JUNIPER NETWORKS

Network Configuration Example

Configuring Bidirectional PIM

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Introduction

This document describes bidirectional PIM (PIM-Bidir), identifies what it is used for, and provides step-by-step instructions on how to configure it with static rendezvous points. It also explains how to verify that Bidirectional PIM is working.

Bidirectional PIM Applications

Bidirectional Protocol Independent Multicast (PIM-Bidir) is one of the Protocol Independent Multicast (PIM) protocols. It provides an alternative to other PIM modes. Bidirectional PIM is designed to support *many-to-many* multicast applications within a single PIM domain.

Bidirectional PIM has several key advantages over a PIM sparse mode deployment:

- It reduces the amount of state which a router must store.
- It scales very well when there are many sources for each group.
- It can scale to an arbitrary number of sources.
- It provides better support for intermittent sources.
- It is a less complicated protocol.
- It does not rely on data triggered events such as:
  - Source registration
  - Shortest-path tree switchover
- The rendezvous point can be configured as an address that is not assigned to any particular device.

Bidirectional PIM is used by large content providers to support:

- Video conferencing
- Financial applications
- Distributing product and customer data between servers in a large network of datacenters
- Distributed inventory polling
- Online gaming

Related Documentation

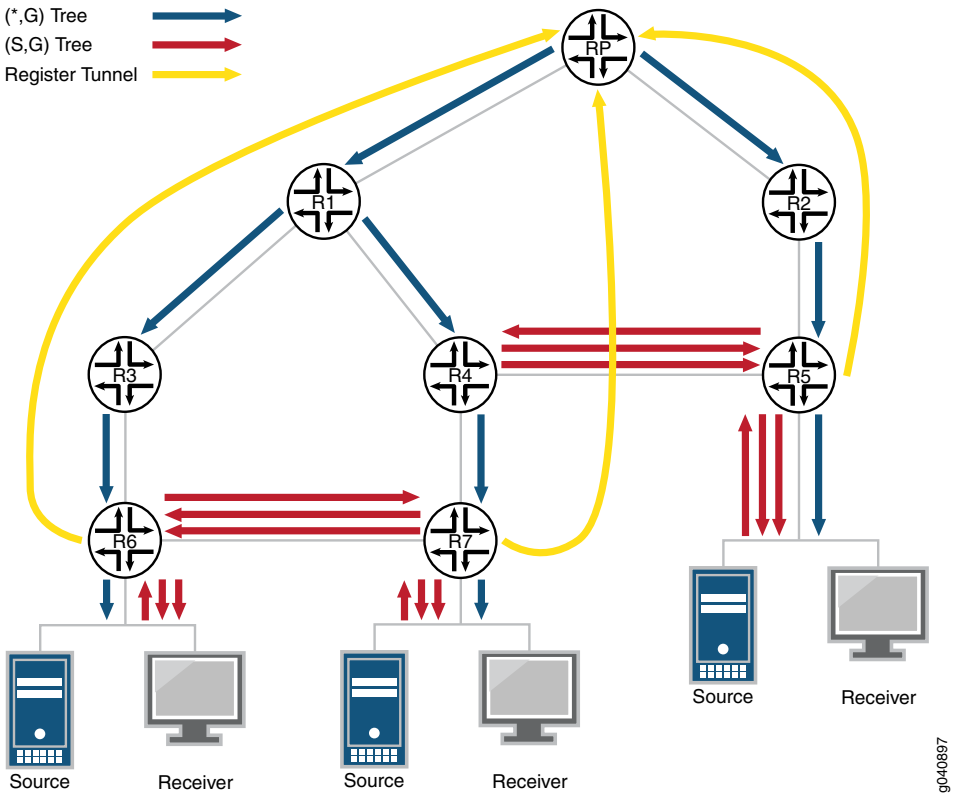
- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

Understanding Bidirectional PIM

Bidirectional PIM (PIM-Bidir) is specified by the IETF in RFC 5015, *Bidirectional Protocol Independent Multicast (BIDIR-PIM)*. It provides an alternative to other PIM modes, such as PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), and PIM source-specific multicast (SSM). In bidirectional PIM, multicast groups are carried across the network over bidirectional shared trees. This type of tree minimizes the amount of PIM routing state information that must be maintained, which is especially important in networks with numerous and dispersed senders and receivers. For example, one important application for bidirectional PIM is distributed inventory polling. In many-to-many applications, a multicast query from one station generates multicast responses from many stations. For each multicast group, such an application generates a large number of (S,G) routes for each station in PIM-SM, PIM-DM, or SSM. The problem is even worse in applications that use bursty sources, resulting in frequently changing multicast tables and, therefore, performance problems in routers.

Figure 1 on page 2 shows the traffic flows generated to deliver traffic for one group to and from three stations in a PIM-SM network.

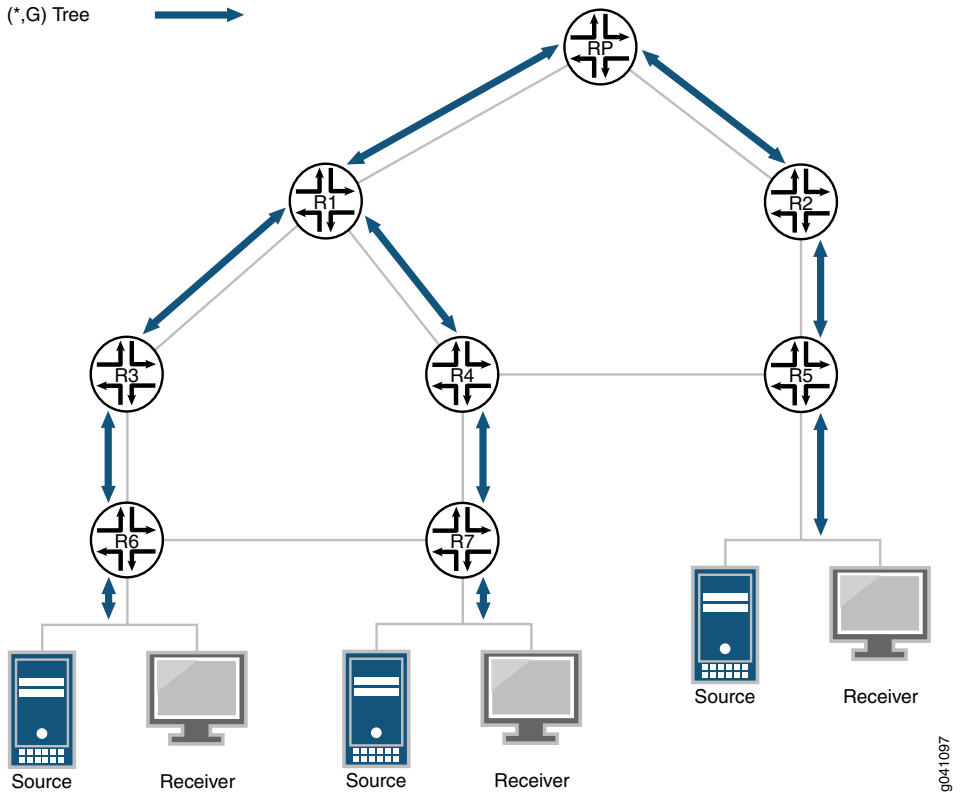
Figure 1: Example PIM Sparse-Mode Tree



Bidirectional PIM solves this problem by building only group-specific (*,G) state. Thus, only a single (*,G) route is needed for each group to deliver traffic to and from all the sources.

Figure 2 on page 3 shows the traffic flows generated to deliver traffic for one group to and from three stations in a bidirectional PIM network.

Figure 2: Example Bidirectional PIM Tree



Bidirectional PIM builds bidirectional shared trees that are rooted at a rendezvous point (RP) address. Bidirectional traffic does not switch to shortest path trees (SPTs) as in PIM-SM and is therefore optimized for routing state size instead of path length. Bidirectional PIM routes are always wildcard-source (*,G) routes. The protocol eliminates the need for (S,G) routes and data-triggered events. The bidirectional (*,G) group trees carry traffic both upstream from senders toward the RP, and downstream from the RP to receivers. As a consequence, the strict reverse path forwarding (RPF)-based rules found in other PIM modes do not apply to bidirectional PIM. Instead, bidirectional PIM routes forward traffic from all sources and the RP. Thus, bidirectional PIM routers must have the ability to accept traffic on many potential incoming interfaces.

Designated Forwarder Election

To prevent forwarding loops, only one router on each link or subnet (including point-to-point links) is a designated forwarder (DF). The responsibilities of the DF are to forward downstream traffic onto the link toward the receivers and to forward upstream traffic from the link toward the RP address. Bidirectional PIM relies on a process called DF election to choose the DF router for each interface and for each RP address. Each bidirectional PIM router in a subnet advertises its interior gateway protocol (IGP) unicast route to the RP address. The router with the best IGP unicast route to the RP address

wins the DF election. Each router advertises its IGP route metrics in DF Offer, Winner, Backoff, and Pass messages.

Junos OS implements the DF election procedures as stated in RFC 5015, except that Junos OS checks RP unicast reachability before accepting incoming DF messages. DF messages for unreachable rendezvous points are ignored.

Bidirectional PIM Modes

In the Junos OS implementation, there are two modes for bidirectional PIM: bidirectional-sparse and bidirectional-sparse-dense. The differences between bidirectional-sparse and bidirectional-sparse-dense modes are the same as the differences between sparse mode and sparse-dense mode. Sparse-dense mode allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as "dense" is not mapped to an RP. Use bidirectional-sparse-dense mode when you have a mix of bidirectional groups, sparse groups, and dense groups in your network. One typical scenario for this is the use of auto-RP, which uses dense-mode flooding to bootstrap itself for sparse mode or bidirectional mode. In general, the dense groups could be for any flows that the network design requires to be flooded.

Each group-to-RP mapping is controlled by the RP **group-ranges** statement and the **ssm-groups** statement.

The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:

- **bidirectional-sparse**—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode.
- **bidirectional-sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in bidirectional, sparse, or SSM mode.

Bidirectional Rendezvous Points

You can configure group-range-to-RP mappings network-wide statically, or only on routers connected to the RP addresses and advertise them dynamically. Unlike rendezvous points for PIM-SM, which must de-encapsulate PIM Register messages and perform other specific protocol actions, bidirectional PIM rendezvous points implement no specific functionality. RP addresses are simply locations in the network to rendezvous toward. In fact, RP addresses need not be loopback interface addresses or even be addresses configured on any router, as long as they are covered by a subnet that is connected to a bidirectional PIM-capable router and advertised to the network.

Thus, for bidirectional PIM, there is no meaningful distinction between static and local RP addresses. Therefore, bidirectional PIM rendezvous points are configured at the **[edit protocols pim rp bidirectional]** hierarchy level, not under **static** or **local**.

The settings at the **[edit protocol pim rp bidirectional]** hierarchy level function like the settings at the **[edit protocols pim rp local]** hierarchy level, except that they create bidirectional PIM RP state instead of PIM-SM RP state.

Where only a single local RP can be configured, multiple bidirectional rendezvous points can be configured having group ranges that are the same, different, or overlapping. It is also permissible for a group range or RP address to be configured as bidirectional and either static or local for sparse-mode.

If a bidirectional PIM RP is configured without a group range, the default group range is 224/4 for IPv4. For IPv6, the default is ff00::/8. You can configure a bidirectional PIM RP group range to cover an SSM group range, but in that case the SSM or DM group range takes precedence over the bidirectional PIM RP configuration for those groups. In other words, because SSM always takes precedence, it is not permitted to have a bidirectional group range equal to or more specific than an SSM or DM group range.

PIM Bootstrap and Auto-RP Support

Group ranges for the specified RP address are flagged by PIM as bidirectional PIM group-to-RP mappings and, if configured, are advertised using PIM bootstrap or auto-RP. Dynamic advertisement of bidirectional PIM-flagged group-to-RP mappings using PIM bootstrap, and auto-RP is controlled as normal using the **bootstrap** and **auto-rp** statements.

Bidirectional PIM RP addresses configured at the **[edit protocols pim rp bidirectional address]** hierarchy level are advertised by auto-RP or PIM bootstrap if the following prerequisites are met:

- The routing instance must be configured to advertise candidate rendezvous points by way of auto-RP or PIM bootstrap, and an auto-RP mapping agent or bootstrap router, respectively, must be elected.
- The RP address must either be configured locally on an interface in the routing instance, or the RP address must belong to a subnet connected to an interface in the routing instance.

IGMP and MLD Support

Internet Group Management Protocol (IGMP) version 1, version 2, and version 3 are supported with bidirectional PIM. Multicast Listener Discovery (MLD) version 1 and version 2 are supported with bidirectional PIM. However, in all cases, only anysource multicast (ASM) state is supported for bidirectional PIM membership.

The following rules apply to bidirectional PIM:

- IGMP and MLD (*,G) membership reports trigger the PIM DF to originate bidirectional PIM (*,G) join messages.
- IGMP and MLD (S,G) membership reports do not trigger the PIM DF to originate bidirectional PIM (*,G) join messages.

Bidirectional PIM and Graceful Restart

Bidirectional PIM accepts packets for a bidirectional route on multiple interfaces. This means that some topologies might develop multicast routing loops if all PIM neighbors are not synchronized with regard to the identity of the designated forwarder (DF) on each

link. If one router is forwarding without actively participating in DF elections, particularly after unicast routing changes, multicast routing loops might occur.

If graceful restart for PIM is enabled and bidirectional PIM is enabled, the default graceful restart behavior is to continue forwarding packets on bidirectional routes. If the gracefully restarting router was serving as a DF for some interfaces to rendezvous points, the restarting router sends a DF Winner message with a metric of 0 on each of these RP interfaces. This ensures that a neighbor router does not become the DF due to unicast topology changes that might occur during the graceful restart period. Sending a DF Winner message with a metric of 0 prevents another PIM neighbor from assuming the DF role until after graceful restart completes. When graceful restart completes, the gracefully restarted router sends another DF Winner message with the actual converged unicast metric.

The no-bidirectional-mode statement at the **[edit protocols pim graceful-restart]** hierarchy level overrides the default behavior and disables forwarding for bidirectional PIM routes during graceful restart recovery, both in cases of simple routing protocol process (rpd) restart and graceful Routing Engine switchover. This configuration statement provides a very conservative alternative to the default graceful restart behavior for bidirectional PIM routes. The reason to discontinue forwarding of packets on bidirectional routes is that the continuation of forwarding might lead to short-duration multicast loops in rare double-failure circumstances.

Junos OS Enhancements to Bidirectional PIM

In addition to the functionality specified in RFC 5015, the following functions are included in the Junos OS implementation of bidirectional PIM:

- Source-only branches without PIM join state
- Support for both IPv4 and IPv6 domain and multicast addresses
- Nonstop routing (NSR) for bidirectional PIM routes
- Support for bidirectional PIM in logical systems
- Support for non-forwarding and virtual router instances

Limitations of Bidirectional PIM

The Junos OS implementation of bidirectional PIM does not support the following functionality:

- SNMP for bidirectional PIM.
- Graceful Routing Engine switchover is configurable with bidirectional PIM enabled, but bidirectional routes do not forward packets during the switchover.
- Multicast VPNs (Draft Rosen and NextGen).

The bidirectional PIM protocol does not support the following functionality:

- Embedded RP
- Anycast RP

Related Documentation

- Example: Configuring Bidirectional PIM on page 7
- Configuring PIM Auto-RP in the Multicast Protocols Configuration Guide
- Configuring PIM Bootstrap Properties for IPv4 or IPv6 in the Multicast Protocols Configuration Guide

Example: Configuring Bidirectional PIM

This example shows how to configure bidirectional PIM, as specified in RFC 5015, *Bidirectional Protocol Independent Multicast (BIDIR-PIM)*.

Requirements

This example uses the following hardware and software components:

- Eight Juniper Networks routers that can be M120, M320, MX Series, or T Series platforms. To support bidirectional PIM, M Series platforms must have I-chip FPCs. M7i, M10i, M40e, and other older M Series routers do not support bidirectional PIM.
- Junos OS Release 12.1 or later running on all eight routers.

Overview

Compared to PIM sparse mode, bidirectional PIM requires less PIM router state information. Because less state information is required, bidirectional PIM scales well and is useful in deployments with many dispersed sources and receivers.

In this example, two rendezvous points are configured statically. One RP is configured as a phantom RP. A phantom RP is an RP address that is a valid address on a subnet, but is not assigned to a PIM router interface. The subnet must be reachable by the bidirectional PIM routers in the network. For the other (non-phantom) RP in this example, the RP address is assigned to a PIM router interface. It can be assigned to either the loopback interface or any physical interface on the router. In this example, it is assigned to a physical interface.

OSPF is used as the interior gateway protocol (IGP) in this example. The OSPF metric determines the designated forwarder (DF) election process. In bidirectional PIM, the DF establishes a loop-free shortest-path tree that is rooted at the RP. On every network segment and point-to-point link, all PIM routers participate in DF election. The procedure selects one router as the DF for every RP of bidirectional groups. This router forwards multicast packets received on that network upstream to the RP. The DF election uses the same tie-break rules used by PIM assert processes.

This example uses the default DF election parameters. Optionally, at the **[edit protocols pim interface (*interface-name* | all)** bidirectional**]** hierarchy level, you can configure the following parameters related to the DF election:

- The robustness-count is the minimum number of DF election messages that must be lost for election to fail.
- The offer period is the interval to wait between repeated DF Offer and Winner messages.
- The backoff period is the period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

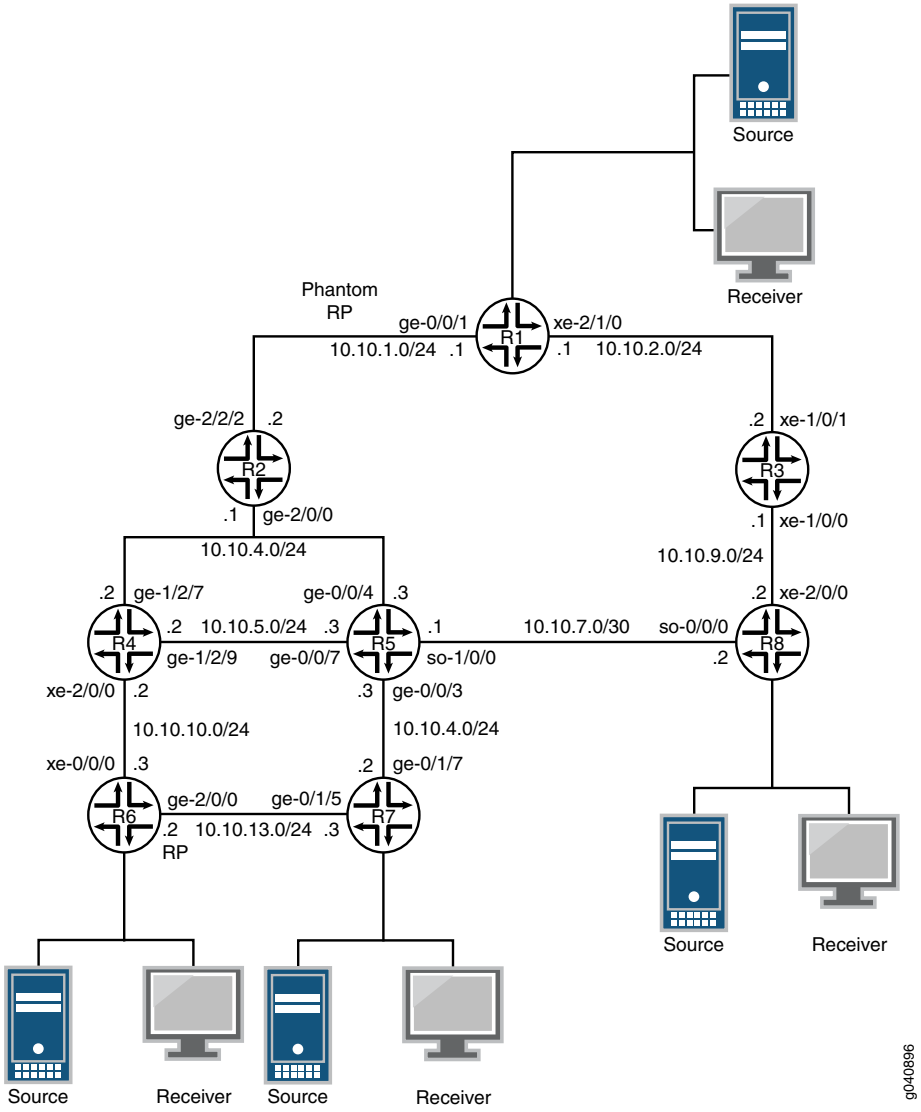
This example uses bidirectional-sparse-dense mode on the interfaces. The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:

- **bidirectional-sparse**—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode.
- **bidirectional-sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in bidirectional, sparse, or SSM mode.

Topology Diagram

Figure 3 on page 9 shows the topology used in this example.

Figure 3: Bidirectional PIM with Statically Configured Rendezvous Points



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Router R1

```
set interfaces ge-0/0/1 unit 0 family inet address 10.10.1.1/24
set interfaces xe-2/1/0 unit 0 family inet address 10.10.2.1/24
set interfaces lo0 unit 0 family inet address 10.255.11.11/32
set protocols ospf area 0.0.0.0 interface ge-0/0/1.0
set protocols ospf area 0.0.0.0 interface xe-2/1/0.0
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols pim traceoptions file df
```

```
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim interface ge-0/0/1.0 mode bidirectional-sparse-dense
set protocols pim interface xe-2/1/0.0 mode bidirectional-sparse-dense
```

Router R2

```
set interfaces ge-2/0/0 unit 0 family inet address 10.10.4.1/24
set interfaces ge-2/2/2 unit 0 family inet address 10.10.1.2/24
set interfaces lo0 unit 0 family inet address 10.255.22.22/32
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface ge-2/2/2.0
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface ge-2/0/0.0
set protocols pim traceoptions file df
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim interface fxp0.0 disable
set protocols pim interface ge-2/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-2/2/2.0 mode bidirectional-sparse-dense
```

Router R3

```
set interfaces xe-1/0/0 unit 0 family inet address 10.10.9.1/24
set interfaces xe-1/0/1 unit 0 family inet address 10.10.2.2/24
set interfaces lo0 unit 0 family inet address 10.255.33.33/32
set protocols ospf area 0.0.0.0 interface xe-1/0/1.0
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface xe-1/0/0.0
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim interface xe-1/0/1.0 mode bidirectional-sparse-dense
set protocols pim interface xe-1/0/0.0 mode bidirectional-sparse-dense
```

Router R4

```
set interfaces ge-1/2/7 unit 0 family inet address 10.10.4.2/24
set interfaces ge-1/2/8 unit 0 family inet address 10.10.5.2/24
set interfaces xe-2/0/0 unit 0 family inet address 10.10.10.2/24
set interfaces lo0 unit 0 family inet address 10.255.44.44/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface ge-1/2/7.0
set protocols ospf area 0.0.0.0 interface ge-1/2/8.0
set protocols ospf area 0.0.0.0 interface xe-2/0/0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols pim traceoptions file df
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface xe-2/0/0.0 mode bidirectional-sparse-dense
```

```
set protocols pim interface ge-1/2/7.0 mode bidirectional-sparse-dense
set protocols pim interface ge-1/2/8.0 mode bidirectional-sparse-dense
```

Router R5

```
set interfaces ge-0/0/3 unit 0 family inet address 10.10.12.3/24
set interfaces ge-0/0/4 unit 0 family inet address 10.10.4.3/24
set interfaces ge-0/0/7 unit 0 family inet address 10.10.5.3/24
set interfaces so-1/0/0 unit 0 family inet address 10.10.7.1/30
set interfaces lo0 unit 0 family inet address 10.255.55.55/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface ge-0/0/7.0
set protocols ospf area 0.0.0.0 interface ge-0/0/4.0
set protocols ospf area 0.0.0.0 interface so-1/0/0.0
set protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface ge-0/0/7.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/0/4.0 mode bidirectional-sparse-dense
set protocols pim interface so-1/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/0/3.0 mode bidirectional-sparse-dense
```

Router R6

```
set interfaces xe-0/0/0 unit 0 family inet address 10.10.10.3/24
set interfaces ge-2/0/0 unit 0 family inet address 10.10.13.2/24
set interfaces lo0 unit 0 family inet address 10.255.66.66/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface ge-2/0/0.0
set protocols ospf area 0.0.0.0 interface xe-0/0/0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface fxp0.0 disable
set protocols pim interface xe-0/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-2/0/0.0 mode bidirectional-sparse-dense
```

Router R7

```
set interfaces ge-0/1/5 unit 0 family inet address 10.10.13.3/24
set interfaces ge-0/1/7 unit 0 family inet address 10.10.12.2/24
set interfaces lo0 unit 0 family inet address 10.255.77.77/32
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface ge-0/1/5.0
set protocols ospf area 0.0.0.0 interface ge-0/1/7.0
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface ge-0/1/5.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/1/7.0 mode bidirectional-sparse-dense
```

Router R8

```
set interfaces so-0/0/0 unit 0 family inet address 10.10.7.2/30
set interfaces xe-2/0/0 unit 0 family inet address 10.10.9.2/24
set interfaces lo0 unit 0 family inet address 10.255.88.88/32
```

```
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface xe-2/0/0.0
set protocols ospf area 0.0.0.0 interface so-0/0/0.0
set protocols pim traceoptions file df
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface xe-2/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface so-0/0/0.0 mode bidirectional-sparse-dense
```

Router R1

Step-by-Step Procedure

To configure Router R1:

1. Configure the router interfaces.

   ```
   [edit interfaces]
   user@R1# set ge-0/0/1 unit 0 family inet address 10.10.1.1/24
   user@R1# set xe-2/1/0 unit 0 family inet address 10.10.2.1/24
   user@R1# set lo0 unit 0 family inet address 10.255.11.11/32
   ```

2. Configure OSPF on the interfaces.

   ```
   [edit protocols ospf area 0.0.0.0]
   user@R1# set interface ge-0/0/1.0
   user@R1# set interface xe-2/1/0.0
   user@R1# set interface lo0.0
   user@R1# set interface fxp0.0 disable
   ```

3. Configure the group-to-RP mappings.

   ```
   [edit protocols pim rp bidirectional]
   user@R1# set address 10.10.1.3 group-ranges 224.1.3.0/24
   user@R1# set address 10.10.1.3 group-ranges 225.1.3.0/24
   user@R1# set address 10.10.13.2 group-ranges 224.1.1.0/24
   user@R1# set address 10.10.13.2 group-ranges 225.1.1.0/24
   ```

   The RP represented by IP address 10.10.1.3 is a phantom RP. The 10.10.1.3 address is not assigned to any interface on any of the routers in the topology. It is, however, a reachable address. It is in the subnet between Routers R1 and R2.

   The RP represented by address 10.10.13.2 is assigned to the **ge-2/0/0** interface on Router R6.

4. Enable bidirectional PIM on the interfaces.

   ```
   [edit protocols pim]
   user@R1# set interface ge-0/0/1.0 mode bidirectional-sparse-dense
   user@R1# set interface xe-2/1/0.0 mode bidirectional-sparse-dense
   ```

5. (Optional) Configure tracing operations for the DF election process.

   ```
   [edit protocols pim]
   user@R1# set traceoptions file df
   user@R1# set traceoptions flag bidirectional-df-election detail
   ```

From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show interfaces
ge-0/0/1 {
    unit 0 {
        family inet {
            address 10.10.1.1/24;
        }
    }
}
xe-2/1/0 {
    unit 0 {
        family inet {
            address 10.10.2.1/24;
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.255.11.11/32;
        }
    }
}
```

```
user@R1# show protocols
ospf {
    area 0.0.0.0 {
        interface ge-0/0/1.0;
        interface xe-2/1/0.0;
        interface lo0.0;
        interface fxp0.0 {
            disable;
        }
    }
}
pim {
    rp {
        bidirectional {
            address 10.10.1.3 { # phantom RP
                group-ranges {
                    224.1.3.0/24;
                    225.1.3.0/24;
                }
            }
            address 10.10.13.2 {
                group-ranges {
                    224.1.1.0/24;
                    225.1.1.0/24;
                }
            }
        }
    }
    interface ge-0/0/1.0 {
```

```
    mode bidirectional-sparse-dense;
  }
  interface xe-2/1/0.0 {
    mode bidirectional-sparse-dense;
  }
  traceoptions {
    file df;
    flag bidirectional-df-election detail;
  }
}
```

If you are done configuring the router, enter **commit** from configuration mode.

Repeat the procedure for every Juniper Networks router in the bidirectional PIM network, using the appropriate interface names and addresses for each router.

Verification

Confirm that the configuration is working properly.

Verifying Rendezvous Points

Purpose Verify the group-to-RP mapping information.

Action

```
user@R1> show pim rps
Instance: PIM.master
Address family INET
RP address      Type        Mode   Holdtime Timeout Groups Group prefixes
10.10.1.3       static      bidir       150    None      2 224.1.3.0/24
                                                           225.1.3.0/24
10.10.13.2      static      bidir       150    None      2 224.1.1.0/24
                                                           225.1.1.0/24
```

Verifying Messages

Purpose Check the number of DF election messages sent and received, and check bidirectional join and prune error statistics.

Action

```
user@R1> show pim statistics
PIM Message type        Received       Sent  Rx errors
V2 Hello                      16         34          0
```

```
...
V2 DF Election                18         38          0
...

Global Statistics

...
Rx Bidir Join/Prune on non-Bidir if           0
Rx Bidir Join/Prune on non-DF if              0
```

Checking the PIM Join State

Purpose Confirm the upstream interface, neighbor, and state information.

Action

```
user@R1> show pim join extensive
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 224.1.1.0
    Bidirectional group prefix length: 24
    Source: *
    RP: 10.10.13.2
    Flags: bidirectional,rptree,wildcard
    Upstream interface: ge-0/0/1.0
    Upstream neighbor: 10.10.1.2
    Upstream state: None
    Bidirectional accepting interfaces:
        Interface: ge-0/0/1.0    (RPF)
        Interface: lo0.0         (DF Winner)

Group: 224.1.3.0
    Bidirectional group prefix length: 24
    Source: *
    RP: 10.10.1.3
    Flags: bidirectional,rptree,wildcard
    Upstream interface: ge-0/0/1.0 (RP Link)
    Upstream neighbor: Direct
    Upstream state: Local RP
    Bidirectional accepting interfaces:
        Interface: ge-0/0/1.0    (RPF)
        Interface: lo0.0         (DF Winner)
        Interface: xe-2/1/0.0    (DF Winner)

Group: 225.1.1.0
    Bidirectional group prefix length: 24
    Source: *
    RP: 10.10.13.2
    Flags: bidirectional,rptree,wildcard
    Upstream interface: ge-0/0/1.0
    Upstream neighbor: 10.10.1.2
    Upstream state: None
    Bidirectional accepting interfaces:
        Interface: ge-0/0/1.0    (RPF)
        Interface: lo0.0         (DF Winner)

Group: 225.1.3.0
    Bidirectional group prefix length: 24
    Source: *
    RP: 10.10.1.3
    Flags: bidirectional,rptree,wildcard
```

```
    Upstream interface: ge-0/0/1.0 (RP Link)
    Upstream neighbor: Direct
    Upstream state: Local RP
    Bidirectional accepting interfaces:
        Interface: ge-0/0/1.0    (RPF)
        Interface: lo0.0         (DF Winner)
        Interface: xe-2/1/0.0    (DF Winner)
```

Meaning The output shows a (*,G-range) entry for each active bidirectional RP group range. These entries provide a hierarchy from which the individual (*,G) routes inherit RP-derived state (upstream information and accepting interfaces). These entries also provide the control plane basis for the (*, G-range) forwarding routes that implement the sender-only branches of the tree.

Displaying the Designated Forwarder

Purpose Display RP address information and confirm the DF elected.

Action

```
user@R1> show pim bidirectional df-election
Instance: PIM.master Family: INET

RPA: 10.10.1.3
Group ranges: 224.1.3.0/24, 225.1.3.0/24
Interfaces:
    ge-0/0/1.0    (RPL)      DF: none
    lo0.0         (Win)      DF: 10.255.179.246
    xe-2/1/0.0    (Win)      DF: 10.10.2.1

RPA: 10.10.13.2
Group ranges: 224.1.1.0/24, 225.1.1.0/24
Interfaces:
    ge-0/0/1.0    (Lose)     DF: 10.10.1.2
    lo0.0         (Win)      DF: 10.255.179.246
    xe-2/1/0.0    (Lose)     DF: 10.10.2.2
```

Displaying the PIM Interfaces

Purpose Verify that the PIM interfaces have bidirectional-sparse-dense (**SDB**) mode assigned.

Action

```
user@R1> show pim interfaces
Instance: PIM.master

Stat = Status, V = Version, NbrCnt = Neighbor Count,
S = Sparse, D = Dense, B = Bidirectional,
DR = Designated Router, P2P = Point-to-point link,
Active = Bidirectional is active, NotCap = Not Bidirectional Capable

Name               Stat Mode IP V State        NbrCnt JoinCnt(sg/*g) DR address
ge-0/0/1.0          Up   SDB   4 2 NotDR,Active      1 0/0            10.10.1.2
lo0.0              Up   SDB   4 2 DR,Active        0 9901/100       10.255.179.246
xe-2/1/0.0          Up   SDB   4 2 NotDR,Active      1 0/0            10.10.2.2
```

Checking the PIM Neighbors

Purpose Check that the router detects that its neighbors are enabled for bidirectional PIM by verifying that the **B** option is displayed.

Action

```
user@R1> show pim neighbors
Instance: PIM.master
B = Bidirectional Capable, G = Generation Identifier,
H = Hello Option Holdtime, L = Hello Option LAN Prune Delay,
P = Hello Option DR Priority, T = Tracking Bit

Interface           IP V Mode        Option       Uptime Neighbor addr
ge-0/0/1.0           4 2             HPLGBT     00:06:46 10.10.1.2
xe-2/1/0.0           4 2             HPLGBT     00:06:46 10.10.2.2
```

Checking the Route to the Rendezvous Points

Purpose Check the interface route to the rendezvous points.

Action

```
user@R1> show route 10.10.13.2
inet.0: 56 destinations, 56 routes (55 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

10.10.13.0/24      *[OSPF/10] 00:04:35, metric 4
                    > to 10.10.1.2 via ge-0/0/1.0

user@R1> show route 10.10.1.3
inet.0: 56 destinations, 56 routes (55 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

10.10.1.0/24       *[Direct/0] 00:06:25
                    > via ge-0/0/1.0
```

Verifying Multicast Routes

Purpose Verify the multicast traffic route for each group.

For bidirectional PIM, the **show multicast route extensive** command shows the (*, G/*prefix*) forwarding routes and the list of interfaces that accept bidirectional PIM traffic.

Action

```
user@R1> show multicast route extensive
Family: INET

Group: 224.0.0.0/4
    Source: *
    Incoming interface list:
        lo0.0 ge-0/0/1.0 xe-4/1/0.0
    Downstream interface list:
        ge-0/0/1.0
    Session description: zeroconfaddr
    Statistics: 0 kBps, 0 pps, 0 packets
    Next-hop ID: 2097157
    Incoming interface list ID: 559
    Upstream protocol: PIM
    Route state: Active
    Forwarding state: Forwarding
    Cache lifetime/timeout: forever
    Wrong incoming interface notifications: 0

Group: 224.1.1.0/24
    Source: *
    Incoming interface list:
        lo0.0 ge-0/0/1.0
```

```
    Downstream interface list:
        ge-0/0/1.0
    Session description: NOB Cross media facilities
    Statistics: 0 kBps, 0 pps, 0 packets
    Next-hop ID: 2097157
    Incoming interface list ID: 579
    Upstream protocol: PIM
    Route state: Active
    Forwarding state: Forwarding
    Cache lifetime/timeout: forever
    Wrong incoming interface notifications: 0

Group: 224.1.3.0/24
    Source: *
    Incoming interface list:
        lo0.0 ge-0/0/1.0 xe-4/1/0.0
    Downstream interface list:
        ge-0/0/1.0
    Session description: NOB Cross media facilities
    Statistics: 0 kBps, 0 pps, 0 packets
    Next-hop ID: 2097157
    Incoming interface list ID: 556
    Upstream protocol: PIM
    Route state: Active
    Forwarding state: Forwarding
    Cache lifetime/timeout: forever
    Wrong incoming interface notifications: 0

Group: 225.1.1.0/24
    Source: *
    Incoming interface list:
        lo0.0 ge-0/0/1.0
    Downstream interface list:
        ge-0/0/1.0
    Session description: Unknown
    Statistics: 0 kBps, 0 pps, 0 packets
    Next-hop ID: 2097157
    Incoming interface list ID: 579
    Upstream protocol: PIM
    Route state: Active
    Forwarding state: Forwarding
    Cache lifetime/timeout: forever
    Wrong incoming interface notifications: 0

Group: 225.1.3.0/24
    Source: *
    Incoming interface list:
        lo0.0 ge-0/0/1.0 xe-4/1/0.0
    Downstream interface list:
        ge-0/0/1.0
    Session description: Unknown
    Statistics: 0 kBps, 0 pps, 0 packets
    Next-hop ID: 2097157
    Incoming interface list ID: 556
    Upstream protocol: PIM
    Route state: Active
    Forwarding state: Forwarding
    Cache lifetime/timeout: forever
    Wrong incoming interface notifications: 0
```

Meaning For information about how the incoming and outgoing interface lists are derived, see the forwarding rules in RFC 5015.

Viewing Multicast Next Hops

Purpose Verify that the correct accepting interfaces are shown in the incoming interface list.

Action

```
user@R1> show multicast next-hops
Family: INET
ID          Refcount KRefcount Downstream interface
2097157           10         5 ge-0/0/1.0


Family: Incoming interface list
ID          Refcount KRefcount Downstream interface
579                5         2 lo0.0
                               ge-0/0/1.0
556                5         2 lo0.0
                               ge-0/0/1.0
                               xe-4/1/0.0
559                3         1 lo0.0
                               ge-0/0/1.0
                               xe-4/1/0.0
```

Meaning The nexthop IDs for the outgoing and incoming next hops are referenced directly in the **show multicast route extensive** command.

Related Documentation

- Understanding Bidirectional PIM on page 2

backoff-period

Syntax backoff-period *milliseconds*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim interface *interface-name* bidirectional df-election],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election],
[edit protocols pim interface *interface-name* bidirectional df-election],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election]

Release Information Statement introduced in Junos OS Release 12.1.

Description Configure the designated forwarder (DF) election backoff period for bidirectional PIM. The **backoff-period** statement configures the period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

NOTE: Junos OS checks rendezvous point (RP) unicast reachability before accepting incoming DF messages. DF messages for unreachable rendezvous points are ignored. This is needed to prevent the following example scenario. Routers A and B are downstream routers on the same LAN, and both are supposed to send DF election messages with an infinite metric on their upstream interfaces (reverse-path forwarding [RPF] interfaces). Router A has a higher IP address than Router B. When both routers lose the path to the RP, both send an Offer message with the infinite metric onto the LAN. Router A wins the election because it has a higher IP address, and Router B backs off as a result. After three Offer messages, according to RFC 5015, Router A looks up the RP and finds no path to the RP. As a result, Router A transitions to the Lose state and sends nothing. On the other hand, after backing off for an interval of 3 x the Offer period, Router B does not receive any messages, and resumes the DF election by sending a new Offer message. Hence, the pattern repeats indefinitely.

Options *milliseconds*—Period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

Range: 100 through 65,535 milliseconds

Default: 1000

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

bidirectional (Interface)

Syntax

```
bidirectional {
  df-election {
    backoff-period milliseconds;
    offer-period milliseconds;
    robustness-count number;
  }
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols pim interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name*],
[edit protocols pim interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name*]

Release Information

Statement introduced in Junos OS Release 12.1.

Description

Configure parameters for bidirectional PIM.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

bidirectional (RP)

Syntax

```
bidirectional {
  address address {
    group-ranges {
      destination-ip-prefix</prefix-length>;
    }
    hold-time seconds;
    priority number;
  }
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols pim rp],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim rp],
[edit protocols pim rp],
[edit routing-instances *routing-instance-name* protocols pim rp]

Release Information

Statement introduced in Junos OS Release 12.1.

Description

Configure the routing device's rendezvous-point (RP) properties for bidirectional PIM.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

no-bidirectional-mode

Syntax no-birectional-mode;

Hierarchy Level [edit logical-systems *logical-system-name* protocols pim graceful-restart],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim graceful-restart],
[edit protocols pim graceful-restart],
[edit routing-instances *routing-instance-name* protocols pim graceful-restart]

Release Information Statement introduced in Junos OS Release 12.1.

Description Disable forwarding for bidirectional PIM routes during graceful restart recovery, both in cases of a routing protocol process (rpd) restart and graceful Routing Engine switchover.

Bidirectional PIM accepts packets for a bidirectional route on multiple interfaces. This means that some topologies might develop multicast routing loops if all PIM neighbors are not synchronized with regard to the identity of the designated forwarder (DF) on each link. If one router is forwarding without actively participating in DF elections, particularly after unicast routing changes, multicast routing loops might occur.

If graceful restart for PIM is enabled and the forwarding of packets on bidirectional routes is disallowed (by including the **no-bidirectional-mode** statement in the configuration), PIM behaves conservatively to avoid multicast routing loops during the recovery period. When the routing protocol process (rpd) restarts, all bidirectional routes are deleted. After graceful restart has completed, the routes are re-added, based on the converged unicast and bidirectional PIM state. While graceful restart is active, bidirectional multicast flows drop packets.

Default If graceful restart for PIM is enabled and the bidirectional PIM is enabled, the default graceful restart behavior is to continue forwarding packets on bidirectional routes. If the gracefully restarting router was serving as a DF for some interfaces to rendezvous points, the restarting router sends a DF Winner message with a metric of 0 on each of these RP interfaces. This ensures that a neighbor router does not become the DF due to unicast topology changes that might occur during the graceful restart period. Sending a DF Winner message with a metric of 0 prevents another PIM neighbor from assuming the DF role until after graceful restart completes. When graceful restart completes, the gracefully restarted router sends another DF Winner message with the actual converged unicast metric.

NOTE: Graceful Routing Engine switchover operates independently of the graceful restart behavior. If graceful Routing Engine switchover is configured without graceful restart, all PIM routes for all modes are deleted when the rpd process restarts. If graceful Routing Engine switchover is configured with graceful restart, the behavior is the same as described here, except that the recovery happens on the Routing Engine that assumes mastership.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Configuring PIM Sparse Mode Graceful Restart in the Multicast Protocols Configuration Guide
- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

df-election

Syntax

```
df-election {
  backoff-period milliseconds;
  offer-period milliseconds;
  robustness-count number;
}
```

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim interface *interface-name* bidirectional],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional],
[edit protocols pim interface *interface-name* bidirectional],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional]

Release Information
Statement introduced in Junos OS Release 12.1.

Description
Optionally, configure the designated forwarder (DF) election parameters for bidirectional PIM.

The remaining statements are explained separately.

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

offer-period

Syntax offer-period *milliseconds*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim interface *interface-name* bidirectional df-election],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election],
[edit protocols pim interface *interface-name* bidirectional df-election],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election]

Release Information Statement introduced in Junos OS Release 12.1.

Description Configure the designated forwarder (DF) election offer period for bidirectional PIM. When a DF election Offer or Winner message fails to be received, the message is retransmitted. The **offer-period** statement modifies the interval between repeated DF election messages. The robustness-count statement determines the minimum number of DF election messages that must fail to be received for DF election to fail. To prevent routing loops, all routers on the link must have a consistent view of the DF. When the DF election fails because DF election messages are not received, forwarding on bidirectional PIM routes is suspended.

If a router receives from a neighbor a better offer than its own, the router stops participating in the election for a period of robustness-count * **offer-period**. Eventually, all routers except the best candidate stop sending Offer messages.

Options *milliseconds*—Interval to wait before retransmitting DF Offer and Winner messages.

Range: 100 through 10,000 milliseconds

Default: 100

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7
- robustness-count on page 26

robustness-count

Syntax robustness-count *number*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim interface *interface-name* bidirectional df-election],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election],
[edit protocols pim interface *interface-name* bidirectional df-election],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name* bidirectional df-election]

Release Information Statement introduced in Junos OS Release 12.1.

Description Configure the designated forwarder (DF) election robustness count for bidirectional PIM. When a DF election Offer or Winner message fails to be received, the message is retransmitted. The **robustness-count** statement sets the minimum number of DF election messages that must fail to be received for DF election to fail. To prevent routing loops, all routers on the link must have a consistent view of the DF. When the DF election fails because DF election messages are not received, forwarding on bidirectional PIM routes is suspended.

If a router receives from a neighbor a better offer than its own, the router stops participating in the election for a period of **robustness-count** * offer-period. Eventually, all routers except the best candidate stop sending Offer messages.

Options *number*—Number of transmission attempts for DF election messages.

Range: 1 through 10

Default: 3

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

address (Bidirectional Rendezvous Points)

Syntax

```
address address {
  group-ranges {
    destination-ip-prefix</prefix-length>;
  }
  hold-time seconds;
  priority number;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols pim rp bidirectional],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim rp bidirectional],
[edit protocols pim rp bidirectional],
[edit routing-instances *routing-instance-name* protocols pim rp bidirectional]

Release Information

Statement introduced in Junos OS Release 12.1.

Description

Configure bidirectional rendezvous point (RP) addresses. The address can be a loopback interface address, an address of a link interface, or an address that is not assigned to an interface but belongs to a subnet that is reachable by the bidirectional PIM routers in the network.

Options

address—Bidirectional RP address.

Default: 232.0.0.0/8

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Understanding Bidirectional PIM on page 2
- Example: Configuring Bidirectional PIM on page 7

show pim bidirectional df-election

Syntax

show pim bidirectional df-election
<brief | detail >
<inet | inet6>
<instance *instance name*>
<logical-system (all | *logical-system-name*)>
<rpa *address*>

Release Information

Command introduced in Junos OS Release 12.1.

Description

For bidirectional PIM, display the designated forwarder (DF) election results for each interface grouped by the rendezvous point addresses (RPAs).

Options

none—Display standard information about all interfaces.

brief | detail—(Optional) Display the specified level of output.

inet | inet6—(Optional) Display DF election results for IPv4 or IPv6 family addresses, respectively.

instance *instance-name*—(Optional) Display DF election results for a specific routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

rpa *address*—(Optional) Display the DF election results for an RP address.

Required Privilege Level

view

List of Sample Output

show pim bidirectional df-election on page 29
show pim bidirectional df-election brief on page 29

Output Fields

Table 1 on page 28 describes the output fields for the **show pim bidirectional df-election** command. Output fields are listed in the approximate order in which they appear.

Table 1: show pim bidirectional df-election Output Fields

Field Name	Field Description	Level of Output
Family	IPv4 address family (**INET**) or IPv6 address family (**INET6**).	All levels
Instance	Name of the routing instance.	All levels
RPA	RP address.	All levels
Group ranges	Address ranges of the multicast groups mapped to this RP address.	All levels

Table 1: show pim bidirectional df-election Output Fields *(continued)*

Field Name	Field Description	Level of Output
Interfaces	Bidirectional PIM interfaces on this router. An interface can win the DF election (**Win**), lose the DF election (**Lose**), or be the RP link (**RPL**). The RP link is the interface directly connected to a subnet that contains a phantom RP address. A phantom RP address is an RP address that is not assigned to a router interface.	All levels **brief** displays the DF election winner only.
DF	IP address of the designated forwarder.	All levels

Sample Output

show pim bidirectional df-election

```
user@host> show pim bidirectional df-election
Instance: PIM.master Family: INET

RPA: 10.10.1.3
Group ranges: 224.1.3.0/24, 225.1.3.0/24
Interfaces:
    ge-0/0/1.0    (RPL)      DF: none
    lo0.0         (Win)      DF: 10.255.179.246
    xe-4/1/0.0    (Win)      DF: 10.10.2.1

RPA: 10.10.13.2
Group ranges: 224.1.1.0/24, 225.1.1.0/24
Interfaces:
    ge-0/0/1.0    (Lose)     DF: 10.10.1.2
    lo0.0         (Win)      DF: 10.255.179.246
    xe-4/1/0.0    (Lose)     DF: 10.10.2.2

Instance: PIM.master Family: INET6

RPA: fec0::10:10:1:3
Group ranges: ff00::/8
Interfaces:
    ge-0/0/1.0    (Lose)     DF: fe80::b2c6:9aff:fe95:86fa
    lo0.0         (Win)      DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0    (Win)      DF: fe80::226:88ff:fec5:3c37

RPA: fec0::10:10:13:2
Group ranges: ff00::/8
Interfaces:
    ge-0/0/1.0    (Lose)     DF: fe80::b2c6:9aff:fe95:86fa
    lo0.0         (Win)      DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0    (Win)      DF: fe80::226:88ff:fec5:3c37
```

show pim bidirectional df-election brief

```
user@host> show pim bidirectional df-election brief
Instance: PIM.master Family: INET

RPA: 10.10.1.3
Group ranges: 224.1.3.0/24, 225.1.3.0/24
Interfaces:
    lo0.0         (Win)      DF: 10.255.179.246
    xe-4/1/0.0    (Win)      DF: 10.10.2.1

RPA: 10.10.13.2
Group ranges: 224.1.1.0/24, 225.1.1.0/24
Interfaces:
```

```
    lo0.0          (Win)      DF: 10.255.179.246

Instance: PIM.master Family: INET6

RPA: fec0::10:10:1:3
Group ranges: ff00::/8
Interfaces:
    lo0.0          (Win)      DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0     (Win)      DF: fe80::226:88ff:fec5:3c37

RPA: fec0::10:10:13:2
Group ranges: ff00::/8
Interfaces:
    lo0.0          (Win)      DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0     (Win)      DF: fe80::226:88ff:fec5:3c37
```


show pim bidirectional df-election interface

Syntax show pim bidirectional df-election interface
<inet | inet6>
<instance *instance name*>
<*interface-name*>
<logical-system (all | *logical-system-name*)>

Release Information Command introduced in Junos OS Release 12.1.

Description For bidirectional PIM, display the default and the configured designated forwarder (DF) election parameters for each interface.

Options **none**—Display standard information about all interfaces.

inet | inet6—(Optional) Display DF election parameters for IPv4 or IPv6 family addresses, respectively.

instance *instance-name*—(Optional) Display DF election parameters for a specific routing instance.

interface-name—(Optional) Display DF election parameters for a specific interface.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level view

List of Sample Output show pim bidirectional df-election interface on page 32

Output Fields Table 2 on page 31 describes the output fields for the **show pim bidirectional df-election interface** command. Output fields are listed in the approximate order in which they appear.

Table 2: show pim bidirectional df-election interface Output Fields

Field Name	Field Description
Instance	Name of the routing instance.
Family	IPv4 address family (**INET**) or IPv6 address family (**INET6**).
Interface	Name of the bidirectional PIM interface.
Robustnes Count	Minimum number of DF election messages that must fail to be received for DF election to fail.
Offer Period	Interval between repeated DF election messages.
Backoff Period	Period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

Table 2: show pim bidirectional df-election interface Output Fields *(continued)*

Field Name	Field Description
RPA	RP address.
State	For each RP address, state of each interface with respect to the DF election: **Offer** (when the election is in progress), **Win**, or **Lose**.
DF	IP address of the designated forwarder.

Sample Output

show pim bidirectional df-election interface

```
user@host> show pim bidirectional df-election interface
Instance: PIM.master Family: INET

Interface: ge-0/0/1.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                             State  DF
  10.10.1.3                       Offer  none
  10.10.13.2                      Lose   10.10.1.2

Interface: lo0.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                             State  DF
  10.10.1.3                       Win    10.255.179.246
  10.10.13.2                      Win    10.255.179.246

Interface: xe-4/1/0.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                             State  DF
  10.10.1.3                       Win    10.10.2.1
  10.10.13.2                      Lose   10.10.2.2

Instance: PIM.master Family: INET6

Interface: ge-0/0/1.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                             State  DF
  fec0::10:10:1:3                 Lose   fe80::b2c6:9aff:fe95:86fa
  fec0::10:10:13:2                Lose   fe80::b2c6:9aff:fe95:86fa

Interface: lo0.0
  Robustness Count: 3
  Offer Period: 100 ms
```

```
  Backoff Period: 1000 ms

  RPA                           State  DF
  fec0::10:10:1:3               Win    fe80::2a0:a50f:fc64:e661
  fec0::10:10:13:2              Win    fe80::2a0:a50f:fc64:e661

Interface: xe-4/1/0.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                           State  DF
  fec0::10:10:1:3               Win    fe80::226:88ff:fec5:3c37
  fec0::10:10:13:2              Win    fe80::226:88ff:fec5:3c37
```

mode (Protocols PIM)

Syntax mode (bidirectional-sparse | bidirectional-sparse-dense | dense | sparse | sparse-dense);

Hierarchy Level [edit logical-systems *logical-system-name* protocols pim interface *interface-name*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim interface *interface-name*],
[edit protocols pim interface *interface-name*],
[edit routing-instances *routing-instance-name* protocols pim interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
bidirectional-sparse and **bidirectional-sparse-dense** options introduced in Junos OS Release 12.1.

Description Configure the PIM mode on the interface.

Options The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:

- **bidirectional-sparse**—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode.
- **bidirectional-sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in bidirectional, sparse, or SSM mode.
- **dense**—Use if all multicast groups are operating in dense mode.
- **sparse**—Use if all multicast groups are operating in sparse mode or SSM mode.
- **sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in sparse mode or SSM mode.

Default: Sparse mode

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring PIM Dense Mode Properties in the Multicast Protocols Configuration Guide
- Configuring PIM Sparse-Dense Mode Properties in the Multicast Protocols Configuration Guide
- Example: Configuring Bidirectional PIM on page 7

group-ranges

Syntax

```
group-ranges {
  destination-ip-prefix</prefix-length>;
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols pim rp bidirectional address *address*],
[edit logical-systems *logical-system-name* protocols pim rp embedded-rp],
[edit logical-systems *logical-system-name* routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols pim rp embedded-rp],
[edit protocols pim rp bidirectional address *address*],
[edit protocols pim rp embedded-rp],
[edit protocols pim rp local family (inet | inet6)],
[edit protocols pim rp static address *address*],
[edit routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit routing-instances *routing-instance-name* protocols pim rp embedded-rp],
[edit routing-instances *routing-instance-name* protocols pim rp local family (inet | inet6)],
[edit routing-instances *routing-instance-name* protocols pim rp static address *address*]

Release Information

Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.
Support for bidirectional RP addresses introduced in Junos OS Release 12.1.

Description

Configure the address ranges of the multicast groups for which this routing device can be a rendezvous point (RP).

Default

The routing device is eligible to be the RP for all IPv4 or IPv6 groups (224.0.0.0/4 or FF70::/12 to FFF0::/12).

Options

destination-ip-prefix</prefix-length>—Addresses or address ranges for which this routing device can be an RP.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Configuring Local PIM RPs in the Multicast Protocols Configuration Guide
- Configuring PIM Embedded RP for IPv6 in the Multicast Protocols Configuration Guide
- Example: Configuring Bidirectional PIM on page 7

hold-time (Protocols PIM)

Syntax hold-time *seconds*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim rp bidirectional address *address*],
[edit logical-systems *logical-system-name* routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit protocols pim rp bidirectional address *address*],
[edit protocols pim rp local family (inet | inet6)],
[edit routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit routing-instances *routing-instance-name* protocols pim rp local family (inet | inet6)]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.
Support for bidirectional RP addresses introduced in Junos OS Release 12.1.

Description Specify the time period for which a neighbor is to consider the sending routing device (this routing device) to be operative (up).

Options *seconds*—Hold time.

Range: 0 through 255

Default: 150 seconds

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Configuring Local PIM RPs in the Multicast Protocols Configuration Guide
- Example: Configuring Bidirectional PIM on page 7

priority (PIM RPs)

Syntax priority *number*;

Hierarchy Level
[edit logical-systems *logical-system-name* protocols pim rp bidirectional address *address*],
[edit logical-systems *logical-system-name* routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit protocols pim rp bidirectional address *address*],
[edit protocols pim rp local family (inet | inet6)],
[edit routing-instances *instance-name* protocols pim rp bidirectional address *address*],
[edit routing-instances *routing-instance-name* protocols pim rp local family (inet | inet6)]

Release Information
Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.
Support for bidirectional RP addresses introduced in Junos OS Release 12.1.

Description For PIM-SM, configure this routing device's priority for becoming an RP.

For bidirectional PIM, configure this RP address' priority for becoming an RP.

The bootstrap router uses this field when selecting the list of candidate rendezvous points to send in the bootstrap message. A smaller number increases the likelihood that the routing device or RP address becomes the RP. A priority value of 0 means that bootstrap router can override the group range being advertised by the candidate RP.

Options *number*—Priority for becoming an RP. A lower value corresponds to a higher priority.

Range: 0 through 255

Default: 1

Required Privilege Level
routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation
- Configuring Local PIM RPs in the Multicast Protocols Configuration Guide
- Example: Configuring Bidirectional PIM on page 7