Multicast Architecture

IP multicast is the transmission of data packets to multiple hosts through a common IP address. Arista switches support multicast transmissions through IGMP, IGMP Snooping, and PIM-SM. These sections describe the Arista multicast architecture.

- Section 38.1: Overview
- Section 38.2: Multicast Architecture Description
- Section 38.3: Multicast Listener Discovery (MLD)
- Section 38.4: Static IP Mroute
- Section 38.5: Multicast Configuration
- Section 38.6: Multicast Commands

38.1 Overview

Arista switches provide layer 2 multicast filtering and layer 3 routing features for applications requiring IP multicast services. The switches support over a thousand separate routed multicast sessions at wire speed without compromising other layer 2/3 switching features. Arista switches support IGMP, IGMP snooping, PIM-SM, and MSDP to simplify and scale data center multicast deployments.

Supported Features

Feature support varies by platform; please consult the release notes for multicast support information by platform.

Multicast and unicast use the same routing table. Unicast routes use TCAM resources, which may also impact the maximum number of multicast routes.

Features Not Supported

The multicast functions not supported by Arista switches include (*,*,G) forwarding or boundary routers, multicast MIBs, and router applications joining multicast groups.
38.2 Multicast Architecture Description

IP multicast is data transmission to a subset of all hosts through a single multicast group address. Multicast packets are delivered using best-effort reliability, similar to unicast packets. Senders use the multicast address as the destination address. Any host, regardless of group membership, can send to a group. However, only group members receive messages sent to a group address.

IP multicast addresses range from 224.0.0.0 to 239.255.255.255. Multicast routing protocol control traffic reserves the address range 224.0.0.0 to 224.0.0.255. The address 224.0.0.0 is never assigned to any group.

Multicast group membership is dynamic; a group's activity level and membership can vary over time. A host can also simultaneously belong to multiple multicast groups.

Figure 38-1 depicts the components that comprise the multicast architecture. The remainder of this section describes the multicast components depicted in the figure.

Figure 38-1: Multicast Architecture

38.2.1 Multicast Control Plane

The multicast control plane builds and maintains multicast distribution trees. It communicates changes in the multicast routing table to the MFIB for multicast forwarding.

- Protocol Independent Multicast (PIM) builds and maintains multicast routing trees using reverse path forwarding (RPF) on a unicast routing table.
- Internet Group Management Protocol (IGMP) identifies multicast group members on subnets directly connected to the switch. Hosts manage multicast group membership with IGMP messages.
- The switch maintains an mroute (multicast routing) table when running PIM to provide forwarding tables used to deliver multicast packets.

The mroute table stores the states of inbound and outbound interfaces for each source/group pair \((S,G)\). The switch discards and forwards packets on the basis of this state information. Each table entry, referred to as an mroute, corresponds to a unique \((S,G)\) and contains:

- the multicast group address
- the multicast source address (or * for all sources)
38.2.2 Multicast Routing Information Base (MRIB)

The MRIB is the channel between multicast control plane clients and the multicast forwarding plane. The `show ip mroute` command displays MRIB entries as (*, G), (S, G), and (*, G/m) multicast entries. MRIB entries are based on source, group, and group masks. The entries are associated with a list of interfaces whose forwarding state is described with flags. MRIB communication is based on the state change of entry and interface flags. Flags are significant to MRIB clients but are not interpreted by the MRIB.

38.2.3 Multicast Forwarding Plane

The multicast forwarding plane consists of the multicast forwarding information base (MFIB), a forwarding engine that is independent of multicast routing protocols. MFIB formats PIM and IGMP multicast routes for protocol-independent hardware packet forwarding and adds them to the hardware multicast expansion table (MET) and the hardware FIB. MFIB uses a core forwarding engine for interrupt-level (fast switching) and process-level (process switching) forwarding. MFIB fast-switches inbound multicast packets that match an MFIB forwarding entry and process-switches packets requiring a forwarding entry if a matching entry does not exist.

38.2.4 Hardware Dependent Forwarding and Fast Drop

In IP multicast protocols, each (S,G) and (*,G) route corresponds to an inbound reverse path forwarding (RPF) interface. Packets arriving on non-RPF interfaces may require PIM processing, as performed by the CPU subsystem software. By default, hardware sends all packets arriving on non-RPF interfaces to the CPU subsystem software. However, the CPU can be overwhelmed by non-RPF packets that do not require software processing. The CPU subsystem software prevents CPU overload by creating a fast-drop entry in hardware for inbound non-RPF packets not requiring PIM processing. Packets matching a fast-drop entry are bridged in the ingress VLAN but not sent to the software, avoiding CPU subsystem software overload. Fast-drop entry usage is critical in topologies with persistent RPF failures.

Protocol events, such as links going down or unicast routing table changes, can change the set of packets that can be fast dropped. Packets that were correctly fast dropped before a topology change may require forwarding to the CPU subsystem software after the change. The CPU subsystem software handles fast-drop entries that respond to protocol events so that PIM can process all necessary non-RPF packets.
38.3 Multicast Listener Discovery (MLD)

Networks use Multicast Listener Discovery (MLD) to control the flow of layer 3 IPv6 multicast traffic. Hosts request and maintain multicast group membership through MLD messages. Multicast routers use MLD to maintain a membership list of active multicast groups for each attached network.

With respect to each of its attached networks, a multicast router is either a querier or non-querier. Each physical network contains only one querier. A network with more than one multicast router designates the router with the lowest IP address as its querier.

In an MLD Report or Done message, the multicast address field holds a specific IPv6 multicast address to which the message sender is listening or is ceasing to listen, respectively.

38.3.1 Platform Compatibility

- 7280R
- 7500R

38.3.2 Configuring Multicast Listener Discovery

38.3.2.1 Enabling MLD

Use `mld` command to enable MLD on an interface. When the switch fills the multicast routing table, it only adds interfaces when the interface receives join messages from downstream devices or when the interface is directly connected to a member of the MLD group. By default, MLD is disabled on an interface.

**Examples**

- This command enables MLD on the Ethernet interface 1.
  ```
  switch(config)#interface Ethernet 1
  switch(config-if-Et1)#mld
  ```
- This command disables MLD on the Ethernet interface 1.
  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#no mld
  ```

38.3.2.2 Configuring MLD

An interface that runs MLD uses default protocol settings unless otherwise configured. The switch provides commands that alter startup query, last member query, and normal query settings.

**MLD**

The switch supports MLD versions 1 through 2. The `mld` command configures multicast routers on the configuration mode interface. Version 2 is the default MLD version.

**Example**

- This command enables MLD on the Ethernet interface 1.
  ```
  switch(config)#interface Ethernet 1
  switch(config-if-Et1)#mld
  ```


**Startup Query**

Membership queries are sent at an increased frequency immediately after an interface starts up to quickly establish the group state. Query count and query interval commands adjust the period between membership queries for a specified number of messages.

The `mld startup-query-interval` command specifies the interval between membership queries that an interface sends immediately after it starts up. The `mld startup-query-count` command specifies the number of queries that the switches sends from the interface at the startup interval rate.

**Examples**

- This command configures the startup query count of 4 on an Ethernet interface 1.
  
  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld startup-query-count 4
  ```

- This command configures the startup query interval of 100 seconds on an Ethernet interface 1.

  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld startup-query-interval 100
  ```

**Membership Queries**

The router with the lowest IP address on a subnet sends membership queries as the MLD querier. When a membership query is received from a source with a lower IP address, the router resets its query response timer. Upon timer expiry, the router begins sending membership queries. If the router subsequently receives a membership query originating from a lower IP address, it stops sending membership queries and resets the query response timer.

The `mld query-interval` command configures the frequency at which the active interface, as an MLD querier, sends membership query messages.

The `mld query-response-interval` command configures the time that a host has to respond to a membership query.

**Examples**

- This command configures the query interval of 30 seconds on an Ethernet interface 1.

  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld query-interval 30
  ```

- This command configures the query response interval of 30 seconds on an Ethernet interface 1.

  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld query-response-interval 30
  ```

**Last Member Query**

When the querier receives an MLD leave message, it verifies the group has no remaining hosts by sending a set of group-specific queries at a specified interval. If the querier does not receive a response to the queries, it removes the group state and discontinues multicast transmissions.

The `mld last-listener-query-count` command specifies the number of query messages the router sends in response to a group-specific or group-source-specific leave message.

The `mld last-listener-query-interval` command configures the transmission interval for sending group-specific or group-source-specific query messages to the active interface.
Examples

- This command configures the last listener query count to 3 on an Ethernet interface 1.
  ```
  switch(config)#interface Ethernet 1
  switch(config-if-Et1)#mld last-listener-query-count 3
  ```
- This command configures the last listener query interval to 2 seconds on an Ethernet interface 1.
  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld last-listener-query-interval 2
  ```

Static Groups

The `mld static-group` command configures the configuration mode interface as a static member of the multicast group at the specified address. The router forwards multicast group packets through the interface without otherwise appearing or acting as a group member. No interface is a static member of a multicast group by default.

Example

- This command configures static groups on an interface Ethernet 1.
  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld static-group ff30::1 a::1
  ```
38.4 Static IP Mroute

The Static IP Multicast route (or Static Mroute) interface overrides the interface that is ordinarily selected from the matching route in the unicast routing table, providing a means for breaking dependency on the unicast topology for the multicast topology. Let us assume that, PIM routers in a multicast network sends PIM joins towards a source to receive traffic from that source. The interface on which to send a PIM join is determined by looking up the unicast routing table for the source address. This interface is the “upstream” or “RPF” interface for that source. When traffic is received from that source, it is ensured it is received on the RPF interface for that source. This mechanism causes multicast traffic to take the same path through a network as unicast traffic would. In some cases, it is desirable to have the multicast traffic take a different path than the unicast traffic. For example, to avoid a slow firewall required for unicast traffic but not for multicast traffic or to receive multicast across a low latency, low bandwidth microwave link while unicast traverses a higher latency, higher bandwidth fiber path.

To overcome this situation, a static IP multicast route (or static mroute) command `ip mroute` command is introduced. The `ip mroute` command specifies a candidate for the RPF interface of any (S,G) multicast route where the source falls within the given source/mask. This interface potentially overrides the interface that would ordinarily have been selected from the matching route in the unicast routing table. This command, therefore, provides a means of breaking the dependence of the multicast topology on the unicast topology. The method of selecting the RPF interface for an (S,G) route is described next.

**Example**

- This command configures a Static IP mroute for a source 1.1.1.1/32 with an administrative distance 20 on an Ethernet interface 2/1.

```
switch(config)#ip mroute 1.1.1.1/32 ethernet 2/1 20
```

38.4.1 Selecting Static Mroute

The Static Mroute is selected based on the following parameters:

- Longest Match
- Administrative Distance
- Interface Status

**Longest Match**

When a given source matches multiple static Mroutes in the MRIB, the longest match will be selected. The order in which the static Mroutes were configured will not be a factor.

**Example**

- If the following static mroutes were configured in order:

```
ip mroute 0.0.0.0/0 Ethernet1
ip mroute 192.168.0.0/16 Ethernet2
ip mroute 192.168.1.0/24 Ethernet3
```

For an (S,G) route where S = 192.168.1.1, the third static mroute listed above would be selected since it is the most specific route to the source. The RPF interface would therefore be Ethernet 3. The table below shows the selected RPF interface for 3 different sources based on the configuration above:
Administrative Distance

User is allowed to specify an administrative distance with each static Mroute. While selecting a Static Mroute for a source, if multiple Static Mroute exist in the MRIB with the same source/mask, then, the one with the lowest Admin distance is selected. The default administrative distance for a Static Mroute is 1.

Interface Status

For a Static Mroute to be considered for selection, the specified interface must be UP and PIM must be enabled on it.

38.4.2 Selecting RPF interface

Static Mroutes are BGP IP Multicast (SAFI 2) learned routes. These routes are stored in the multicast routing information base (MRIB), a separate routing table. The RPF interface is selected for a source as follows:

Initially, a source route is looked up in the MRIB. If the MRIB lookup yields a route, that route is used for selecting the RPF interface. Therefore, any configured Static Mroutes matching the source wins the selection process over a 'Connected' route to the source. For a static mroute to be considered for selection, the specified interface must be up and PIM must be enabled on it. By default, Static Mroute have an Admin distance of 1. If multiple Static Mroutes exist with equal longest prefix match, the mroute with the lowest Admin distance will win. Admin distance is not be used to compare selection between unicast RIB and MRIB routes. Successful Static Mroute looked up in the MRIB are always chosen over unicast RIB lookups.

If MRIB lookup does not yield a route, then the unicast RIB is looked up for a route to select the RPF interface. If the selected route has ECMP, one of the corresponding paths is selected as RPF neighbor.

Note

The path to choose RPF neighbor is selected based on the hashing scheme; and protocols specified for valid paths, multi-path configuration, directly connected sources, and assert winners.

Example

- Let us assume that the Static Mroute is configured, and for this example let us consider that the default Admin distance for connected routes is 0, 1 for static routes, and 110 for OSPF routes.

  ip mroute 172.16.0.0/16 Ethernet1
  ip mroute 192.168.0.0/16 Ethernet2
  ip mroute 192.168.1.0/24 Ethernet3
  ip mroute 192.168.1.0/24 Ethernet4 255
  ip mroute 192.168.1.3/32 Ethernet5 255
  ip mroute 200.10.0.0/16 Ethernet5
  ip mroute 200.11.0.32/16 Ethernet5

- So the MRIB table contains the following:
And let us assume the unicast RIB table contains the following:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Interface</th>
<th>Protocol</th>
<th>Admin Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>172.16.0.0/16</td>
<td>Ethernet 1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>192.168.0.0/16</td>
<td>Ethernet 2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>192.168.1.0/24</td>
<td>Ethernet 3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>192.168.1.0/24</td>
<td>Ethernet 4</td>
<td></td>
<td>255</td>
</tr>
<tr>
<td>192.168.1.3/32</td>
<td>Ethernet 5</td>
<td></td>
<td>255</td>
</tr>
<tr>
<td>200.10.0.0/16</td>
<td>Ethernet 5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>200.11.0.1/32</td>
<td>Ethernet 5</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
The table below shows the RPF interface selections for a set of sources along with which Static Mroute was chosen, which unicast RIB route was chosen, which was the eventual winner, and the reasoning behind the selection.

<table>
<thead>
<tr>
<th>Source</th>
<th>Static Mroute</th>
<th>Unicast Route</th>
<th>Winner</th>
<th>RPF Interface</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0.0.1</td>
<td>-</td>
<td>1</td>
<td>Unicast Route</td>
<td>Ethernet 6</td>
<td>Only the unicast Rib yields a route to the source so it wins</td>
</tr>
<tr>
<td>200.11.0.1</td>
<td>7</td>
<td>-</td>
<td>Static Mroute</td>
<td>Ethernet 5</td>
<td>Only the MRIB yields a route to the source so it wins</td>
</tr>
<tr>
<td>192.168.1.3</td>
<td>5</td>
<td>5</td>
<td>Unicast Route</td>
<td>Ethernet 10</td>
<td>In the MRIB (5) is the longest match. While comparing the static mroute and the unicast route, the unicast route is the winner because it has a lower Admin distance</td>
</tr>
<tr>
<td>192.168.2.1</td>
<td>2</td>
<td>3</td>
<td>Static Mroute</td>
<td>Ethernet 2</td>
<td>In the MRIB (2) is the longest match. While comparing the static mroute and the unicast route, the static Mroute is the winner because it has a lower Admin distance</td>
</tr>
<tr>
<td>192.168.1.1</td>
<td>3</td>
<td>4</td>
<td>Static Mroute</td>
<td>Ethernet 3</td>
<td>In the MRIB both (3) and (4) are the longest match but (3) has the lower Admin distance. While comparing the static mroute and the unicast route, the static mroute is the winner even though both have the same distance</td>
</tr>
</tbody>
</table>
38.5 Multicast Configuration

This section describes the following configuration tasks:

- Section 38.5.1: Multicast Configuration
- Section 38.5.2: Configuring MFIB
- Section 38.5.3: Displaying and Clearing the Mroute Table

38.5.1 Multicast Configuration

38.5.1.1 Enabling IPv4 Multicast Routing

Enabling IPv4 multicast routing allows the switch to forward multicast packets. The `routing` command enables multicast routing. When multicast routing is enabled, `running-config` contains a `routing` statement.

**Example**

These commands enable IPv4 multicast routing on the switch.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#routing
```

38.5.1.2 Enabling IPv6 Multicast Routing

Enabling IPv6 Multicast routing allows the switch to distribute IPv6 datagrams to one or more recipients. IPv6 PIM builds and maintains Multicast routing using reverse path forwarding (RPF) based on unicast routing table. IPv6 PIM is protocol-independent and can use routing tables consisting of OSPFv3, IPv6 BGP or static routes, for RPF lookup. MLD is used to discover Multicast hosts and maintain group membership on directly attached link. This feature is supported on 7280R and 7500R. Source-specific multicast (SSM) is currently supported on L3 routed port.

**PIM Sparse Mode**

In PIM-SM, each host (sender and/or receiver) is associated with a designated router (DR) which acts for all directly connected hosts in PIM-SM transactions. Upon receiving of MLD report from host or PIM join from downstream PIM neighbor, (S,G) route is created or programmed and router sends a PIM join to upstream PIM neighbor with shortest path to the source.

**Configuring IPv6 Multicast Routing**

The following steps are to configure IPv6 multicast routing on the switch.

**Step 1** Enabling IPv6 multicast-routing

By default, multicast-routing is disabled on switch. The following commands are used to enable IPv6 multicast-routing.

**Example**

```
switch(config)#router multicast
switch(config-router-multicast)#ipv6
switch(config-router-multicast-ipv6)#routing
```

**Step 2** Enabling IPv6 PIM Sparse Mode

By default, IPv6 PIM is disabled on an interface. The `pim ipv6 sparse-mode` command enables an interface to participate in IPv6 multicast-routing domain.
Example

```
switch(config)#interface ethernet 15/1
switch(config-if-Et15/1)#pim ipv6 sparse-mode
```

**Note**

SVI is not supported.

**Step 3  Enabling MLD**

By default, MLD is disabled on an interface. Enabling MLD is needed only on the interface that is connected to the MLD host which would like to receive IPv6 multicast traffic.

Example

```
switch(config)#interface ethernet 15/1
switch(config-if-Et15/1)#mld
```

**38.5.1.3 Multicast-Routing Configuration Example**

```
router multicast
ipv6
Routing
interface Ethernet15/1
no switchport
ipv6 enable
ipv6 address 40:1::3/64
mld
pim ipv6 sparse-mode
```

**Displaying IPv6 Multicast Routing Information**

- The `show mld membership` command displays the MLD group membership table as shown.

```
switch#show mld membership
Interface Group Source
Filter Mode
-------------------------------------------------------------
Ethernet2/1.1 ff33::1:0:0:1 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:2 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:3 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:4 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:5 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:6 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:7 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:8 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:9 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:a 101:1::2
   include
Ethernet2/1.1 ff33::1:0:0:b 101:1::2
   include
```
• The `show pim ipv6 sparse-mode route` command displays the PIM Sparse Mode Multicast Routing table as shown.

```
switch# show pim ipv6 sparse-mode route
PIM Sparse Mode Multicast Routing Table
Flags: E - Entry forwarding on the RPT, J - Joining to the SPT
       R - RPT bit is set, S - SPT bit is set, L - Source is attached
       W - Wildcard entry, X - External component interest
       I - SG Include Join alert rcvd, P - (*,G) Programmed in hardware
       H - Joining SPT due to policy, D - Joining SPT due to protocol
       Z - Entry marked for deletion, C - Learned from a DR via a register
       A - Learned via Anycast RP Router, M - Learned via MSDP
       N - May notify MSDP, K - Keepalive timer not running
       T - Switching Incoming Interface, B - Learned via Border Router
RPF route: U - From unicast routing table
          M - From multicast routing table
ff33::1:0:0:1
  101:1::2, 2:03:00, flags: S
  Incoming interface: Ethernet11/1
  RPF route: [U] 101:1::/64 [110/1] via fe80::464c:a8ff:feb7:39e9
  Outgoing interface list:
    Ethernet6/1.1
    Ethernet4/1.1
    Ethernet7/1.1
    Ethernet9/1.1
    Ethernet8/1.1
    Ethernet2/1.1
    Ethernet5/1.1
    Ethernet3/1.1
```

• The `show multicast fib ipv6` command displays the Multicast Forwarding Information Base (MFIB) table.

```
switch# show mfib ipv6
Activity poll time: 60 seconds
ff33::1::0:0:1
  101:1::2, 2:03:00, flags: S
  Incoming interface: Ethernet11/1
  RPF route: [U] 101:1::/64 [110/1] via fe80::464c:a8ff:feb7:39e9
  Outgoing interface list:
    Ethernet6/1.1
    Ethernet4/1.1
    Ethernet7/1.1
    Ethernet9/1.1
    Ethernet8/1.1
    Ethernet2/1.1
    Ethernet5/1.1
    Ethernet3/1.1
Activity 0:00:35 ago
```
• The `show platform fap mroute ipv6` command displays the Platform Hardware Forwarding table.

```
switch# show platform fap mroute ipv6
 Jericho0 Multicast Routes:
                    Location     GroupId     Group                                      Source
IIF      McId       OIF
--------------------------
  FLP/TT     FLP/TT       TT                        FLP
  FLP         FLP         FLP
-------------------------------------------------------------------------------
  4096/2048   1/1      ff33::1:0:0:23/128          101:1::2/128
  Vlan1357  21504     Vlan1044(Et7/1) Vlan1123(Et9/1)
  Vlan1200(Et8/1) Vlan1223(Et2/1)
  Vlan1226(Et5/1) Vlan1232(Et3/1)
  Vlan1307(Et6/1) Vlan1337(Et4/1)
```

38.5.1.4 Multicast Boundary Configuration

The multicast boundary specifies subnets where source traffic entering an interface is filtered to prevent the creation of mroute states on the interface. The interface is not included in the outgoing interface list (OIL). Multicast PIM, IGMP and other multicast data cannot cross the boundary, facilitating the use of a multicast group address in multiple administrative domains.

The `ip multicast boundary` command configures the multicast boundary. The multicast boundary can be specified through multiple IPv4 subnets or one standard IPv4 ACL.

In an ACL method, the multicast subnets are allowed only from the permit entries of the ACL and rest is either denied or filtered. Whereas, in a non-ACL method the statements configure subnets that are only denied or filtered.

Examples

• These commands configure the multicast address of 229.43.23.0/24 as a multicast boundary where source traffic is restricted from VLAN interface 300.

```
switch(config)# interface vlan 300
switch(config-if-vl300)# ip multicast boundary 229.43.23.0/24
switch(config-if-vl300)#
```

• These commands create a standard ACL, then implement the ACL in an `ip multicast boundary` command to allow multicast for subnet (224.0.0.0/4) and create a multicast boundary for all remaining subnets by denying them.

```
switch(config)# ip access-list standard mbac1
switch(config-std-acl-mbac1)# 10 deny 225.123.0.0/16
switch(config-std-acl-mbac1)# 20 deny 239.120.10.0/24
switch(config-std-acl-mbac1)# 30 permit 224.0.0.0/4
switch(config-std-acl-mbac1)# exit
switch(config)# interface vlan 200
switch(config-if-Vl200)# ip multicast boundary mbac1
switch(config-if-Vl200)# exit
switch(config)#
```

38.5.2 Configuring MFIB

MFIB formats PIM and IGMP multicast routes for protocol-independent hardware packet forwarding and adds them to the hardware multicast expansion table (MET) and the hardware FIB.
MFIB Polling Interval
The switch records activity levels for multicast routes in the MFIB after polling the corresponding hardware activity bits. The `activity polling-interval` command specifies the frequency at which the switch polls the hardware activity bits for the multicast routes.

Example
- These commands set the MFIB activity polling period to 15 seconds.
  
  ```
  switch(config)#router multicast
  switch(config-router-multicast)#ipv4
  switch(config-router-multicast-ipv4)#activity polling-interval 15
  switch(config-router-multicast-ipv4)#
  ```

MFIB Fast Drops
In IP multicast protocols, every (S,G) or (*,G) route is associated with an inbound RPF (reverse path forwarding) interface. Packets arriving on an interface not associated with the route may need CPU-dependent PIM processing, so packets received by non-RPF interfaces are sent to the CPU by default, causing heavy CPU processing loads.

Multicast routing protocols often do not require non-RPF packets; these packets do not require software processing. The CPU therefore updates the hardware MFIB with a fast-drop entry when it receives a non-RPF interface packet that PIM does not require. Additional packets that match the fast-drop entry are not sent to the system software.

Fast drop is enabled on all interfaces by default. The `no ip mfib fastdrop` command disables MFIB fast drop for the configuration mode interface.

Example
- This command disables MFIB fast drop for the VLAN interface 120.
  
  ```
  switch(config)#interface vlan 120
  switch(config-if-Vl120)#no ip mfib fastdrop
  switch(config-if-Vl120)#
  ```

The `ip mfib max-fastdrops` command limits the number of fast-drop routes that the switch’s MFIB table can contain. The default fast-drop route limit is 1024.

Example
- This command sets the maximum number of fast-drop routes to 2000.
  
  ```
  switch(config)#ip mfib max-fastdrops 2000
  switch(config)#
  ```

The `clear ip mfib fastdrop` command, in global configuration mode, removes all MFIB fast-drop entries on all interfaces.

Example
- This command removes all fast-drop entries from the MFIB table.
  
  ```
  switch#clear ip mfib fastdrop
  switch#
  ```

The `show multicast fib ipv4` command displays information about the routes and interfaces in the IPv4 MFIB.
- `show multicast fib ipv4` displays MFIB information for hardware-forwarded routes.
- `show multicast fib ipv4 software` displays MFIB information for software-forwarded routes.
Example

- This command displays MFIB information for hardware-forwarded routes.

```bash
switch>show multicast fib ipv4
Activity poll time: 60 seconds
239.255.255.250 172.17.26.25
  Vlan26 (iif)
  Vlan2028
  Cpu
    Activity 0:02:11 ago
239.255.255.250 172.17.26.156
  Vlan26 (iif)
  Vlan2028
  Cpu
    Activity 0:02:11 ago
239.255.255.250 172.17.26.178
  Vlan26 (iif)
  Vlan2028
  Cpu
    Activity 0:03:37 ago
switch>
```

**MFIB Unresolved Cache-entries Max**

The `unresolved cache-entries max` command configures the maximum number of unresolved (S,G) routes that the switch can cache packets. All packets belonging to (S,G) routes exceeding the limit are dropped. The default buffer size is 4000 routes. See `ip multicast boundary` to limit the number of cached packets per S,G.

Example

- This command sets the maximum MFIB unresolved cache-entry buffer size to 6000 routes in the default VRF.

```bash
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#unresolved cache-entries max 6000
switch(config-router-multicast-ipv4)#
```

**MFIB Unresolved Packet-buffers Max**

The `ip multicast boundary` command specifies the number of packets per unresolved route that are queued while the route is being resolved by the switch. The limit for `ip multicast boundary` is for an individual route, packets that exceed this limit are dropped. By default, the switch processes 3 unresolved packets for an individual route. See unresolved cache-entries max to limit the number of unresolved routes that are cached.

Example

- This command configures the switch in the default VRF to cache up to thirty multicast packets from any route before that route is resolved.

```bash
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#unresolved packet-buffers max 30
switch(config-router-multicast-ipv4)#
```
38.5.3 Displaying and Clearing the Mroute Table

The mroute table stores the states of inbound and outbound interfaces for each source/group pair (S,G). The switch discards and forwards packets on the basis of this state information. Each table entry, referred to as an mroute, corresponds to a unique (S,G) and contains:

- the multicast group address
- the multicast source address (or * for all sources)
- the inbound interface
- a list of outbound interfaces

Clearing mroute Entries

The clear ip mroute command removes route entries from the mroute table:

- clear ip mroute * all entries from the mroute table.
- clear ip mroute gp_ipv4 all entries for the specified multicast group.
- clear ip mroute gp_ipv4 src_ipv4 all entries for the specified source sending to a specified group.

Examples

- This command removes all route entries from the mroute table.
  
  switch#clear ip mroute *
  
  switch#

- This command removes entries for source 228.3.10.1 sending to multicast group 224.2.205.42.
  
  switch#clear ip mroute 224.2.205.42 228.3.10.1
  
  switch#

Displaying the mroute Table

The show ip mroute command displays information from the IP multicast routing table.

Example

- This command displays IP multicast routing table statistics.
  
  switch>show ip mroute count
  
  IP Multicast Statistics
  1 groups and 1 sources
  Multicast routes: 1 (*,G), 1 (S,G)
  Average of 1.00 sources per group
  Maximum of 1 sources per group:
    228.24.12.1
  switch>

  The show ip mroute command displays information from the IP multicast routing table.

- show ip mroute displays information for all routes in the table.
- show ip mroute gp_addr displays information for the specified multicast group.
Example

- This command displays the IP multicast routing table for the multicast group 225.1.1.1.

```bash
switch>show ip mroute 225.1.1.1
PIM Sparse Mode Multicast Routing Table
Flags: E - Entry forwarding on the RPT, J - Joining to the SPT
R - RPT bit is set, S - SPT bit is set
W - Wildcard entry, X - External component interest
I - SG Include Join alert rcvd, P - Ex-Prune alert rcvd
H - Joining SPT due to policy, D - Joining SPT due to protocol
Z - Entry marked for deletion
A - Learned via Anycast RP Router
225.1.1.1
  172.28.1.100, 5d04h, flags: S
  Incoming interface: Vlan281
  Outgoing interface list:
    Port-Channel1999
switch>
```
38.6 Multicast Commands

Multicast Configuration Commands (Global)
- activity polling-interval
- ip mfib max-fastdrops
- ip mroute
- ip multicast boundary
- ip multicast static
- multipath deterministic
- multipath none
- route
- router multicast
- routing
- unresolved cache-entries max

Multicast Configuration Commands (Interface)
- ip mfib fastdrop
- ip multicast boundary

Multicast Clear Commands
- clear ip mfib fastdrop
- clear ip mroute

Multicast Display Commands
- show ip mroute
- show ip mroute count
- show ip multicast boundary
- show pim ipv6 sparse-mode route
- show multicast fib ipv4
- show multicast fib ipv4 software
- show multicast fib ipv6
- show pim ipv6 sparse-mode route
- show platform fap mroute ipv6
activity polling-interval

The switch records activity levels for multicast routes in the mfib after polling the corresponding hardware activity bits. The **activity polling-interval** command specifies the frequency at which the switch polls the hardware activity bits for the multicast routes.

The **no activity polling-interval** and **default activity polling-interval** commands restore the default interval of 60 seconds by removing the **activity polling-interval** command from **running-config**.

**Command Mode**

Router Multicast IPv4 Configuration

**Command Syntax**

```
activity polling-interval period
no activity polling-interval
default activity polling-interval
```

**Parameters**

- **period**  
  interval (seconds) between polls. Values range from 1 to 60. Default is 60.

**Example**

- These commands set the MFIB activity polling period to 15 seconds.

  ```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#activity polling-interval 15
switch(config-router-multicast-ipv4)#
```
clear ip mfib fastdrop

The clear ip mfib fastdrop command removes all fast-drop entries from the MFIB table.

**Command Mode**
Privileged EXEC

**Command Syntax**
clear ip mfib fastdrop

**Example**
- This command removes all fast-drop entries from the MFIB table.

```
switch#clear ip mfib fastdrop
switch#
```
clear ip mroute

The `clear ip mroute` command removes route entries from the mroute table, as follows:

- `clear ip mroute *` removes all entries from the mroute table.
- `clear ip mroute gp_ipv4` removes all entries for the specified multicast group.
- `clear ip mroute gp_ipv4 src_ipv4` removes all entries for the specified source sending to the specified group.

Command Mode
Privileged EXEC

Command Syntax
`clear ip mroute ENTRY_LIST`

Parameters
- `ENTRY_LIST` entries that the command removes from the mroute table. Options include:
  - `*` all route entries
  - `gp_ipv4` all entries for multicast group `gp_ipv4` (dotted decimal notation)
  - `gp_ipv4 src_ipv4` all entries for source (`src_ipv4`) sending to group (`gp_ipv4`)

Examples
- This command removes all route entries from the mroute table.
  
  ```
  switch#clear ip mroute *
  switch#
  ```

- This command removes entries for the source 228.3.10.1 sending to multicast group 224.2.205.42.
  
  ```
  switch#clear ip mroute 224.2.205.42 228.3.10.1
  switch#
  ```
**ip mfib fastdrop**

In IP multicast protocols, every (S,G) or (*,G) route is associated with an inbound RPF (reverse path forwarding) interface. Packets arriving on an interface not associated with the route may need CPU-dependent PIM processing, so packets received by non-RPF interfaces are sent to the CPU by default, causing heavy CPU processing loads.

Multicast routing protocols often do not require non-RPF packets; these packets do not require software processing. The CPU therefore updates the hardware MFIB with a fast-drop entry when it receives a non-RPF interface packet that PIM does not require. Additional packets that match the fast-drop entry are not sent to the system software.

Fast drop is enabled on all interfaces by default. The `no ip mfib fastdrop` command disables MFIB fast drop for the configuration mode interface.

The `ip mfib fastdrop` and `default ip mfib fastdrop` commands enable MFIB fast drop for the configuration mode interface by removing the corresponding `no ip mfib fastdrop` command from `running-config`.

The `clear ip mfib fastdrop` command, in global configuration mode, removes all MFIB fast-drop entries on all interfaces.

**Command Mode**

- Interface-Ethernet Configuration
- Interface-Port-channel Configuration
- Interface-VLAN Configuration

**Command Syntax**

- `ip mfib fastdrop`
- `no ip mfib fastdrop`
- `default ip mfib fastdrop`

**Examples**

- This command disables MFIB fast drop for VLAN interface 120.

  ```plaintext
  switch(config)#interface vlan 120
  switch(config-if-Vl120)#no ip mfib fastdrop
  switch(config-if-Vl120)#
  ```
ip mfib max-fastdrops

The `ip mfib max-fastdrops` command limits the number of fast-drop routes that the switch’s MFIB table can contain.

The `no ip mfib max-fastdrops` and `default ip mfib max-fastdrops` commands restore the default fast-drop route limit of 1024 by removing the `ip mfib max-fastdrops` command from `running-config`.

Command Mode
- Global Configuration

Command Syntax
- `ip mfib max-fastdrops quantity`
- `no ip mfib max-fastdrops`
- `default ip mfib max-fastdrops`

Parameters
- `quantity` maximum number of fast-drop routes. Value ranges from 0 to 1000000 (one million). Default is 1024.

Example
- This command sets the maximum number of fast-drop routes to 2000.

```
switch(config)#ip mfib max-fastdrops 2000
switch(config)#
```
ip mroute

The ip mroute command configures the Static Mroute on the switch.
The no ip mroute and default ip mroute commands remove the specified static mroute from running-config.

Command Mode
  Global Configuration

Command Syntax
  ip mroute [ <source-prefix>|<source-address> <mask> ]
  [ <rpf-interface>|<rpf-neighbor> ]
  [ admin distance ]

Example
  • This command configures a Static IP mroute for a source 1.1.1.1/32 with an administrative distance 20 on a Ethernet interface 2/1.

    switch(config)#ip mroute 1.1.1.1/32 ethernet 2/1 20
ip multicast boundary

The ip multicast boundary command specifies subnets where source traffic entering the configuration mode interface is dropped, preventing the creation of mroute states on the interface. The interface is not included in the outgoing interface list (OIL). The multicast boundary can be specified through multiple IPv4 subnets or one standard IPv4 ACL.

In an ACL method, the multicast subnets are allowed only from the permit entries of the ACL and rest is either denied or filtered. Whereas, in a non-ACL method the statements configure subnets that are only denied or filtered.

Multicast PIM, IGMP and other multicast data cannot cross the boundary, facilitating the use of a multicast group address in multiple administrative domains.

The no ip multicast boundary and default ip multicast boundary commands delete the specified subnet restriction by removing the corresponding ip multicast boundary command from running-config. When these commands do not specify a subnet address, all ip multicast boundary statements for the configuration mode interface are removed.

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

Command Syntax
ip multicast boundary SUBNET [TCAM]
no ip multicast boundary [SUBNET]
default ip multicast boundary [SUBNET]

Parameters
- SUBNET  the subnet address configured as the multicast boundary. Options include:
  - net_addr  multicast subnet address (CIDR or address mask).
  - acl_name  standard access control list (ACL) that specifies the multicast group addresses.
- TCAM  specifies address inclusion in the routing table. Options include:
  - <no parameter>  boundaries ((S,G) entries) are added to routing table.
  - out  boundaries are not added to routing table.

Guidelines
When out is selected, the first inbound data packet corresponding to the SUBNET may be sent to the CPU. In response, the packet is dropped and the boundary prefix is added to the hardware table. In this scenario, the mroute entry is added only when data traffic is received.

Restrictions
Only one command that specifies an ACL can be assigned to an interface. Commands that specify an ACL and a subnet cannot be simultaneously assigned to an interface.

Examples
- This command configures the multicast address of 229.43.23.0/24 as a multicast boundary where source traffic is restricted from VLAN interface 300.
  switch(config)#interface vlan 300
  switch(config-if-vl300)#ip multicast boundary 229.43.23.0/24
  switch(config-if-vl300)#
• These commands create a standard ACL, then implement the ACL in an ip multicast boundary command to allow multicast for subnet (224.0.0.0/4) and create a multicast boundary for all remaining subnets by denying them.

    switch(config)#ip access-list standard mbac1
    switch(config-std-acl-mbac1)#10 deny 225.123.0.0/16
    switch(config-std-acl-mbac1)#20 deny 239.120.10.0/24
    switch(config-std-acl-mbac1)#30 permit 224.0.0.0/4
    switch(config-std-acl-mbac1)#exit
    switch(config)#interface vlan 200
    switch(config-if-Vl200)#ip multicast boundary mbac1
    switch(config-if-Vl200)#exit
    switch(config)#
**ip multicast static**

The `ip multicast static` command enables static multicast routing on the switch.

The `exit` command returns the switch to global configuration mode.

**Command Mode**
- Interface Ethernet Configuration

**Command Syntax**
- `ip multicast static`

**Example**
- The following commands configure the static multicast routing on the switch.

```
switch(config)#interface ethernet 1/2
switch(config-if-Et1/2)#no switchport
switch(config-if-Et1/2)#ip address 1.1.1.1/24
switch(config-if-Et1/2)#ip multicast static
```
mld

The mld command enables multicast listener discovery on an interface which controls the flow of layer 3 IPv6 multicast traffic. Hosts request and maintain multicast group membership through MLD messages. Multicast routers use MLD to maintain a membership list of active multicast groups for each attached network.

The no mld and default mld commands restore the default behavior by removing the corresponding mld command from the running-config.

Note

It is possible to change the values of the querier parameters used by MLD.

Command Syntax

mld | last-listener-query-count | last-listener-query-interval | query-interval |
| query-response-interval | robustness | startup-query-count |
| startup-query-interval | static-group
no mld
default mld

Command Mode

Interface-Ethernet Configuration

Parameters

• last-listener-query-count the number of group-specific or group-source-specific queries to send before the router assumes there are no more listeners.
• last-listener-query-interval the interval between the last listener queries.
• query-interval the interval between the general queries regularly sent by a querier.
• query-response-interval the interval that the host has to respond to a general query.
• robustness the number of general queries to send before the router assumes there are no more listeners.
• startup-query-count the number of queries a router sends at startup.
• startup-query-interval the interval between the general queries sent by a querier at startup.
• static-group the number of static groups or sources of MLD messages.

Examples

• This command enables MLD on the Ethernet interface 1.

  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld
mld last-listener-query-count

The `mld last-listener-query-count` command specifies the number of query messages the switch sends in response to a group-specific or group-source-specific leave message.

After receiving a message from a host leaving a group, the switch sends query messages at intervals specified by `mld last-listener-query-interval`. If the switch does not receive a response to the queries after sending the number of messages specified by this parameter, it stops forwarding messages to the host.

The `no mld last-listener-query-count` and `default mld last-listener-query-count` commands reset the last-listener-query-count to the default value by removing the corresponding `mld last-listener-query-count` command from the `running-config`. Default value is 2.

**Command Mode**
Interface-Ethernet Configuration

**Command Syntax**
- `mld last-listener-query-count number`
- `no mld last-listener-query-count`
- `default mld last-listener-query-count`

**Parameters**
- `number` the last listener query count. Values range from 0 to 100. Default value is 2.

**Example**
- This command configures the last listener query count to 3 on an Ethernet interface 1.

```
switch(config)#interface Ethernet 1
switch(config-if-Et1)#mld last-listener-query-count 3
```
**mld last-listener-query-interval**

The *mld last-listener-query-interval* command configures the switch’s transmission interval for sending group-specific or group-source-specific query messages from the configuration mode interface.

When a switch receives a message from a host that is leaving a group, it sends query messages at intervals set by this command. The *mld last-listener-query-count* specifies the number of messages that are sent before the switch stops forwarding packets to the host.

If the switch does not receive a response after this period, it stops forwarding traffic to the host on behalf of the group, source, or channel.

The *no mld last-listener-query-interval* and *default mld last-listener-query-interval* commands reset the last-listener-query-interval to the default value by removing the corresponding *mld last-listener-query-interval* command from the *running-config*. Default value is one second.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
  mld last-listener-query-interval period
  no mld last-listener-query-interval
  default mld last-listener-query-interval
```

**Parameters**

- *period*  the last listener query interval in seconds. Values range from 1 to 3175.

**Example**

- This command configures the last listener query interval to 2 seconds on an Ethernet interface 1.

  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld last-listener-query-interval 2
  ```
**mld query-interval**

The `mld query-interval` command configures the frequency at which the configuration mode interface, as an MLD querier, sends host-query messages.

An MLD querier sends host-query messages to discover the multicast groups that have members on networks attached to the interface. The switch implements a default query interval of 125 seconds.

The `no mld query-interval` and `default mld query-interval` commands reset the query interval to the default value by removing the corresponding `mld query-interval` command from the `running-config`.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
mld query-interval period
no mld query-interval
default mld query-interval
```

**Parameters**

- `period` the interval between query messages in seconds. Values range from 1 to 3175.

**Example**

- This command configures the query interval of 30 seconds on an Ethernet interface 1.
  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld query-interval 30
  ```
mld query-response-interval

The `mld query-response-interval` command configures the maximum response time that the recipient can wait before responding with a membership report on receipt of a general query.

The `no mld query-response-interval` and `default mld query-response-interval` commands reset the query interval to the default value by removing the corresponding `mld query-response-interval` command from the `running-config`.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
mld query-interval period
no mld query-interval
default mld query-interval
```

**Parameters**

- `period`  the query response interval in seconds. Values range from 1 to 3175.

**Example**

- This command configures the query response interval of 30 seconds on an Ethernet interface 1.

```
switch(config)#interface Ethernet1
switch(config-if-Et1)#mld query-response-interval 30
```
**mld robustness**

The `mld robustness` command configures the number of general queries to be sent before the router assumes there are no more listeners.

The `no mld robustness` and `default mld robustness` commands reset the robustness to the default value by removing the corresponding `mld robustness` command from the `running-config`.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
  mld robustness robust_value
  no mld robustness
  default mld robustness
```

**Parameters**

- `robust_value`  the robustness count. Values range from 1 to 100.

**Example**

- This command configures the robustness value to 2 on an Ethernet interface 1.

```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld robustness 2
```
**mld startup-query-count**

The `mld startup-query-count` command specifies the number of query messages that an interface sends during the startup query interval.

When an interface starts running MLD, it can establish the group state more quickly by sending query messages at a higher frequency. The `mld startup-query-interval` and `mld startup-query-count` commands define the startup period and the query message transmission frequency during that period.

The `no mld startup-query-count` and `default mld startup-query-count` commands restore the default startup-query-count value by removing the corresponding `mld startup-query-count` command from the `running-config`.

**Command Mode**
Interface-Ethernet Configuration

**Command Syntax**

```
mld startup-query-count number
no mld startup-query-count
default mld startup-query-count
```

**Parameters**

- `number` the startup query count. Values range from 1 to 100.

**Example**

- This command configures the startup query count of 4 on an Ethernet interface 1.

```
switch(config)#interface Ethernet1
switch(config-if-Et1)#mld startup-query-count 4
```
mld startup-query-interval

The **mld startup-query-interval** command specifies the interval between the general queries sent by a querier on startup.

When an interface starts running MLD, it can establish the group state quicker by sending query messages at a higher frequency. The **mld startup-query-interval** and **mld startup-query-count** commands define the startup period and the query message transmission frequency during that period.

The **no mld startup-query-count** and **default mld startup-query-interval** commands restore the default startup-query-interval value by removing the corresponding **mld startup-query-interval** command from the *running-config*.

**Command Mode**

Interface-Ethernet Configuration

**Command Syntax**

```
 mld startup-query-interval period
 no mld startup-query-interval
 default mld startup-query-interval
```

**Parameters**

- **period**  
  the startup query interval in seconds. Values range from 1 to 3175.

**Example**

- This command configures the startup query interval of 100 seconds on an Ethernet interface 1.

  ```
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld startup-query-interval 100
  ```
mld static-group

The mld static-group command configures the configuration mode interface as a static member of a specified multicast group. This allows the router to forward multicast group packets through the interface without otherwise appearing or acting as a group member. By default, static group memberships are not configured on any interfaces.

If the command includes a source address, only multicast group messages received from the specified host address are fast-switched. Otherwise, all multicast traffic of the specified group is fast-switched.

The no mld static-group and default mld static-group commands remove the configuration mode interface’s group membership by removing the corresponding mld startup-group command from the running-config.

Command Mode
Interface-Ethernet Configuration

Command Syntax

mld static-group source_address [group_address | access-list acl_name]
no mld static-group source_address [group_address | access-list acl_name]
default mld static-group source_address [group_address | access-list acl_name]

Parameters
- source_address  IP address of the host that originates multicast data packets.
- group_address  IPv6 address of a multicast group.
- access-list  IPv6 access list to use as a static group list.
- acl_name  specifies access-list name

Examples
- This command configures static groups on an interface Ethernet 1.
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld static-group ff30::1 a::1
- This command configures multiple static groups using an access list on an interface Ethernet 1.
  switch(config)#interface Ethernet1
  switch(config-if-Et1)#mld static-group access-list testAccessList
**multipath deterministic**

By default, multicast traffic is load balanced by distributing packets over all ECMP links. The `no multipath deterministic` command routes multicast ECMP traffic to the neighbor with the highest IPv4 address.

The `multipath deterministic` and `default multipath deterministic` commands restore the default behavior of randomly distributing multicast traffic over all ECMP links.

**Command Mode**

Router Multicast IPv4 Configuration

**Command Syntax**

```
multipath deterministic
no multipath deterministic
default multipath deterministic
```

**Related Commands**

- `multipath none` performs the same function as `no multipath deterministic`

**Example**

- These commands configure the switch to route multicast traffic through the ECMP link to the neighbor with the highest IP address.

  ```
  switch(config)#router multicast
  switch(config-router-multicast)#ipv4
  switch(config-router-multicast-ipv4)#no multipath deterministic
  switch(config-router-multicast-ipv4)#
  ```

- These commands configure the switch to load balance multicast traffic by distributing packets over all ECMP links.

  ```
  switch(config)#router multicast
  switch(config-router-multicast)#ipv4
  switch(config-router-multicast-ipv4)#multipath deterministic
  switch(config-router-multicast-ipv4)#
  ```
**multipath none**

By default, multicast traffic is load balanced by distributing packets over all ECMP links. The `multipath none` command routes multicast ECMP traffic to the neighbor with the highest IPv4 address.

The `no multipath none` and `default multipath none` commands restore the default behavior of randomly distributing multicast traffic over all ECMP links by removing the `multipath none` command from `running-config`.

**Command Mode**
- Global Configuration

**Command Syntax**

```
multipath none
no multipath none
default multipath none
```

**Related Commands**
- `multipath deterministic` performs the same function as `no multipath none`

**Example**
- These commands configure the switch to route multicast traffic through the ECMP link to the neighbor with the highest IP address.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#multipath none
switch(config-router-multicast-ipv4)#
```

- These commands configure the switch to load balance multicast traffic by distributing packets over all ECMP links.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#no multipath none
switch(config-router-multicast-ipv4)#
```
route

The `route` command configures a static multicast route for the specified source, destination group, and incoming interface on the router.

The `no route` and `default route` commands remove the specified static multicast route by removing the corresponding `route` command from `running-config`.

**Command Mode**

- Router Multicast IPv4 Configuration
- Router Multicast VRF IPv4 Configuration

**Command Syntax**

```
route group_address [source_address] iif interface [oif interface] [cpu] [iifFrr interface] [priority priority_num]
no route group_address
default route group_address
```

**Parameters**

- `group_address` the multicast group address
- `source_address` the optional source address for the multicast route
- `iif interface` incoming interface for the static route
- `cpu` optionally mirrors multicast packets to the CPU
- `oif interface` optional outgoing interface to be included among those on which the multicast traffic is forwarded
- `iifFrr interface` optional interface for multicast-only fast reroute
- `interface` options include:
  - `Ethernet ethernet_port` Ethernet interface
  - `Null0` automatically installs a fastdrop for the route and drops all traffic
  - `Port-Channel lag_no` port-channel interface or sub-interface; values range from 1-2000 or 1-2000.1-4094
  - `Register0` mimics a PIM protocol state (primarily for testing) and drops all incoming traffic
  - `Vlan vlan_no` VLAN interface
- `priority priority_num` specifies an optional priority for the multicast route. If the same route is present in several multicast routing tables, the priority number is used to select the best available route. Values range from 0 to 255; PIM routes by default have a priority of 0, while static multicast routes by default have a priority of 255.

**Examples**

- These commands create a static multicast route in the default VRF. The static route has a group address of 225.3.3.3 and source address of 1.1.1.1. It uses VLAN 100 as its incoming interface, VLANs 200 and 300 as its outgoing interfaces, and Ethernet interface 2 as its multicast-only fast reroute interface.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#route 225.3.3.3 1.1.1.1 iif Vlan100 oif Vlan200 Vlan300 iifFrr Ethernet2
switch(config-router-multicast-ipv4)#
```
**router multicast**

The `router multicast` command places the switch in router-multicast configuration mode to configure IPv4 and IPv6 router multicast traffic.

**Command Mode**

Global Configuration

**Command Syntax**

`router multicast`

**Example**

- The following command places the switch in router-multicast configuration mode.

```plaintext
switch(config)#router multicast
switch(config-router-multicast)#
```
**routing**

The *routing* command allows the switch to forward multicast packets. Multicast routing is disabled by default.

The *no routing* and *default routing* commands disable multicast routing by removing the *routing* command from *running-config*.

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

**Command Syntax**
- `routing`
- `no routing`
- `default routing`

**Example**
- These commands enable multicast routing on the switch.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#routing
switch(config-router-multicast-ipv4)#
```
rpf route

The **rpf route** command specifies a candidate for the multicast reverse path forwarding (RPF) interface of any (S,G) multicast route (mroute), where the source falls within the given network prefix. Static mroutes are stored in a separate routing table, the multicast routing information base (MRIB).

**Command Mode**

Router Multicast IPv4 Configuration  
Router Multicast VRF IPv4 Configuration

**Command Syntax**

```
rpf route {<source_prefix>|<source_address> <mask>}  
{<rpf_interface>|<rpf_neighbor>)[admin_distance]
no rpf route {<source_prefix>|<source_address> <mask>}  
{<rpf_interface>|<rpf_neighbor>}
default rpf route {<source_prefix>|<source_address> <mask>}  
{<rpf_interface>|<rpf_neighbor>}
```

**Parameters**

- **source_prefix** specifies the source prefix.
- **source_address** specifies the source address.
- **mask** specifies the address mask.
- **rpf_interface** specifies the multicast RPF interface.
- **rpf_neighbor** specifies the multicast RPF neighbor.
- **admin_distance** specifies the administrative distance (optional). Values range from 1 to 255.

**Examples**

- These commands select the longest match when a source matches multiple static mroutes in the MRIB.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#rpf route 10.0.0.0/16 Ethernet 4
switch(config-router-multicast-ipv4)#rpf route 11.10.1.0/24 Ethernet 5
switch(config-router-multicast-ipv4)#rpf route 11.10.1.2/32 Ethernet 6
switch(config-router-multicast-ipv4)##
```

- These commands include an administrative distance of 255 on Ethernet interface 5 with static mroute.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#rpf route 10.0.0.0/16 Ethernet 4
switch(config-router-multicast-ipv4)#rpf route 11.10.1.0/24 Ethernet 5 255
switch(config-router-multicast-ipv4)#rpf route 11.10.1.2/32 Ethernet 6
switch(config-router-multicast-ipv4)#
```
**show ip mroute**

The `show ip mroute` command displays information from the IP multicast routing table.

- `show ip mroute` displays information for all routes in the table.
- `show ip mroute gp_addr` displays information for the specified multicast group.

**Command Mode**

EXEC

**Command Syntax**

```
show ip mroute
show ip mroute gp_addr
```

**Parameters**

- `gp_addr` group IP address (dotted decimal notation).

**Example**

- This command displays the IP multicast routing table entry for the multicast group 225.1.1.11

```
switch>show ip mroute 225.1.1.11
PIM Sparse Mode Multicast Routing Table
Flags: E - Entry forwarding on the RPT, J - Joining to the SPT
       R - RPT bit is set, S - SPT bit is set
       W - Wildcard entry, X - External component interest
       I - SG Include Join alert rcvd, P - Ex-Prune alert rcvd
       H - Joining SPT due to policy, D - Joining SPT due to protocol
       Z - Entry marked for deletion
       A - Learned via Anycast RP Router
225.1.1.1
   172.28.1.100, 5d04h, flags: S
   Incoming interface: Vlan281
   Outgoing interface list:
     Port-Channel1999
switch>
```
show ip mroute count

The **show ip mroute count** command displays IP multicast routing table statistics.

The **show ip mroute** command displays information from the IP multicast routing table.

**Command Mode**

EXEC

**Command Syntax**

`show ip mroute count`

**Example**

- This command displays IP multicast routing table statistics.

```
switch>show ip mroute count
IP Multicast Statistics
1 groups and 1 sources
Multicast routes: 1 (*,G), 1 (S,G)
Average of 1.00 sources per group
Maximum of 1 sources per group:
    228.24.12.1
switch>
```
show ip multicast boundary

The *show ip multicast boundary* command displays the summary of all IP multicast boundaries across all interfaces.

**Command Mode**

EXEC

**Command Syntax**

```
show ip multicast boundary [group_prefix | group_prefix/length [out] | interface {ethernet e_num | loopback l_num | management m_num | port-channel p_num | vlan v_num} | out]
```

**Parameters**

- `<no parameters>` displays the summary of all IP multicast boundaries across all interfaces
- `group_prefix` displays the list of IP multicast boundaries matching the specified group address with subnet mask.
- `group_prefix/length` displays the list of IP multicast boundaries matching the specified group address with CIDR notation. Option includes:
  - `out` displays the specified group address’s IP multicast boundaries whose control plane filtering is enabled
- `interface` displays IP multicast boundary of the specified interface. Options include:
  - `ethernet e_num` displays IP multicast boundaries of the specified Ethernet interface
  - `loopback l_num` displays IP multicast boundaries of the specified Loopback interface
  - `management m_num` displays IP multicast boundaries of the specified management interface
  - `port-channel p_num` displays IP multicast boundaries of the specified port channel interface
  - `vlan v_num` displays IP multicast boundaries of the specified VLAN interface
- `out` displays all IP multicast boundaries whose only control plane filtering is enabled

**Examples**

- This command displays the summary of all IP multicast boundaries across all interfaces.
  ```
  switch(config-if-Et24) show ip multicast boundary
  Interface Denied Prefix Data Plane Filtered
  Ethernet1 224.5.5.0/24 Yes
  Ethernet1 224.6.6.0/24 Yes
  Ethernet2 224.4.4.0/24 Yes
  Ethernet3 224.5.5.0/24 No
  ```
- This command displays all IP multicast boundaries matching 224.5.5.0 255.255.255.255.
  ```
  switch(config-if-Et24)# show ip multicast boundary 224.5.5.0 255.255.255.255
  Interface Denied Prefix Data Plane Filtered
  Ethernet1 224.5.5.0 255.255.255.255
  Ethernet3 224.5.5.0 255.255.255.255 No
  ```
- This command displays all IP multicast boundaries matching 224.5.5.0/24.
  ```
  switch(config-if-Et24)# show ip multicast boundary 224.5.5.0/24
  Interface Denied Prefix Data Plane Filtered
  Ethernet1 224.5.5.0/24
  Ethernet3 224.5.5.0/24 No
  ```
• This command displays all IP multicast boundaries of the Ethernet1 interface.
  switch(config-if-Et24)# show ip multicast boundary interface Ethernet1
  Interface Denied Prefix Data Plane Filtered
  Ethernet1 224.5.5.0/24
  Ethernet1 224.6.6.0/24 No

• This command displays the list of IP multicast boundaries whose only control plane filtering is enabled.
  switch(config-if-Et24)# show ip multicast boundary out
  Interface Denied Prefix Data Plane Filtered
  Ethernet1 224.5.5.0/24 No
  Ethernet3 224.5.5.0/24 No
show mld membership

The show mld membership command displays MLD group and source membership information on a specific interface.

**Command Mode**
EXEC

**Command Syntax**
```
show mld membership [dynamic | group | interface | static]
```

**Parameters**
- `dynamic` displays MLD information for a dynamic group.
- `group` displays MLD information for a specified multicast group address.
- `interface` displays MLD information for the specified interface.
- `static` displays MLD information for statically configured group.

**Example**
- This command displays MLD group and source information on the Ethernet interface 3 and 6.

```
switch# show mld membership
Interface   Group     Source     Filter Mode
----------   -----      ------      -----------
Ethernet3    ff30::1   a::2       include
Ethernet3    ff30::1   a::1       include
Ethernet6    ff30::2   a::2       include
```
show mld querier

The `show mld querier` command displays information about the MLD querier and querier parameters.

**Command Mode**

EXEC

**Command Syntax**

`show mld querier [interface | parameters]`

**Parameters**

- `interface` displays MLD querier information.
- `parameters` displays MLD querier parameters.

**Example**

- This command displays MLD querier on the Ethernet interface Et3 and Et6.

```
Switch#show mld querier
Interface    Querier                                  General    Other      Version
Query      Querier                                  Expiry     Expiry
---------    -------                                  ---------- ---------  -------
Et3          fe80::1:ff:fe01:0                        0:01:14    N/A        2
Et6          fe80::1:ff:fe01:0                        0:01:14    N/A        2
```

- This command displays MLD querier parameters on the Ethernet interface Et3 and Et6.

```
Switch#show mld querier parameters
Interface    Robustness Query Response Query Startup Query Startup Last Listener Query Last Listener Query
Interval     Interval       Interval       Interval        Interval       Count        Interval       Count
---------     ---------- --------   ---------  ---------  -------    --------   --------
Et3           2          125        10         31.25      2          1          2
Et6           2          125        10         31.25      2          1          2
```
show mld statistics

The show mld statistics command displays total statistics information of incoming and outgoing MLD messages on a specific interface.

**Command Mode**

EXEC

**Command Syntax**

`show mld statistics version value`

**Parameters**

- `version` specifies MLD version.
- `value` specifies the MLD version number. Accepted version values are 1 and 2.

**Example**

- This command displays total MLD statistics on the Ethernet interface Et3 and Et6.

```plaintext
switch#show mld statistics
MLD Total (Version1 + Version2) Statistics
Received | Sent
Interface  Queries  Reports  Dones  Others  Errors  | Queries
-------------------------------------------------------------------
Et3       0         12      0       0       0        | 12
Et6       0         11      0       0       0        | 12
```
show mld summary

The `show mld summary` command displays MLD summary information.

**Command Mode**

EXEC

**Command Syntax**

`show mld summary`

**Parameters**

- `interface` displays MLD summary on a specified interface.

**Example**

- This command displays MLD summary on the Ethernet interface 3 and 6.

```
Arista# show mld summary
Interface        IPv6 link-local address    Group Count Querier State
---------------- --------------------------------- ----------- --------------
Ethernet3        fe80::1:ff:fe01:0          2           querier
Ethernet6        fe80::1:ff:fe01:0          2           querier

Number of MLD interfaces: 2
Number of total groups joined across all MLD interfaces: 4
```
show multicast fib ipv4

The show multicast fib ipv4 command displays information about interfaces and the hardware-forwarded routes included in the IPv4 Multicast Forwarding Information Base (MFIB).

Command Mode
EXEC

Command Syntax
show multicast fib ipv4 [group_address [source_address] | bidirectional | count | counter | df | rpa | software | sparse-mode | static | summary | vrf]

Parameters
- <no parameters> displays information for all hardware-forwarded routes in the MFIB
- group_address displays the information of the specified multicast group address. Options include:
  - source_address displays the information of the specified multicast group and source addresses
  - count displays the multicast routes count of the specified group address
  - counters displays the multicast route traffic count of the specified group address
  - bidirectional displays the information of bidirectional routes
  - count displays the count of multicast routes
  - counter displays the count of multicast route traffic in either bytes or packets
  - df displays the bidirectional Protocol Independent Multicast (PIM) Designated Forwarder (DF) bitmap
  - rpa displays the bidirectional PIM Rendezvous Point Address (RPA) index
  - software displays the software multicast FIB
  - sparse-mode displays the sparse-mode information
  - static displays the static multicast information
  - summary displays the multicast FIB summary
  - vrf vrf_name displays information of the corresponding VRF

Guidelines
The counter is not available (N/A) if a multicast route does not have an associated counter. If the counter value for any source in a group address is N/A, then the sum of counters for the group address is N/A. However, the counter values for other sources are still displayed.

Examples
- This command displays the bidirectional PIM RPA index.
  switch>show multicast fib ipv4 rpa
  Prefix                                      Rpa Index
  225.0.0.0/8                                  1
  226.0.0.0/8                                  1

- This command displays the static multicast route information.
  switch>show multicast fib ipv4 static count
  (S,G) routes: 34
  (*,G) routes: 31
  Fastdrop routes: 0
  Prefix routes: 12
- This command displays the multicast routes' count of the specified group and source addresses.
  
  `switch> show multicast fib ipv4 229.0.0.0 10.1.5.101 count`
  
  Activity poll time: 60 seconds
  (S,G) routes: 1
  Fastdrop routes: 0

- This command displays the multicast route traffic count of the specified group and source addresses.
  
  `switch> show multicast fib ipv4 229.0.0.0 10.1.5.101 counters`
  
  Activity poll time: 60 seconds
  229.0.0.0 10.1.5.101
  Byte: 46128
  Packet: 93
  Port-Channel100 (iif)
  Activity 0:53:52 ago

- This command displays the multicast FIB summary.
  
  `switch> show multicast fib ipv4 summary`
  
  Number of multicast routes: 12
  Number of fastdrop routes : 45
**show multicast fib ipv4 software**

The `show multicast fib ipv4 software` command displays information about the interfaces and the software-forwarded routes included in the IPv4 multicast forwarding information base (MFIB). Use the `show multicast fib ipv4` command for hardware-forwarded routes.

Parameter options are available to filter output by group address or group and source address.

**Command Mode**

EXEC

**Command Syntax**

```plaintext
show multicast fib ipv4 software [INFO_LEVEL][ROUTE]
```

**Parameters**

- **INFO_LEVEL** specifies the type of information displayed. Options include
  - `<no parameter>` displays packet reception counters.
  - `detail` displays packet reception counters and packet queued/dropped counters.

- **ROUTE** routes displayed, filtered by multicast group and source IP addresses:
  - `<no parameter>` shows information for all software-forwarded routes in the MFIB.
  - `group_addr` shows information only for the specified multicast group.
  - `group_addr source address` shows information only for the specified group and source.

**Example**

- This command displays MFIB information for all software-forwarded routes in the MFIB.
  ```plaintext
  switch>show multicast fib ipv4 software
  239.255.255.250 172.17.41.150
  Vlan3040 (iif)
  Packets Received: 18
  Bytes Received : 9147
  RPF Failures    : 0
  239.255.255.250 172.17.41.120
  Vlan3040 (iif)
  Packets Received: 6
  Bytes Received : 966
  RPF Failures    : 0
  switch>
  ```

- This command displays detailed MFIB information for all software-forwarded routes in the MFIB.
  ```plaintext
  switch>show multicast fib ipv4 software detail
  239.255.255.250 172.17.41.150
  Vlan3040 (iif)
  Packets Received: 18
  Bytes Received : 9147
  RPF Failures    : 0
  Packets Queued/Dropped : 0 / 0
  239.255.255.250 172.17.41.120
  Vlan3040 (iif)
  Packets Received: 6
  Bytes Received : 966
  RPF Failures    : 0
  Packets Queued/Dropped : 0 / 0
  switch>
  ```
show multicast fib ipv6

The **show multicast fib ipv6** command displays the Multicast Forwarding Information Base (MFIB) table.

**Command Mode**

EXEC

**Command Syntax**

  show multicast fib ipv6

**Example**

- The command output displays the Multicast Forwarding Information Base (MFIB) table as shown.

  switch#show multicast fib ipv6
  Activity poll time: 60 seconds
  ff33::1:0:0:1 101:1::2
    Ethernet11/1 (iif)
    Ethernet9/1.1
    Ethernet2/1.1
    Ethernet3/1.1
    Ethernet6/1.1
    Ethernet5/1.1
    Ethernet8/1.1
    Ethernet7/1.1
    Ethernet4/1.1
  Activity 0:00:35 ago
show pim ipv6 sparse-mode route

The `show pim ipv6 sparse-mode route` command displays the PIM Sparse Mode Multicast Routing table.

**Command Mode**
- EXEC

**Command Syntax**
- `show pim ipv6 sparse-mode route`

**Example**
- The command output displays the PIM Sparse Mode Multicast Routing table as shown.

```
switch#show pim ipv6 sparse-mode route
PIM Sparse Mode Multicast Routing Table
Flags: E - Entry forwarding on the RPT, J - Joining to the SPT
    R - RPT bit is set, S - SPT bit is set, L - Source is attached
    W - Wildcard entry, X - External component interest
    I - SG Include Join alert rcvd, P - (*.G) Programmed in hardware
    H - Joining SPT due to policy, D - Joining SPT due to protocol
    Z - Entry marked for deletion, C - Learned from a DR via a register
    A - Learned via Anycast RP Router, M - Learned via MSDP
    N - May notify MSDP, K - Keepalive timer not running
    T - Switching Incoming Interface, B - Learned via Border Router
RPF route: U - From unicast routing table
    M - From multicast routing table
ff33::1:0:0:1
101:1::2, 2:03:00, flags: S
    Incoming interface: Ethernet11/1
    RPF route: [U] 101:1::/64 [110/1] via fe80::464c:a8ff:feb7:39e9
    Outgoing interface list:
        Ethernet6/1.1
        Ethernet4/1.1
        Ethernet7/1.1
        Ethernet9/1.1
        Ethernet8/1.1
        Ethernet2/1.1
        Ethernet5/1.1
        Ethernet3/1.1
```
show platform fap mroute ipv6

The `show platform fap mroute ipv6` command displays the Platform Hardware Forwarding table.

**Command Mode**
EXEC

**Command Syntax**
```
show platform fap mroute ipv6
```

**Example**
- The command output displays the Platform Hardware Forwarding table as shown

```
switch#show platform fap mroute ipv6
Jericho0 Multicast Routes:
----------------------------
Location  GroupId  Group                     Source
IIF       McId     OIF
  FLP/TT    FLP/TT   TT                       FLP
  FLP       FLP      FLP
----------------------------
4096/2048 1/1  ff33::1:0:0:23/128 101:1::2/128
Vlan1357 21504 Vlan1044(Et7/1) Vlan1123(Et9/1)
Vlan1200(Et8/1) Vlan1223(Et2/1)
Vlan1226(Et5/1) Vlan1232(Et3/1)
```
**unresolved cache-entries max**

The *unresolved cache-entries max* command configures the maximum number of unresolved (S,G) routes that the switch can cache packets. The default buffer size is 4000 (S,G) routes.

The *no unresolved cache-entries max* and *default unresolved cache-entries max* commands restore the default unresolved cache-entries buffer size of 4000 (S,G) routes by removing the *unresolved cache-entries max* command from *running-config*. See *ip multicast boundary* to limit the number of cached packets per S,G.

**Command Mode**

- Router Multicast IPv4 Configuration
- Router Multicast VRF IPv4 Configuration

**Command Syntax**

```
unresolved cache-entries max quantity_entries
no unresolved cache-entries max
default unresolved cache-entries max
```

**Parameters**

- `quantity_entries` maximum buffer size (routes). Value ranges from 10 to 10000000. Default is 4000.

**Example**

- This command sets the maximum MFIB unresolved cache-entry buffer size to 6000 routes in the default VRF.

```bash
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#unresolved cache-entries max 6000
switch(config-router-multicast-ipv4)#
```
unresolved packet-buffers max

The **unresolved packet-buffers max** command specifies the number of (S,G) multicast packets for an individual route that the switch can process before the (S,G) entry is entered into cache. Packets that are received in excess of this limit before the route is programmed into the cache are dropped. By default, the switch processes 3 unresolved packets for an individual route.

The **no unresolved packet-buffers max** and **default unresolved packet-buffers max** commands restore the number of unresolved packets that the switch processes to the default value of 3 packets by removing the **unresolved packet-buffers max** command from **running-config**. See **unresolved cache-entries max** to limit the number of unresolved routes that are cached.

**Command Mode**

- Router Multicast IPv4 Configuration
- Router Multicast VRF IPv4 Configuration

**Command Syntax**

```
unresolved packet-buffers max quantity_packets
no unresolved packet-buffers max
default unresolved packet-buffers max
```

**Parameters**

- **quantity_packets**: packets per unresolved route that the switch processes. Values range from 3 to 10000000. Default is 3.

**Example**

- This command programs the switch in the default VRF to process thirty multicast packets from any route regardless of its entry’s presence in the multicast routing cache.

```
switch(config)#router multicast
switch(config-router-multicast)#ipv4
switch(config-router-multicast-ipv4)#unresolved packet-buffers max 30
switch(config-router-multicast-ipv4)#
```