



Monitoring and Maintaining IP Multicast

This module describes many ways to monitor and maintain an IP multicast network, such as

- displaying which neighboring multicast routers are peering with the local router
- displaying multicast packet rates and loss information
- tracing the path from a source to a destination branch for a multicast distribution tree
- displaying the contents of the IP multicast routing table, information about interfaces configured for PIM, the PIM neighbors discovered by the router, and contents of the IP fast-switching cache
- clearing caches, tables, and databases
- monitoring the delivery of IP multicast packets and being alerted if the delivery fails to meet certain parameters (IP multicast heartbeat)
- using session description and announcement protocols and applications to assist the advertisement of multicast multimedia conferences and other multicast sessions and communicating the relevant session setup information to prospective participants (SAP listener support)
- storing IP multicast packet headers in a cache and displaying them to find out information such as who is sending IP multicast packets to what groups and any multicast forwarding loops in your network
- using managed objects to remotely monitor and configure PIM using Simple Network Management Protocol (SNMP)
- disabling fast switching of IP multicast in order to log debug messages
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Finding Feature Information

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

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

Prerequisites for Monitoring and Maintaining IP Multicast

- Before performing the tasks in this module, you should be familiar with the concepts described in the “IP Multicast Technology Overview” module.
- You must also have enabled IP multicast and have Protocol Independent Multicast (PIM) configured and running on your network. Refer to the “Configuring Basic IP Multicast” module.

Information About Monitoring and Maintaining IP Multicast

IP Multicast Heartbeat

The IP Multicast Heartbeat feature enables you to monitor the delivery of IP multicast packets and to be alerted if the delivery fails to meet certain parameters.

Although you could alternatively use MRM to monitor IP multicast, you can perform the following tasks with IP multicast heartbeat that you cannot perform with MRM:

- Generate an SNMP trap
- Monitor a production multicast stream

When IP multicast heartbeat is enabled, the router monitors IP multicast packets destined for a particular multicast group at a particular interval. If the number of packets observed is less than a configured minimum amount, the router sends an SNMP trap to a specified network management station to indicate a loss of heartbeat exception.

The **ip multicast heartbeat** command does not create a heartbeat if there is no existing multicast forwarding state for *group* in the router. This command will not create a multicast forwarding state in the router. Use the **ip igmp static-group** command on the router or on a downstream router to force forwarding of IP multicast traffic. Use the **snmp-server host ipmulticast** command to enable the sending of IP multicast traps to specific receiver hosts. Use the **debug ip mhbeat** command to debug the Multicast Heartbeat feature.

Session Announcement Protocol (SAP)

Session Announcement Protocol (SAP) listener support is needed to use session description and announcement protocols and applications to assist the advertisement of multicast multimedia conferences and other multicast sessions and to communicate the relevant session setup information to prospective participants.

Sessions are described by the Session Description Protocol (SDP), which is defined in RFC 2327. SDP provides a formatted, textual description of session properties (for example, contact information, session lifetime, and the media) being used in the session (for example, audio, video, and whiteboard) with their specific attributes such as time-to-live (TTL) scope, group address, and User Datagram Protocol (UDP) port number.

Many multimedia applications rely on SDP for session descriptions. However, they may use different methods to disseminate these session descriptions. For example, IP/TV relies on the web to disseminate session descriptions to participants. In this example, participants must know of a web server that provides the session information.

MBONE applications (for example, vic, vat, and wb) and other applications rely on multicast session information sent throughout the network. In these cases, SAP is used to transport the SDP session announcements. SAP Version 2 uses the well-known session directory multicast group 224.2.127.254 to disseminate SDP session descriptions for global scope sessions and group 239.255.255.255 for administrative scope sessions.



Note The Session Directory (SDR) application is commonly used to send and receive SDP/SAP session announcements.

PIM MIB Extensions for SNMP Traps for IP Multicast

Protocol Independent Multicast (PIM) is an IP multicast routing protocol used for routing multicast data packets to multicast groups. RFC 2934 defines the PIM MIB for IPv4, which describes managed objects that enable users to remotely monitor and configure PIM using Simple Network Management Protocol (SNMP).

PIM MIB extensions introduce the following new classes of PIM notifications:

- neighbor-change--This notification results from the following conditions:
 - A router's PIM interface is disabled or enabled (using the **ip pim** command in interface configuration mode)
 - A router's PIM neighbor adjacency expires (defined in RFC 2934)
- rp-mapping-change--This notification results from a change in the rendezvous point (RP) mapping information due to either Auto-RP messages or bootstrap router (BSR) messages.
- invalid-pim-message--This notification results from the following conditions:
 - An invalid (*, G) Join or Prune message is received by the device (for example, when a router receives a Join or Prune message for which the RP specified in the packet is not the RP for the multicast group)
 - An invalid PIM register message is received by the device (for example, when a router receives a register message from a multicast group for which it is not the RP)

Benefits of PIM MIB Extensions

PIM MIB extensions:

- Allow users to identify changes in the multicast topology of their network by detecting changes in the RP mapping.
- Provide traps to monitor the PIM protocol on PIM-enabled interfaces.
- Help users identify routing issues when multicast neighbor adjacencies expire on a multicast interface.
- Enable users to monitor RP configuration errors (for example, errors due to flapping in dynamic RP allocation protocols like Auto-RP).

How to Monitor and Maintain IP Multicast

Displaying Multicast Peers Packet Rates and Loss Information and Tracing a Path

Monitor IP multicast routing when you want to know which neighboring multicast routers are peering with the local router, what the multicast packet rates and loss information are, or when you want to trace the path from a source to a destination branch for a multicast distribution tree.

SUMMARY STEPS

1. **enable**
2. **mrinfo** [*host-name* | *host-address*] [*source-address* | *interface*]
3. **mstat** {*source-name* | *source-address*} [*destination-name* | *destination-address*] [*group-name* | *group-address*]
4. **mtrace** {*source-name* | *source-address*} [*destination-name* | *destination-address*] [*group-name* | *group-address*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	mrinfo [<i>host-name</i> <i>host-address</i>] [<i>source-address</i> <i>interface</i>] Example: Router# mrinfo	(Optional) Queries which neighboring multicast routers are “peering” with the local router.

	Command or Action	Purpose
Step 3	mstat { <i>source-name</i> <i>source-address</i> } [<i>destination-name</i> <i>destination-address</i>] [<i>group-name</i> <i>group-address</i>] Example: <pre>Router# mstat allsource</pre>	(Optional) Displays IP multicast packet rate and loss information.
Step 4	mtrace { <i>source-name</i> <i>source-address</i> } [<i>destination-name</i> <i>destination-address</i>] [<i>group-name</i> <i>group-address</i>] Example: <pre>Router# mtrace allsource</pre>	(Optional) Traces the path from a source to a destination branch for a multicast distribution tree.

Displaying IP Multicast System and Network Statistics

Display IP multicast system statistics to show the contents of the IP multicast routing table, information about interfaces configured for PIM, the PIM neighbors discovered by the router, contents of the IP fast-switching cache, and the contents of the circular cache header buffer.

SUMMARY STEPS

1. **enable**
2. **ping** [*group-name* | *group-address*]
3. **show ip mroute** [*group-address* | *group-name*] [*source-address* | *source-name*] [*type number*] [**summary**] [**count**] [**active kbps**]
4. **show ip pim interface** [*type number*] [**df** | **count**] [*rp-address*] [**detail**]
5. **show ip pim neighbor** [*type number*]
6. **show ip pim rp** [**mapping** | **metric**] [*rp-address*]
7. **show ip rpf** {*source-address* | *source-name*} [**metric**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: <pre>Router> enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	ping [<i>group-name</i> <i>group-address</i>] Example: <pre>Router# ping cbone-audio</pre>	(Optional) Sends an ICMP echo request message to a multicast group address or group name.
Step 3	show ip mroute [<i>group-address</i> <i>group-name</i>] [<i>source-address</i> <i>source-name</i>] [<i>type number</i>] [summary] [count] [active kbps]	(Optional) Displays the contents of the IP multicast routing table.

	Command or Action	Purpose
	Example: Router# show ip mroute cbone-audio	
Step 4	show ip pim interface [<i>type number</i>] [df count] [<i>rp-address</i>] [detail] Example: Router# show ip pim interface gigabitethernet1/0/0 detail	(Optional) Displays information about interfaces configured for PIM.
Step 5	show ip pim neighbor [<i>type number</i>] Example: Router# show ip pim neighbor	(Optional) Lists the PIM neighbors discovered by the router.
Step 6	show ip pim rp [mapping metric] [<i>rp-address</i>] Example: Router# show ip pim rp metric	(Optional) Displays the RP routers associated with a sparse mode multicast group.
Step 7	show ip rpf { <i>source-address</i> <i>source-name</i> } [metric] Example: Router# show ip rpf 172.16.10.13	(Optional) Displays how the router is doing RPF (that is, from the unicast routing table, DVMRP routing table, or static mroutes). Also displays the unicast routing metric.

Clearing IP Multicast Routing Table or Caches

Clear IP multicast caches and tables to delete entries from the IP multicast routing table, the Auto-RP cache, the IGMP cache, and the caches of Catalyst switches. When these entries are cleared, the information is refreshed by being relearned, thus eliminating any incorrect entries.

SUMMARY STEPS

1. **enable**
2. **clear ip mroute** {*** | *group-name* [*source-name* | *source-address*] | *group-address* [*source-name* | *source-address*]}
3. **clear ip pim auto-rp** *rp-address*
4. **clear ip igmp group** [*group-name* | *group-address* | *interface-type interface-number*]
5. **clear ip cgmp** [*interface-type interface-number*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example:	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
	Router> enable	
Step 2	clear ip mroute <i>{* group-name [source-name source-address] group-address [source-name source-address]}</i> Example: Router# clear ip mroute 224.2.205.42 228.3.0.0	(Optional) Deletes entries from the IP multicast routing table.
Step 3	clear ip pim auto-rp <i>rp-address</i> Example: Router# clear ip pim auto-rp 224.5.6.7	(Optional) Clears the Auto-RP cache.
Step 4	clear ip igmp group <i>[group-name group-address interface-type interface-number]</i> Example: Router# clear ip igmp group 224.0.255.1	(Optional) Deletes entries from the IGMP cache.
Step 5	clear ip cgmp <i>[interface-type interface-number]</i> Example: Router# clear ip cgmp	(Optional) Clears all group entries from the caches of Catalyst switches.

Monitoring IP Multicast Delivery Using IP Multicast Heartbeat

SUMMARY STEPS

1. enable
2. configure terminal
3. ip multicast-routing distributed
4. snmp-server host *{hostname | ip-address}* [traps | informs] [version {1 | 2c | 3 [auth | noauth | priv]}] *community-string[udp-port port] [notification-type]*
5. snmp-server enable traps ipmulticast
6. ip multicast heartbeat *group-address minimum-number window-size interval*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip multicast-routing distributed Example: Router(config)# ip multicast-routing distributed	Enables IP multicast routing.
Step 4	snmp-server host <i>{hostname ip-address}</i> [traps informs] [version { 1 2c 3 [auth noauth priv]}] <i>community-string</i> [udp-port <i>port</i>] [<i>notification-type</i>] Example: Router(config)# snmp-server host 224.1.0.1 traps public	Specifies the recipient of an SNMP notification operation.
Step 5	snmp-server enable traps ipmulticast Example: Router(config)# snmp-server enable traps ipmulticast	Enables the router to send IP multicast traps.
Step 6	ip multicast heartbeat <i>group-address</i> <i>minimum-number</i> <i>window-size</i> <i>interval</i> Example: Router(config)# ip multicast heartbeat 224.1.1.1 1 1 10	Enables the monitoring of the IP multicast packet delivery. <ul style="list-style-type: none"> The <i>interval</i> should be set to a multiple of 10 seconds on platforms that use Multicast Distributed Fast Switching (MDFS) because on those platforms, the packet counters are only updated once every 10 seconds. Other platforms may have other increments.

Advertising Multicast Multimedia Sessions Using SAP Listener

Enable SAP listener support when you want to use session description and announcement protocols and applications to assist the advertisement of multicast multimedia conferences and other multicast sessions and to communicate the relevant session setup information to prospective participants.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip sap cache-timeout** *minutes*
4. **interface** *type number*
5. **ip sap listen**
6. **end**
7. **clear ip sap** [*group-address* | “*session-name*”]

8. show ip sap [group-address | “ session-name ”] detail]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip sap cache-timeout <i>minutes</i> Example: Router(config)# ip sap cache-timeout 600	(Optional) Limits how long a SAP cache entry stays active in the cache. <ul style="list-style-type: none"> • By default, SAP cache entries are deleted 24 hours after they are received from the network.
Step 4	interface <i>type number</i> Example: Router(config)# interface gigabitethernet 1/0/0	Selects an interface that is connected to hosts on which IGMPv3 can be enabled.
Step 5	ip sap listen Example: Router(config-if)# ip sap listen	Enables the Cisco IOS XE software to listen to session directory announcements.
Step 6	end Example: Router(config-if)# end	Ends the session and returns to EXEC mode.
Step 7	clear ip sap [group-address “ session-name ”] Example: Router# clear ip sap "Sample Session"	Deletes a SAP cache entry or the entire SAP cache.
Step 8	show ip sap [group-address “ session-name ”] detail] Example: Router# show ip sap 224.2.197.250 detail	(Optional) Displays the SAP cache.

Disabling Fast Switching of IP Multicast

Disable fast switching if you want to log debug messages, because when fast switching is enabled, debug messages are not logged.

You might also want to disable fast switching, which places the router in process switching, if packets are not reaching their destinations. If fast switching is disabled and packets are reaching their destinations, then switching may be the cause.

Fast switching of IP multicast packets is enabled by default on all interfaces (including generic routing encapsulation [GRE] and DVMRP tunnels), with one exception: It is disabled and not supported over X.25 encapsulated interfaces. The following are properties of fast switching:

- If fast switching is disabled on an *incoming* interface for a multicast routing table entry, the packet is sent at process level for all interfaces in the outgoing interface list.
- If fast switching is disabled on an *outgoing* interface for a multicast routing table entry, the packet is process-level switched for that interface, but may be fast switched for other interfaces in the outgoing interface list.
- When fast switching is enabled, debug messages are not logged.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **no ip mroute-cache**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface gigabitethernet 1/0/0	Specifies an interface.
Step 4	no ip mroute-cache Example: Router(config-if)# no ip mroute-cache	Disables fast switching of IP multicast.

Enabling PIM MIB Extensions for IP Multicast

Perform this task to enable PIM MIB extensions for IP multicast.



Note

- The pimInterfaceVersion object was removed from RFC 2934 and, therefore, is no longer supported in software.
- The following MIB tables are not supported in Cisco software:
 - pimIpMRouteTable
 - pimIpMRouteNextHopTable

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **snmp-server enable traps pim [neighbor-change | rp-mapping-change | invalid-pim-message]**
4. **snmp-server host host-address [traps | informs] community-string pim**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	snmp-server enable traps pim [neighbor-change rp-mapping-change invalid-pim-message] Example: Device(config)# snmp-server enable traps pim neighbor-change	Enables a device to send PIM notifications. <ul style="list-style-type: none"> • neighbor-change --This keyword enables notifications indicating when a device's PIM interface is disabled or enabled, or when a device's PIM neighbor adjacency expires. • rp-mapping-change --This keyword enables notifications indicating a change in RP mapping information due to either Auto-RP messages or BSR messages. • invalid-pim-message --This keyword enables notifications for monitoring invalid PIM protocol operations (for example, when a device receives a join or prune message for which the RP specified in the packet is not the RP for the multicast group or when

	Command or Action	Purpose
		a device receives a register message from a multicast group for which it is not the RP).
Step 4	snmp-server host <i>host-address</i> [traps informs] <i>community-string</i> pim Example: Device(config)# snmp-server host 10.10.10.10 traps public pim	Specifies the recipient of a PIM SNMP notification operation.

Configuration Examples for Monitoring and Maintaining IP Multicast

Displaying IP Multicast System and Network Statistics Example

The following is sample output from the **mrinfo** command:

```
Router# mrinfo
192.31.7.37 (labs-allcompany) [version cisco 12.3] [flags: PMSA]:
192.31.7.37 -> 192.31.7.34 (lab-southwest) [1/0/pim]
192.31.7.37 -> 192.31.7.47 (lab-northwest) [1/0/pim]
192.31.7.37 -> 192.31.7.44 (lab-southeast) [1/0/pim]
131.119.26.10 -> 131.119.26.9 (lab-northeast) [1/32/pim]
```

The following is sample output from the **mstat** command in user EXEC mode:

```
Router> mstat labs-in-china 172.16.0.1 224.0.255.255

Type escape sequence to abort.
Mtrace from 172.16.0.0 to 172.16.0.10 via group 224.0.255.255
>From source (labs-in-china) to destination (labs-in-africa)
Waiting to accumulate statistics.....
Results after 10 seconds:
Source Response Dest Packet Statistics For Only For Traffic
172.16.0.0      172.16.0.10 All Multicast Traffic From 172.16.0.0
| __/ rtt 48 ms Lost/Sent = Pct Rate To 224.0.255.255
v / hop 48 ms -----
172.16.0.1      labs-in-england
| ^ ttl 1
v | hop 31 ms 0/12 = 0% 1 pps 0/1 = --% 0 pps
172.16.0.2
172.16.0.3      infolabs.com
| ^ ttl 2
v | hop -17 ms -735/12 = --% 1 pps 0/1 = --% 0 pps
172.16.0.4
172.16.0.5      infolabs2.com
| ^ ttl 3
v | hop -21 ms -678/23 = --% 2 pps 0/1 = --% 0 pps
172.16.0.6
172.16.0.7      infolabs3.com
```

```

| ^ ttl 4
v | hop 5 ms 605/639 = 95% 63 pps 1/1 = --% 0 pps
172.16.0.8
172.16.0.9      infolabs.cisco.com
| \__ ttl 5
v \ hop 0 ms 4 0 pps 0 0 pps
172.16.0.0      172.16.0.10
Receiver Query Source

```

The following is sample output from the **mtrace** command in user EXEC mode:

```

Router> mtrace 172.16.0.0 172.16.0.10 239.254.254.254
Type escape sequence to abort.
Mtrace from 172.16.0.0 to 172.16.0.10 via group 239.254.254.254
From source (?) to destination (?)
Querying full reverse path...
0 172.16.0.10
-1 172.16.0.8 PIM thresh^ 0 0 ms
-2 172.16.0.6 PIM thresh^ 0 2 ms
-3 172.16.0.5 PIM thresh^ 0 894 ms
-4 172.16.0.3 PIM thresh^ 0 893 ms
-5 172.16.0.2 PIM thresh^ 0 894 ms
-6 172.16.0.1 PIM thresh^ 0 893 ms

```

Monitoring IP Multicast Delivery Using IP Multicast Heartbeat Example

The following example shows how to monitor IP multicast packets forwarded through this router to group address 224.1.1.1. If no packet for this group is received in a 10-second interval, an SNMP trap will be sent to the SNMP management station with the IP address of 224.1.0.1.

```

!
ip multicast-routing
!
snmp-server host 224.1.0.1 traps public
snmp-server enable traps ipmulticast
ip multicast heartbeat 224.1.1.1 1 1 10

```

Advertising Multicast Multimedia Sessions Using SAP Listener Example

The following example enables a router to listen to session directory announcements and changes the SAP cache timeout to 30 minutes.

```

ip multicast routing
ip sap cache-timeout 30
interface loopback 0
 ip address 10.0.0.51 255.255.255.0
 ip pim sparse-dense mode
 ip sap listen

```

The following is sample output from the **show ip sap** command for a session using multicast group 224.2.197.250:

```

Router# show ip sap 224.2.197.250
SAP Cache - 198 entries
Session Name: Session1
Description: This broadcast is brought to you courtesy of Name1.
Group: 0.0.0.0, ttl: 0, Contiguous allocation: 1

```

```

Lifetime: from 10:00:00 PDT Jul 4 1999 until 10:00:00 PDT Aug 1 1999
Uptime: 4d05h, Last Heard: 00:01:40
Announcement source: 128.102.84.134
Created by: sample 3136541828 3139561476 IN IP4 128.102.84.134
Phone number: Sample Digital Video Lab (555) 555-5555
Email: email1 <name@email.com>
URL: http://url.com/
Media: audio 20890 RTP/AVP 0
    Media group: 224.2.197.250, ttl: 127
    Attribute:ptime:40
Media: video 62806 RTP/AVP 31
    Media group: 224.2.190.243, ttl: 127

```

Displaying IP Multicast System and Network Statistics Example

show ip mroute

The following is sample output from the **show ip mroute** command for a router operating in sparse mode:

```

Router# show ip mroute

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
       Y - Joined MDT-data group, y - Sending to MDT-data group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop, State/Mode
(*, 224.0.255.3), uptime 5:29:15, RP is 192.168.37.2, flags: SC
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1, Dvmrp
  Outgoing interface list:
    GigabitEthernet0, Forward/Sparse, 5:29:15/0:02:57
(192.168.46.0/24, 224.0.255.3), uptime 5:29:15, expires 0:02:59, flags: C
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1
  Outgoing interface list:
    GigabitEthernet0, Forward/Sparse, 5:29:15/0:02:57

```

show ip pim interface

The following is sample output from the **show ip pim interface** command when an interface is specified:

```

Router# show ip pim interface GigabitEthernet1/0/0

Address          Interface          Ver/   Nbr   Query  DR    DR
                  Mode              Count  Intvl Prior
172.16.1.4       GigabitEthernet1/0/0  v2/S   1     100 ms 1     172.16.1.4

```

The following is sample output from the **show ip pim rp** command:

```

Router# show ip pim rp

Group:227.7.7.7, RP:10.10.0.2, v2, v1, next RP-reachable in 00:00:48

```

show ip pim rp

The following is sample output from the **show ip pim rp** command when the **mapping** keyword is specified:

```

Router# show ip pim rp mapping
PIM Group-to-RP Mappings
This system is an RP (Auto-RP)
This system is an RP-mapping agent
Group(s) 227.0.0.0/8
  RP 10.10.0.2 (?), v2v1, bidir
    Info source:10.10.0.2 (?), via Auto-RP
    Uptime:00:01:42, expires:00:00:32
Group(s) 228.0.0.0/8
  RP 10.10.0.3 (?), v2v1, bidir
    Info source:10.10.0.3 (?), via Auto-RP
    Uptime:00:01:26, expires:00:00:34
Group(s) 229.0.0.0/8
  RP 10.10.0.5 (mcast1.cisco.com), v2v1, bidir
    Info source:10.10.0.5 (mcast1.cisco.com), via Auto-RP
    Uptime:00:00:52, expires:00:00:37
Group(s) (-)230.0.0.0/8
  RP 10.10.0.5 (mcast1.cisco.com), v2v1, bidir
    Info source:10.10.0.5 (mcast1.cisco.com), via Auto-RP
    Uptime:00:00:52, expires:00:00:37

```

The following is sample output from the **show ip pim rp** command when the **metric** keyword is specified:

```

Router# show ip pim rp metric

```

RP Address	Metric Pref	Metric	Flags	RPF Type	Interface
10.10.0.2	0	0	L	unicast	Loopback0
10.10.0.3	90	409600	L	unicast	GigabitEthernet3/3/0
10.10.0.5	90	435200	L	unicast	GigabitEthernet3/3/0

show ip rpf

The following is sample output from the **show ip rpf** command:

```

Router# show ip rpf 172.16.10.13
RPF information for host1 (172.16.10.13)
  RPF interface: BRI0
  RPF neighbor: sj1.cisco.com (172.16.121.10)
  RPF route/mask: 172.16.0.0/255.255.0.0
  RPF type: unicast
  RPF recursion count: 0
  Doing distance-preferred lookups across tables

```

The following is sample output from the **show ip rpf** command when the **metric** keyword is specified:

```

Router# show ip rpf 172.16.10.13 metric
RPF information for host1.cisco.com (172.16.10.13)
  RPF interface: BRI0
  RPF neighbor: neighbor.cisco.com (172.16.121.10)
  RPF route/mask: 172.16.0.0/255.255.0.0
  RPF type: unicast
  RPF recursion count: 0
  Doing distance-preferred lookups across tables
  Metric preference: 110

```

Enabling PIM MIB Extensions for IP Multicast Example

The following example shows how to configure a router to generate notifications indicating that a PIM interface of the router has been enabled. The first line configures PIM traps to be sent as SNMP v2c traps to the host with IP address 10.0.0.1. The second line configures the router to send the neighbor-change class of trap notification to the host.

```
snmp-server host 10.0.0.1 traps version 2c public pim
snmp-server enable traps pim neighbor-change
interface ethernet0/0
 ip pim sparse-dense-mode
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Cisco IOS IP SLAs commands	Cisco IOS IP Multicast Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 2934	<i>Protocol Independent Multicast for IPv4 MIB</i>

MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> • CISCO-IPMROUTE-MIB • MSDP-MIB • IGMP-STD-MIB 	To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

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

Feature Information for Monitoring and Maintaining IP Multicast

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

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

Table 1: Feature Information for Monitoring and Maintaining IP Multicast

Feature Names	Releases	Feature Configuration Information
PIM MIB Extensions	Cisco IOS XE Release 2.1	Protocol Independent Multicast (PIM) is an IP multicast routing protocol used for routing multicast data packets to multicast groups. RFC 2934 defines the PIM for IPv4 MIB, which describes managed objects that enable users to remotely monitor and configure PIM using Simple Network Management Protocol (SNMP).
Multicast Heartbeat	Cisco IOS XE Release 2.1	The IP multicast heartbeat feature provides a way to monitor the status of IP multicast delivery and be informed when the delivery fails (via Simple Network Management Protocol [SNMP] traps).

