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 Configuration
- Section 38.4: 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.

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 Configuration

This section describes the following configuration tasks:

- Section 38.3.1: Multicast Configuration
- Section 38.3.2: Configuring MFIB
- Section 38.3.3: Configuring Static IP Mroute
- Section 38.3.4: Displaying and Clearing the Mroute Table

38.3.1 Multicast Configuration

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
  ```

Enabling IPv6 Multicast Routing

Enabling IPv6 multicast routing allows the switch to forward IPv6 datagrams. By default, IPv6 multicast routing is disabled on the switch.

Example

- These commands enable IPv6 multicast routing on the switch.

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

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
  ```
• 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)#
```

38.3.2 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.
  
  ```
  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.
  
  ```
  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.
  ```
  switch(config)#router multicast
  switch(config-router-multicast)#ipv4
  switch(config-router-multicast-ipv4)#unresolved packet-buffers max 30
  ```

38.3.3 Configuring 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 dependence on the unicast topology for the multicast topology. The command `multipath deterministic` specifies a candidate for the multicast reverse path forwarding (RPF) interface of any (S,G) multicast route, where the source falls within the given network prefix.

38.3.3.1 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 mroutes 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 mroutes 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, multipath configuration, directly connected sources, and assert winners.

38.3.3.2 Selecting Static Mroutes
The longest match is selected when a source matches multiple static mroutes in the MRIB. The order in which static mroutes were configured is not a factor.
Example

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

```bash
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
```#

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

```bash
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 11.0.1.0/24 Ethernet 5 255
switch(config-router-multicast-ipv4)#rpf route 11.10.1.2/32 Ethernet 6
switch(config-router-multicast-ipv4)#
```

38.3.4 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.

  ```bash
  switch#clear ip mroute *
  switch#
  ```

- This command removes entries for source 228.3.10.1 sending to multicast group 224.2.205.42.

  ```bash
  switch#clear ip mroute 224.2.205.42 228.3.10.1
  switch#
  ```

Displaying the mroute Table

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

```bash
```

```bash
```
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.
  
  ```
  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>
  ```
38.4 Multicast Commands

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

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 multicast fib ipv4
- show multicast fib ipv4 software
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.

```
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 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]
oip 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 mbacl
switch(config-std-acl-mbacl)#10 deny 225.123.0.0/16
switch(config-std-acl-mbacl)#20 deny 239.120.10.0/24
switch(config-std-acl-mbacl)#30 permit 224.0.0.0/4
switch(config-std-acl-mbacl)#exit
switch(config)#interface vlan 200
switch(config-if-Vl200)#ip multicast boundary mbacl
switch(config-if-Vl200)#exit
switch(config)#
```
**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
```

- 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
```

```
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 multicast traffic
- `iif interface`  specifies an incoming interface for the static route
- `cpu`  optionally mirrors multicast packets to the CPU
- `oif interface`  specifies an optional outgoing interface for the static route
- `iifFrr interface`  specifies an optional interface for multicast-only fast reroute
- `interface`  options include:
  - `Ethernet ethernet_port`  Ethernet interface
  - `Null0`  drops all traffic
  - `Port-Channel lag_no`  port-channel interface or sub-interface; values range from 1-2000 or 1-2000.1-4094
  - `Register0`  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)#
  ```
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
  ```
**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 225.1.1.1
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>
```
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  224.5.0/24   Yes
  Ethernet1  224.6.0/24   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
  Ethernet2  224.5.5.0 255.255.255.255
  Ethernet3  224.5.5.0 255.255.255.255
  ```
- 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
  ```
• 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
```

• 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
Ethernet3 224.5.5.0/24
```
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

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.

  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.

  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>
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.

```
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)#
```