bsr` command places the switch in Router-PIM BSR Configuration Mode.

**Command Mode**
- Global Configuration

**Command Syntax**

```
router pim bsr
```

**Example**
- This command places the switch in Router-PIM BSR Configuration Mode.
  ```
  switch(config)#router pim bsr
  switch(config-router-pim-bsr)#
  ```
router pim sparse-mode

The `router pim sparse-mode` command places the switch in Router-PIM Sparse-Mode Configuration Mode.

**Command Mode**
- Global Configuration

**Command Syntax**
- `router pim sparse-mode`

**Example**
- This command places the switch in Router-PIM Sparse-Mode Configuration Mode.
  
  ```
  switch(config)#router pim sparse-mode
  switch(config-router-pim-sparse)#
  ```
**show ip pim bsr**

The *show ip pim bsr* command displays the switch’s bootstrap router (BSR) information.

**Command Mode**

EXEC

**Command Syntax**

```
show ip pim bsr [GROUP_FILTER]
```

**Parameters**

- `GROUP_FILTER` specifies groups for which command displays information.
  - `<no parameter>` Displays data for all groups.
  - `net_addr` Displays message for specified group address. (CIDR or address mask).

**Example**

- This command configures the switch’s BSR information.

  switch>**show ip pim bsr**
  PIMv2 Bootstrap information
  This system is the Bootstrap Router (BSR)
  BSR address: 10.1.1.1
  Uptime: 00:14:42, BSR Priority: 0, Hash mask length: 30
  Next bootstrap message in 00:00:05
show ip pim config-sanity

The `show ip pim config-sanity` command displays diagnostic information about the switch's PIM configuration.

**Command Mode**

EXEC

**Command Syntax**

show ip pim config-sanity

**Example**

- This command displays PIM configuration diagnostic information.

  switch>show ip pim config-sanity

  DISCLAIMER: Below are only hints of potential PIM misconfiguration. They do not necessary imply that there is a real problem.

  The interfaces with PIM which are down: Vl14

  switch>
show ip pim interface

The `show ip pim interface` command displays information about interfaces configured for PIM.

Command Mode

EXEC

Command Syntax

```
show ip pim interface [INT_NAME] [INFO_LEVEL]
```

Parameters

- **INT_NAME** Interface type and number. Values include:
  - `<no parameter>` displays information for all interfaces.
  - `ethernet e_num` Ethernet interface specified by `e_num`.
  - `port-channel p_num` Port-Channel Interface specified by `p_num`.
  - `vlan v_num` VLAN interface specified by `v_num`.
  - `vxlan vx_num` VXLAN interface specified by `vx_num`.
- **INFO_LEVEL** specifies level of information detail provided by the command:
  - `<no parameter>` table of basic configuration information.
  - `detail` list of complete configuration information.

Examples

- This command displays information about all interfaces on which PIM is enabled.

```
switch>show ip pim interface
Address        Interface      Mode      Neighbor   Hello DR   DR Address     PktsQed
PktsDropped
10.17.254.30   Vlan3910       sparse    1          30    1    10.17.254.30   0
0
10.17.254.162  Vlan3925       sparse    2          30    1    10.17.254.163  0
0
10.17.254.106  Vlan3912       sparse    1          30    1    10.17.254.106  0
0
10.17.254.137  Ethernet12     sparse    1          30    1    10.17.254.138  0
0
switch>
```
This command displays detailed PIM information for VLAN 26 interface.

```
switch>show ip pim interface vlan 26 detail
Interface address is 172.17.26.1
Vif number is 1
PIM: enabled
  PIM version: 2, mode: sparse
  PIM DR: 172.17.26.1 (this system)
  PIM DR Priority: 1
  PIM neighbor count: 0
  PIM Hello Interval: 30 seconds
  PIM Hello Priority: 1
  PIM Hello Lan Delay: 500 milliseconds
  PIM Hello Override Interval: 2500 milliseconds
  PIM Hello Lan Prune Delay in use
  PIM Hello Generation ID: 0x4a05aa0
  PIM Hello Generation ID is not required
  PIM Triggered Hello Delay: 5 seconds
  PIM Join-Prune Interval: 60 seconds
  PIM State-Refresh processing: disabled
  PIM State-Refresh Interval: unknown seconds
  PIM Graft Retry Interval: unknown seconds
  PIM domain border: disabled
switch>
```
show ip pim neighbor

The `show ip pim neighbor` command displays information about Protocol Independent Multicast (PIM) neighbors discovered by hello messages.

**Command Mode**

EXEC

**Command Syntax**

```
show ip pim neighbor [INT_NAME] [BFD_DATA]
```

**Parameters**

- **INT_NAME** Interface type and number. Values include
  - `<no parameter>` displays information for all interfaces.
  - `ethernet e_num` Ethernet interface specified by `e_num`.
  - `loopback l_num` Loopback interface specified by `l_num`.
  - `management m_num` Management interface specified by `m_num`.
  - `port-channel p_num` Port-Channel Interface specified by `p_num`.
  - `vlan v_num` VLAN interface specified by `v_num`.
  - `vxlan vx_num` VXLAN interface specified by `vx_num`.
- **BFD_DATA** Specifies inclusion of BFD data.
  - `<no parameter>` BFD data is not displayed.
  - `bfd` BFD data is displayed.

**Example**

- This command displays information about neighbor PIM routers.
  ```
  switch>show ip pim neighbor
  PIM Neighbor Table
  Neighbor Address  Interface    Uptime    Expires  Mode
  10.17.255.2       Vlan2028    21d22h    00:01:31  sparse
  switch>
  ```

- This command displays information about neighbor PIM routers and the status of BFD.
  ```
  switch>show ip pim neighbor bfd
  PIM Neighbor Table
  Flags: U - BFD is enabled and is UP
          I - BFD is enabled and is INIT
          D - BFD is enabled and is DOWN
          N - Not running BFD
  Neighbor Address  Interface    Uptime    Expires  Mode  Flags
  10.17.255.2       Vlan2028    21d22h    00:01:31  sparse  U
  switch>
  ```
**show ip pim protocol counters**

The *show ip pim protocol* command displays statistics about Protocol Independent Multicast (PIM) control messages sent and received by the switch.

**Command Mode**

EXEC

**Command Syntax**

```
show ip pim protocol counters [INT_NAME]
```

**Parameters**

- **INT_NAME** Interface type and number. Values include
  - *<no parameter>* displays information for all interfaces.
  - *ethernet e_num* Ethernet interface specified by *e_num*.
  - *loopback l_num* Loopback interface specified by *l_num*.
  - *management m_num* Management interface specified by *m_num*.
  - *port-channel p_num* Port-Channel Interface specified by *p_num*.
  - *vlan v_num* VLAN interface specified by *v_num*.
  - *vxlan vx_num* VXLAN interface specified by *vx_num*.

**Example**

- This command displays statistics about inbound and outbound PIM control messages.

```plaintext
switch>show ip pim protocol counters
PIM Control Counters

<table>
<thead>
<tr>
<th></th>
<th>Received</th>
<th>Sent</th>
<th>Invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assert</td>
<td>0</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>Bootstrap Router</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CRP Advertisement</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graft</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graft Ack</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hello</td>
<td>63168</td>
<td>126355</td>
<td>0</td>
</tr>
<tr>
<td>J/P</td>
<td>275714</td>
<td>143958</td>
<td>0</td>
</tr>
<tr>
<td>Join</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Prune</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Register</td>
<td>0</td>
<td>13643</td>
<td>0</td>
</tr>
<tr>
<td>Register Stop</td>
<td>11839</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>State Refresh</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

switch>
```
**show ip pim register-source**

The `show ip pim register-source` command displays the name of the interface from where the switch derives the IP address that it uses to fill the source field in all outbound PIM SM register packets. The `register local-interface` command specifies this interface.

By default, the source field is filled with the IP address from the interface associated with the best route to the RP. The `show ip pim register-source` command does not return a value when the source field is filled with the default value.

**Command Mode**

EXEC

**Command Syntax**

`show ip pim register-source`

**Example**

- This command displays the register-source interface.

```
switch>show ip pim register-source
Ethernet22
switch>
```
show ip pim rp

The `show ip pim rp` command displays the status and multicast group of each cached rendezvous point (RP).

**Command Mode**

EXEC

**Command Syntax**

`show ip pim rp`

**Example**

- This command displays the cached RPs.

```
switch>show ip pim rp
show ip pim rp
The PIM RP Set
Group: 224.0.0.0/4
  RP: 10.1.2.3
    Uptime: 00:05:12, Expires: never, Priority: 1 Override: 1
```
show ip pim rp-candidate

The `show ip pim rp-candidate` command displays the rendezvous point (RP) that is used for a specified multicast group.

**Command Mode**

EXEC

**Command Syntax**

`show ip pim rp-candidate`

**Example**

- This command displays the switch’s candidate-RP information.

```
switch>show ip pim rp-candidate
Candidate RP information
    Candidate RP Address: 10.0.12.2
    CRP Holdtime: 150 seconds
    Group 224.2.0.0/16 Priority 2
```
show ip pim rp-hash

The `show ip pim rp-hash` displays the group to RP-hash mapping for the specified group and the list of qualifying candidate RPs.

**Command Mode**

EXEC

**Command Syntax**

```
show ip pim rp-hash ipv4_addr [INFO_LEVEL]
```

**Parameters**

- `ipv4_addr` multicast group IPv4 address.
- `INFO_LEVEL` specifies level of information detail provided by the command.
  - `<no parameter>` RP-hash map and list of candidate RPs.
  - `detail` includes data about the selected RP.

**Example**

- This command displays the RP that the switch uses for multicast group 224.1.0.0.

```
switch>show ip pim rp-hash 224.1.0.0
RP 10.1.2.3
```
show ip pim upstream joins

The **show ip pim upstream joins** command displays the join messages that the switch is scheduled to send.

**Command Mode**

EXEC

**Command Syntax**

```bash
show ip pim upstream joins [JOIN_ADDRESSES] [NEIGHBOR_FILTER]
```

**Parameters**

- **JOIN_ADDRESSES** Filters messages by source and group addresses.
  - `<no parameter>` displays all join messages.
  - `source_addr` displays all join messages for specified source group IPv4 address.
  - `group_addr` displays all join messages for specified multicast IPv4 address.
  - `source_addr group_addr` displays join message with specified source and group addresses.
  - `group_addr source_addr` displays join message with specified group and source addresses.
    - `group_addr` must be a valid multicast IPv4 address.

- **NEIGHBOR_FILTER** specifies neighbors for which command provides data.
  - `<no parameter>` Displays messages for all neighbors.
  - `neighbor neighbor_addr` Displays message for specified neighbor address.

**Example**

- This command displays the list of join messages the switch is scheduled to send. The example only displays the first two messages.

  ```bash
  switch>show ip pim upstream joins
  
  ------------ show ip pim upstream joins ------------
  
  Neighbor address: 10.1.1.1
  Via interface: 10.1.1.2
  Next message in 1 seconds
  Group: 10.10.10.3
    Joins:
    10.25.1.1/32 SPT
    Prunes:
    No prunes included
  Neighbor address: 10.1.1.6
  Via interface: 10.1.1.5
  Next message in 1 seconds
  Group: 10.14.1.69
    Joins:
    10.105.14.3/32 SPT
    Prunes:
    No prunes included
  switch>
  ```
ssm range

The ssm range command defines the source specific multicast (SSM) range of IP multicast addresses.

SSM is a multicast packet delivery method where only packets originating from a specific source address requested by a receiver are routed to that receiver. SSM explicitly excludes the use of (*,G) join for applicable multicast groups. Source-specific multicast differs from any-source multicast (ASM), where a receiver expresses interest in traffic to a multicast address, then receives traffic from all multicast sources sending to that address.

When the command is issued in Router-PIM Sparse-mode IPv4 Configuration Mode it applies to the default VRF; to use this command in a non-default VRF, issue it in Router-PIM Sparse-mode VRF IPv4 Configuration Mode.

The no ssm range and default ssm range commands remove the SSM IP multicast address range by deleting the ssm range statement from running-config.

Command Mode

Router-PIM Sparse-mode IPv4 Configuration
Router-PIM Sparse-mode VRF IPv4 Configuration

Command Syntax

ssm range {acl_name | standard}
no ssm range
default ssm range

Parameters

- acl_name sets the SSM range to address set specified by the standard ACL.
- standard sets the SSM range to 232/8.

Examples

- These commands configure the SSM address range to 232/8 in the default VRF.

```bash
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#ssm range standard
switch(config-router-pim-sparse-ipv4)#
```

- These commands configure the SSM address range to those permitted by the LIST_1 standard ACL in the default VRF. The ACL permits the subnet address range 233.0.0.0/24.

```bash
switch(config)#ip access-list standard LIST_1
switch(config-std-acl-LIST_1)#permit 233.0.0.0/24
switch(config-std-acl-LIST_1)#exit
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#ssm range LIST_1
switch(config-router-pim-sparse-ipv4)#
```
spt threshold

The `spt threshold` command configures shortest path tree (SPT) threshold actions for IPv4 multicast groups. To specify the threshold action for multicast groups that match a specified access control list (ACL), use the `match list` option. When the command is issued without this option, it is applied throughout the configuration-mode VRF. Any ACL-based configuration overrides global configuration.

- When `running-config` does not list this command, the switch joins the SPT immediately after receiving the first PIM packet from a new source. The switch joins the SPT by sending PIM join message toward the source.
- When `running-config` lists this command with a value of infinity, the switch never joins the SPT.

The `no spt threshold` and `default spt threshold` commands remove the corresponding `spt threshold` command from `running-config`.

**Command Mode**

- Router-PIM Sparse-mode IPv4 Configuration
- Router-PIM Sparse-mode VRF IPv4 Configuration

**Command Syntax**

```
spt threshold {0 | infinity} [match list acl_name]
no spt threshold {0 | infinity} [match list acl_name]
default spt threshold {0 | infinity} [match list acl_name]
```

**Parameters**

- **0**  The switch immediately joins the SPT. This is the default value.
- **infinity**  The switch never joins the SPT.
- **acl_name**  name of access control list. If no ACL is supplied, the configuration is applied to all multicast groups within the VRF which are not configured by an ACL.

**Examples**

- This command configures the switch in the default VRF to immediately join the SPT for multicast groups matched by the ACL “group-1.”

```sh
switch(config)#router pim sparse-mode
switch(config-router-pim-sparse)#ipv4
switch(config-router-pim-sparse-ipv4)#spt threshold 0 match list group-1
switch(config-router-pim-sparse-ipv4)#
```
sztimeout

The `sztimeout` command configures the maximum span of active scope-zone. The `no sztimeout` and `default sztimeout` commands delete the current scope zoned timeout configuration.

Command Modes
Router-PIM BSR IPv4 Configuration
Router-PIM BSR VRF IPv4 Configuration

Syntax
```plaintext
    sztimeout timeout
no sztimeout
default sztimeout
```

Parameter
`timeout` Maximum span of active scope-zone in seconds. The value ranges from 120 to 4294967295. The default value is 1300.

Guideline
The scope zoned timeout must contain a minimum value of 10 times of configured holdtime; else the system displays a warning message.

Examples
- This command configures 600 seconds as the maximum of active scope-zone in router-pim bsr ipv4 configuration mode.
  ```plaintext
  switch(config)#router pim bsr
  switch(config-router-pim-bsr)#ipv4
  switch(config-router-pim-bsr-ipv4)#sztimeout 600
  switch(config-router-pim-bsr-ipv4)#
  ```
- This command configures 2200 seconds as the maximum of active scope-zone in router-pim bsr vrf ipv4 configuration mode.
  ```plaintext
  switch0(config)#router pim bsr
  switch(config-router-pim-bsr)#vrf vrf01
  switch(config-router-pim-bsr-vrf-vrf01)#ipv4
  switch(config-router-pim-bsr-vrf-vrf01-ipv4)#sztimeout 2200
  switch(config-router-pim-bsr-vrf-vrf01-ipv4)#
  ```