



# IP Multicast Optimization: Multicast Subsecond Convergence

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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 <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

## Prerequisites for Multicast Subsecond Convergence

Service providers must have a multicast-enabled core in order to use the Cisco Multicast Subsecond Convergence feature.

## Restrictions for Multicast Subsecond Convergence

Devices that use the subsecond designated router (DR) failover enhancement must be able to process hello interval information arriving in milliseconds. Devices that are congested or do not have enough CPU cycles to process the hello interval can assume that the Protocol Independent Multicast (PIM) neighbor is disconnected, although this may not be the case.

# Information About Multicast Subsecond Convergence

## Benefits of Multicast Subsecond Convergence

- The scalability components improve on the efficiency of handling increases (or decreases) in service users (receivers) and service load (sources or content).
- New algorithms and processes (such as aggregated join messages, which deliver up to 1000 individual messages in a single packet) reduce the time to reach convergence by a factor of 10.
- Multicast subsecond convergence improves service availability for large multicast networks.
- Multicast users such as financial services firms and brokerages receive better quality of service (QoS), because multicast functionality is restored in a fraction of the time previously required.

## Multicast Subsecond Convergence Scalability Enhancements

The Multicast Subsecond Convergence feature provides scalability enhancements that improve on the efficiency of handling increases (or decreases) in service users (receivers) and service load (sources or content). Scalability enhancements in this release include the following:

- Improved Internet Group Management Protocol (IGMP) and PIM state maintenance through new timer management techniques
- Improved scaling of the Multicast Source Discovery Protocol (MSDP) Source-Active (SA) cache

The scalability enhancements provide the following benefits:

- Increased potential PIM multicast route (mroute), IGMP, and MSDP SA cache state capacity
- Decreased CPU usage

## PIM Router Query Messages

Multicast subsecond convergence allows you to send PIM router query messages (PIM hellos) every few milliseconds. The PIM hello message is used to locate neighboring PIM devices. Before the introduction of this feature, the device could send the PIM hellos only every few seconds. By enabling a device to send PIM hello messages more often, this feature allows the device to discover unresponsive neighbors more quickly. As a result, the device can implement failover or recovery procedures more efficiently.

### Related Topics

[Modifying the PIM Router Query Message Interval](#), on page 5

[Modifying the PIM Router Query Message Interval Example](#), on page 8

## Reverse Path Forwarding

Unicast Reverse Path Forwarding (RPF) helps to mitigate problems caused by the introduction of malformed or forged IP source addresses into a network by discarding IP packets that lack a verifiable IP source address.

Malformed or forged source addresses can indicate denial-of-service (DoS) attacks based on source IP address spoofing.

RPF uses access control lists (ACLs) in determining whether to drop or forward data packets that have malformed or forged IP source addresses. An option in the ACL commands allows system administrators to log information about dropped or forwarded packets. Logging information about forged packets can help in uncovering information about possible network attacks.

Per-interface statistics can help system administrators quickly discover the interface serving as the entry point for an attack on the network.

## RPF Checks

PIM is designed to forward IP multicast traffic using the standard unicast routing table. PIM uses the unicast routing table to decide if the source of the IP multicast packet has arrived on the optimal path from the source. This process, the RPF check, is protocol-independent because it is based on the contents of the unicast routing table and not on any particular routing protocol.

### Related Topics

[Modifying the Periodic RPF Check Interval](#), on page 4

[Example Modifying the Periodic RPF Check Interval](#), on page 7

## Triggered RPF Checks

Multicast subsecond convergence provides the ability to trigger a check of RPF changes for mroute states. This check is triggered by unicast routing changes. By performing a triggered RPF check, users can set the periodic RPF check to a relatively high value (for example, 10 seconds) and still fail over quickly.

The triggered RPF check enhancement reduces the time needed for service to be restored after disruption, such as for single service events (for example, in a situation with one source and one receiver) or as the service scales along any parameter (for example, many sources, many receivers, and many interfaces). This enhancement decreases in time-to-converge PIM (mroute), IGMP, and MSDP (SA cache) states.

## RPF Failover

In an unstable unicast routing environment that uses triggered RPF checks, the environment could be constantly triggering RPF checks, which places a burden on the resources of the device. To avoid this problem, use the **ip multicast rpf backoff** command to prevent a second triggered RPF check from occurring for the length of time configured. That is, the PIM “backs off” from another triggered RPF check for a minimum amount of milliseconds as configured by the user.

If the backoff period expires without further routing table changes, PIM then scans for routing changes and accordingly establishes multicast RPF changes. However, if more routing changes occur during the backoff period, PIM doubles the backoff period to avoid overloading the device with PIM RPF changes while the routing table is still converging.

### Related Topics

[Configuring PIM RPF Failover Intervals](#), on page 5

[Example Configuring PIM RPF Failover Intervals](#), on page 8

## Topology Changes and Multicast Routing Recovery

The Multicast Subsecond Convergence feature set enhances both enterprise and service provider network backbones by providing almost instantaneous recovery of multicast paths after unicast routing recovery.

Because PIM relies on the unicast routing table to calculate its RPF when a change in the network topology occurs, unicast protocols first need to calculate options for the best paths for traffic, and then multicast can determine the best path.

Multicast subsecond convergence allows multicast protocol calculations to finish almost immediately after the unicast calculations are completed. As a result, multicast traffic forwarding is restored substantially faster after a topology change.

## How to Configure Multicast Subsecond Convergence

### Modifying the Periodic RPF Check Interval

Perform this optional task to modify the intervals at which periodic RPF checks occur.



#### Note

Cisco recommends that you do *not* change the default values for the **ip rpf interval** command. The default values allow subsecond RPF failover. The default interval at which periodic RPF checks occur is 10 seconds.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast rpf interval** *seconds* [**list** *access-list* | **route-map** *route-map*]

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
Step 3	<b>ip multicast rpf interval</b> <i>seconds</i> [ <b>list</b> <i>access-list</i>   <b>route-map</b> <i>route-map</i> ] <b>Example:</b> Device(config)# ip multicast rpf interval 10	Configures the periodic RPF check intervals to occur at a specified interval, in seconds.

**Related Topics**[RPF Checks](#), on page 3[Example Modifying the Periodic RPF Check Interval](#), on page 7

## Configuring PIM RPF Failover Intervals

Perform this optional task to configure the intervals at which PIM RPF failover will be triggered by changes in the routing tables.



**Note** Cisco recommends that you do *not* modify the default values for the **ip multicast rpf backoff** command. The default values allow subsecond RPF failover.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast rpf backoff** *minimum maximum* [**disable**]

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
Step 3	<b>ip multicast rpf backoff</b> <i>minimum maximum</i> [ <b>disable</b> ] <b>Example:</b> Device(config)# ip multicast rpf backoff 100 2500	Configures the minimum and the maximum backoff intervals.

**Related Topics**[RPF Failover](#), on page 3[Example Configuring PIM RPF Failover Intervals](#), on page 8

## Modifying the PIM Router Query Message Interval

Perform this task to modify the PIM router query message interval.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface** *type slot / subslot / port*
4. **ip pim query-interval** *period [msec]*

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>interface</b> <i>type slot / subslot / port</i> <b>Example:</b> Device(config)# interface gigabitethernet 1/0/0	Specifies the interface and enters interface configuration mode.
<b>Step 4</b>	<b>ip pim query-interval</b> <i>period [msec]</i> <b>Example:</b> Device(config-if)# ip pim query-interval 45	Configures the frequency at which multicast routers send PIM router query messages.

**Related Topics**

[PIM Router Query Messages](#), on page 2

[Modifying the PIM Router Query Message Interval Example](#), on page 8

**Verifying Multicast Subsecond Convergence Configurations**

Perform this task to display detailed information about and to verify information regarding the Multicast Subsecond Convergence feature.

**SUMMARY STEPS**

1. **enable**
2. **show ip pim interface** *type number*
3. **show ip pim neighbor**

## DETAILED STEPS

### Step 1 enable

#### Example:

```
Device> enable
```

Enables privileged EXEC mode.

- Enter your password if prompted.

### Step 2 show ip pim interface *type number*

Use this command to display information about interfaces configured for PIM.

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

#### Example:

```
Device# show ip pim interface GigabitEthernet 1/0/0
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
```

### Step 3 show ip pim neighbor

Use this command to display the PIM neighbors discovered by the Cisco IOS XE software.

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

#### Example:

```
Device# show ip pim neighbor
PIM Neighbor Table
Neighbor          Interface          Uptime/Expires   Ver  DR
Address           Prio/Mode
172.16.1.3        GigabitEthernet1/0/0 00:03:41/250 msec v2   1 / S
```

# Configuration Examples for Multicast Subsecond Convergence

## Example Modifying the Periodic RPF Check Interval

In the following example, the **ip multicast rpf interval** has been set to 10 seconds. This command does not show up in **show running-config** output unless the interval value has been configured to be the nondefault value.

```
!
ip multicast-routing
ip multicast rpf interval 10
.
.
.
interface Ethernet0/0
 ip address 172.16.2.1 255.255.255.0
```

```

.
.
.
ip pim sparse-mode
!

```

**Related Topics**

[Modifying the Periodic RPF Check Interval](#), on page 4  
[RPF Checks](#), on page 3

## Example Configuring PIM RPF Failover Intervals

In the following example, the **ip multicast rpf backoff** command has been configured with a minimum backoff interval value of 100 and a maximum backoff interval value of 2500. This command does not show up in **show running-config** command output unless the interval value has been configured to be the nondefault value.

```

!
ip multicast-routing
.
.
.
ip multicast rpf backoff 100 2500
!
!
interface Ethernet0/0
 ip address 172.16.2.1 255.255.255.0
.
.
.
ip pim sparse-mode
!

```

**Related Topics**

[Configuring PIM RPF Failover Intervals](#), on page 5  
[RPF Failover](#), on page 3

## Modifying the PIM Router Query Message Interval Example

In the following example, the **ip pim query-interval** command has been set to 100 milliseconds. This command does not show up in **show running-config** command output unless the interval value has been configured to be the nondefault value.

```

!
interface gigabitethernet0/0/1
 ip address 172.16.2.1 255.255.255.0
ip pim query-interval 100 msec
ip pim sparse-mode

```

**Related Topics**

[Modifying the PIM Router Query Message Interval](#), on page 5  
[PIM Router Query Messages](#), on page 2



## Additional References

### Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Commands List, All Releases</a>
Cisco IOS IP SLAs commands	<a href="#">Cisco IOS IP Multicast Command Reference</a>
PIM Sparse Mode concepts and configuration	“Configuring Basic IP Multicast” module or “Configuring IP Multicast in IPv6 Networks” module

### MIBs

MIB	MIBs Link
No new or modified MIBs are supported by these features, and support for existing MIBs has not been modified by these features.	To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### 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.	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

## Feature History and Information for Multicast Subsecond Convergence

Release	Modification
Cisco IOS XE 3.3SE	This feature was introduced.

