Multicast only Fast Re-Route

Multicast only Fast Re-Route (MoFRR) is an IP solution that minimizes packet loss in a network when there is a link or node failure. It works by making simple enhancements to multicast routing protocols like Protocol Independent Multicast (PIM).

MoFRR transmits a multicast join message from a receiver toward a source on a primary path, while also transmitting a secondary multicast join message from the receiver toward the source on a backup path. Data packets are received from both the primary path and the secondary paths. The redundant packets are discarded at topology merge points due to Reverse Path Forwarding (RPF) checks. When a failure is detected on the primary path, the repair is made by changing the interface on which packets are accepted to the secondary interface. Because the repair is local, it is fast--greatly improving convergence times in the event of node or link failures on the primary path.

Prerequisites for MoFRR

- Before performing the tasks in this module, you should be familiar with the concepts described in " IP Multicast Technology Overview " module.

- The tasks in this module assume that IP multicasting has been enabled and that PIM interfaces have been configured using the tasks described in the " Configuring Basic IP Multicast " module.

Restrictions for MoFRR

- The MoFRR feature is disabled by default and must be enabled using the CLI.

- The Equal Cost Multipath Protocol (ECMP) feature is a requirement in order for the MoFRR feature to function.

- MoFRR works only for Specific Multicast (SM) S, G, and Source Specific Multicast (SSM) routes.

- MoFRR is applicable to only IPv4 Multicast, not IPv6 Multicast.

- MoFRR does not support extranet routes.

- MoFRR works where the Reverse Path Forwarding (RPF) lookups are done in a single VRF.

- Both primary and secondary paths should exist in the same multicast topology.

- MoFRR is supported on images supporting IPv4 MFIB only.

# Information About MoFRR

Overview of MoFRR

The MoFRR feature provides the ability to minimize packet loss in a network when there is a link or node failure by enhancing, but not changing, multicast routing protocols such as PIM. With MoFRR, multicast routing protocols do not have to wait or depend on unicast routing protocols to detect network failures.

The MoFRR feature can be divided into two planes, red and blue, that are fully disjoint from each other all the way into the points of presence (POPs) as shown in the figure.

This two-plane design eliminates single points of failure in the core network. The upstream full-line arrows indicate the normal path taken when the PIM joins the flow from the POPs toward the source of the network.

MoFRR adds the broken-arrow path where the provider edge (PE) routers send an alternate PIM join to their neighbor toward the source. Each PE router then receives two copies of the same stream, one from the blue plane and one from the red plane. As a result of multicast RPF checks, the following occurs:

- The multicast stream received over the primary path (in the reverse direction of the full-line arrows) is accepted and forwarded to the downstream links.

- The copy of the stream received on the alternate path (in the reverse direction of the broken-line arrows) is discarded

IPTV source

POP₁ POP₂ POPₙ

Normal Path
Alternate Path
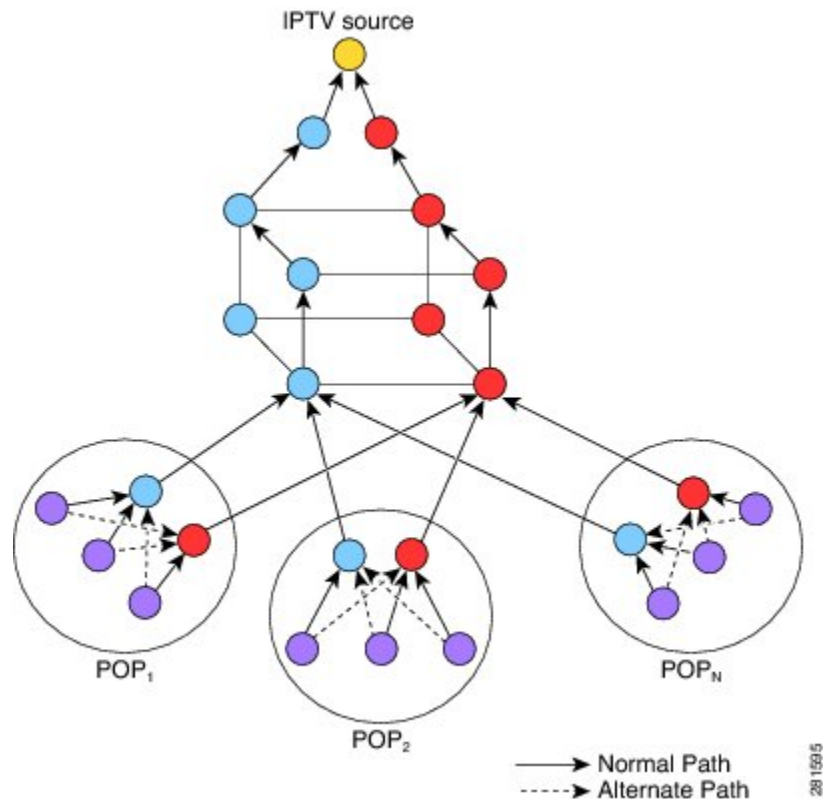
When a routing failure occurs, for example due to a link failure in the blue path, the red upstream router in the red plane becomes the primary upstream router to reach the source. This link to the router then becomes the RPF interface, and the copy of the multicast stream being received on the link is accepted and forwarded to the downstream links.

MoFRR achieves faster convergence by prebuilding the alternate multicast tree and receiving the traffic on that alternate path. The example discussed above is a simple case where there are two paths from each PE device toward the source, one along the blue plane and one along the red plane. MoFRR switchover as a result of routing convergence is expected to be in the order of -200 milliseconds.

How to Configure MoFRR

Enabling MoFRR

Perform this task to configure MoFRR.

Multiple ACL configurations are not allowed. Multicast routes are enabled for MoFRR based on the first match in the ACL.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip multicast-routing [vrf vrf-name] [distributed]**

4. **interface type number [name-tag]**
5. **ip address** *ip-address mask* [**secondary** [**vrf** *vrf-name*]]
6. **ip pim** {**dense-mode**[**proxy-register**{**list** *access-list* | **route-map** *map-name*}] | **passive** | **sparse-mode** | **sparse-dense-mode**}
7. **exit**
8. Repeat Steps 4 through 7 for each interface to be configured.
9. **ip multicast [vrf vrf-name] rpf mofrr {access-list-number | access-list-name} [sticky]**
10. **ip access-list** { **standard** | **extended** } { *access-list-name* | *access-list-number* }
11. [**sequence-number**] **permit source** [**source-wildcard**[
12. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**ip multicast-routing [vrf vrf-name] [distributed]** **Example:** `Device(config)# ip multicast-routing vrf vrf1`	Enables multicast routing. Depending on your release, the **distributed** keyword may not be supported for this command. • In this example, multicast routing is enabled on a vrf instance named vrf1.
Step 4	**interface type number [name-tag]** **Example:** `Device(config)# interface loopback 4`	Selects an interface that is connected to hosts on which PIM can be enabled. • In this example, loopback interface 4 is selected.

Step 5	**ip address** *ip-address mask* [**secondary** [**vrf** *vrf-name*]]
	
	Example:
	
	`Device(config-if)# ip address 209.165.200.225`
	`255.255.255.224`
		Sets a primary or secondary IP address for the interface.
		
		• In this example, 209.165.200.225 is set as the primary address for loopback interface 4.

Step 6	**ip pim** {**dense-mode**[**proxy-register**{**list** *access-list*	**route-map** *map-name*}]	**passive**	**sparse-mode**	**sparse-dense-mode**} **Example:** `Device(config-if)# ip pim sparse-dense-mode`	Enables PIM sparse-dense mode on an interface.

	Command or Action	**Purpose**
Step 7	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode and returns to global configuration mode.
Step 8	Repeat Steps 4 through 7 for each interface to be configured.	--
Step 9	**ip multicast [vrf vrf-name] rpf mofrr {access-list-number	access-list-name} [sticky]** **Example:** `Device(config)# ip multicast rpf mofrr 150`	Enables MoFRR for a multicast routing entry that is specific to a source and a group (S, G) matching the ACL. • In this example, MoFRR is enabled for the S, G matching the ACL numbered 150.
Step 10	**ip access-list { standard	extended } {** *access-list-name* **|** *access-list-number* **}** **Example:** `Device(config)# ip access-list extended 150`	Defines a standard or extended IP access list or object group access control list (OGACL) by name or number. • In this example, an ACL numbered 150 is defined. **Note** MoFRR accepts extended ACLs only. It does not accept standard ACLs.
Step 11	**[sequence-number] permit source [source-wildcard[** **Example:** `Device(config-ext-nacl)# permit 192.168.34.0 0.0.0.255`	Sets conditions to allow a packet to pass a numbered IP access list. • In this example, packets from source address 192.168.34.0 are allowed to pass the ACL.
Step 12	**end** **Example:** `Device(config-ext-nacl)# end`	Exits standard named access list configuration mode and returns to privileged EXEC mode.

Verifying That MoFRR Is Enabled

Perform these steps to verify the configuration of MoFRR.

SUMMARY STEPS

1. **enable**
2. **show ip rpf [vrf vrf-name] source-address [group-address] [rd route-distinguisher]} [metric]**
3. **show ip mroute** [**vrf** *vrf-name*] [[**active** [*kbps*] [**interface** *type number*] | **bidirectional** | **count** [**terse**] | **dense** | **interface** *type number* | **proxy** | **pruned** | **sparse** | **ssm** | **static** | **summary**] | [*group-address* [*source-address*]] [**count** [*terse*] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*source-address group-address*] [**count** [*terse*] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*group-address*] **active** [*kbps*] [**interface** *type number* | **verbose**]]

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip rpf** [**vrf vrf-name**] **source-address** [**group-address**] [**rd route-distinguisher**]} [**metric**] **Example:** `Device# show ip rpf 10.1.1.100`	Displays the information that IP multicast routing uses to perform the Reverse Path Forwarding (RPF) check for a multicast source. **Note** The MoFRR keyword will be displayed in the command output for MoFRR-enabled routes.
Step 3	**show ip mroute** [**vrf** *vrf-name*] [[**active** [*kbps*] [**interface** *type number*] | **bidirectional** | **count** [**terse**] | **dense** | **interface** *type number* | **proxy** | **pruned** | **sparse** | **ssm** | **static** | **summary**] | [*group-address* [*source-address*]] [**count** [*terse*] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*source-address group-address*] [**count** [**terse**] | **interface** *type number* | **proxy** | **pruned** | **summary**] | [*group-address*] **active** [*kbps*] [**interface** *type number* | **verbose**]] **Example:** `Device# show ip mroute`	Displays the contents of the multicast routing (mroute) table. **Note** The MoFRR keyword will be displayed in the command output for MoFRR-enabled routes.

Configuration Examples for MoFRR

Example Enabling MoFRR

This example shows MoFRR being enabled for the S, G matching ACL 125.

```
Device> enable
Device# configure terminal
Device(config)# ip multicast-routing vrf2
Device(config)# interface fastethernet 0/0
Device(config-if)# ip address 209.165.200.225 0.0.0.0
Device(config-if)# ip pim sparse-dense-mode
Device(config-if)# exit
Device(config)# ip multicast rpf mofrr 125
Device(config)# ip access-list
extended 125
Device(config-ext-nacl)# permit 209.165.201.1 255.255.255.224
Device(config-ext-nacl)# end
```

Example Verifying That MoFRR Is Enabled

The smaple output in the following example shows that MoFRR is enabled for the 209.165.200.225 multicast source IP address. The relevant command output is shown in bold.

```
device> enable
Device# show ip rpf 209.165.200.225
RPF information for ? (209.165.200.225) MoFRR Enabled
  RPF interface: Ethernet1/4
  RPF neighbor: ? (209.165.201.1)
  RPF route/mask: 255.255.255.224
  RPF type: unicast (ospf 200)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
  Secondary RPF interface: Ethernet1/3
  Secondary RPF neighbor: ? (209.165.202.129)
```

For a detailed explanation of the output, see the **show ip rpf** command in the *Cisco Ip Multicast Command Reference*.

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
IP multicast commands: complete command syntax, command mode, defaults, command history, usage guidelines, and examples	*Cisco IOS IP Multicast Command Reference*
Overview of the IP multicast technology area	IP Multicast Technology Overview module
Concepts, tasks, and examples for configuring an IP multicast network using PIM	Configuring a Basic IP Multicast module

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	--

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

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 MoFRR

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 MoFRR

Feature Name	Releases	Feature Information
MoFRR	Cisco IOS XE Release 3.2S 15.2(3)T 15.1(2)SY	The MoFRR feature provides the ability to minimize packet loss in a network when there is a link or node failure by enhancing, but not changing, multicast routing protocols such as PIM. With MoFRR, multicast routing protocols do not have to wait or depend on unicast routing protocols to detect network failures. The following commands were introduced or modified: **ip access-list, ip multicast rpf mofrr, ip multicast-routing, permit (IP), show ip mroute, show ip rpf** .