PIM Auto−RP Behavior with Other RP Distribution Techniques in SM Domain Configuration Example

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Introduction

This document describes a deployment example where Mixed Rendezvous Point (RP) distribution methods are used along with Auto−RP and a common problem that might be seen with the workaround. Sparse Mode (SM) is one of the operating modes of Protocol Independent Multicast (PIM) which uses explicit Join/Prune Messages and RP instead of Dense Mode (DM) PIMs or Distance Vector Multicast Routing Protocol's (DVMRP's) broadcast and prune technique.

Each multicast group has a shared tree via which receivers hear of new sources and new receivers hear of all sources. The RP is the root of this per−group shared tree, called the RP−Tree.

PIM SM uses RP, which is the root of the shared tree. An RP acts as the meeting point for sources and receivers of multicast data. In a PIM SM network, sources must send their traffic to the RP through PIM Register Messages.

There could be multiple ways to spread RP information to the PIM routers that operate in SM:

- Static RP
- Auto−RP
- Bootstrap (BSR)

Prerequisites

Requirements

Cisco recommends that you have knowledge of different flavors of PIM modes and PIM RP distribution techniques.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Background Information

Auto−RP and BSR are the dynamic ways to distribute RP information to other routers in the PIM SM domain, unlike the configuration of Static RP on all the routers which is a laborious task in scalable networks.

Auto−RP uses two terms − Candidate RP and Mapping Agents. Each Candidate RP advertises itself to the Mapping Agent that the multicast groups would like it to be the Candidate RP for. Mapping Agents elect the best RP from the Candidate RPs for a group and advertise this information to the other routers in the PIM Multicast Domain.

The above advertisement of messages by Auto−RP is acheived by using two group addresses, 224.0.1.39 and 224.0.1.40. These are assigned by Internet Assigned Numbers Authority (IANA) for Auto−RP.

Candidate RPs send RP Announce messages on the 224.0.1.39 group. These messages contain a list of multicast groups the device would like to be the RP for. Mapping Agents listen to 224.0.1.39 in order to collect the RP information from all candidate RPs and send RP Discovery Messages on the 224.0.1.40 group. The RP Discovery Messages destined to 224.0.1.40 contain the best elected RP−to−group mapping information from Mapping Agents.

All the PIM routers join the multicast group 224.0.1.40 when the first PIM−enabled interface comes up. This interface is seen in the outgoing interface list for this group if it is the Designated Router (DR) on that PIM Segment.

Note: It is the responsibility of the DR to connect the receiver to the shared tree if there are multiple PIM routers on that segment.

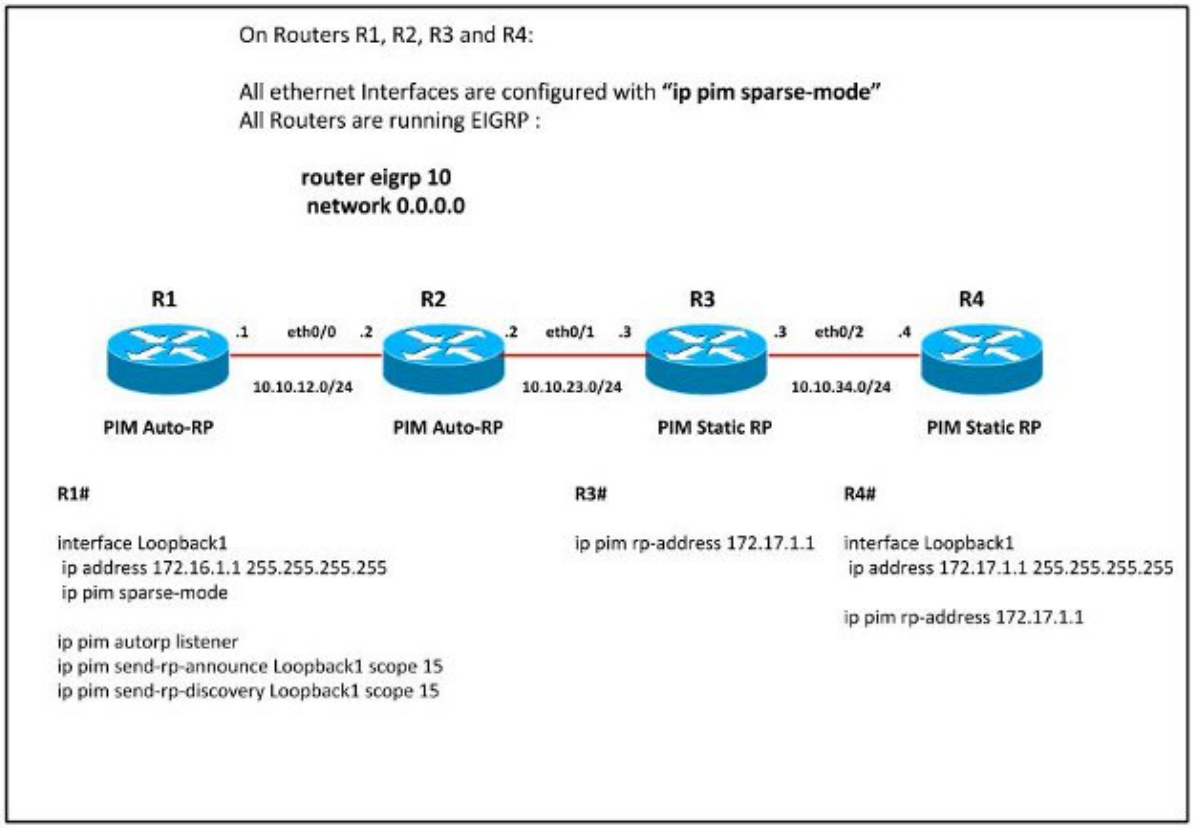
One of the advantages to listen by default on group 224.0.1.40 is that you do not need to configure leaf routers in the PIM domain in order to learn RP Information via Auto−RP. In case of any change in RP designation you just need the configuration change on the routers that are RPs.

By default, the RP Discovery Message could not be sent out of PIM SM enabled interfaces. One of the possible solutions to send this information to other PIM Enabled Routers is to enter the ***ip pim autorp listener*** command. If you enter the ***ip pim autorp listener*** command it causes the IP multicast traffic for the two Auto−RP groups, 224.0.1.39 and 224.0.1.40, to be PIM DM flooded across the interfaces configured for PIM SM. This way the routers which listen for group 224.0.1.40 learn the Auto−RP information and hence learn the RP address.

Configure

Network Diagram

Consider this Mixed RP Deployed Topology with PIM Auto−RP and Static RP where all routers run Cisco IOS® Release 15.2(4)S6.



The PIM SM is enabled on all routers with the "ip pim autorp listener" configured on router R1.Thus the PIM Auto−RP Messages are received on R2, and hence it learns the RP information.

Note: The "ip pim autorp listener" is only for flooding the messages for two Auto−RP groups, 224.0.1.39 and 224.0.1.40, to be PIM DM flooded. It does not have any impact on the receival of the Auto−RP messages.

Configuration

R2#

```
R2#show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s) 224.0.0.0/4
  RP 172.16.1.1 (?), v2v1
    Info source: 172.16.1.1 (?), elected via Auto-RP>
         Uptime: 01:14:22, expires: 00:02:32

R2#show ip pim neighbor
PIM Neighbor Table
```

```
Mode: B − Bidir Capable, DR − Designated Router, N − Default DR Priority,
      P − Proxy Capable, S − State Refresh Capable, G − GenID Capable
Neighbor          Interface               Uptime/Expires    Ver   DR
Address                                                           Prio/Mode
10.10.12.1        Ethernet0/0             00:53:18/00:01:33 v2    1 / S P G
10.10.23.3        Ethernet0/1             00:56:31/00:01:44 v2    1 / DR S P G

R2#show ip mroute 224.0.1.40

(*, 224.0.1.40), 00:55:01/stopped, RP 0.0.0.0, flags: DCL
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet0/0, Forward/Sparse, 00:46:41/00:02:52

(172.16.1.1, 224.0.1.40), 00:47:20/00:02:17, flags: PLTX
  Incoming interface: Ethernet0/0, RPF nbr 10.10.12.1
  Outgoing interface list: Null
```

These Auto−RP messages are not forwarded to router R3 as " ip pim autorp listener" is not configured, so the router R3 shows Static RP as PIM RP.

```
R3#show ip pim rp mapp
PIM Group−to−RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.17.1.1 (?)
```

Verify

There is currently no verification procedure available for this configuration.

Troubleshoot

Now, configure R2 as the DR for the segment between R2−R3 and see the difference in the outputs.

```
R2(config)#int eth0/1
R2(config−if)#ip pim dr−priority 100
R2(config−if)#end
R2#
*Sep  1 13:17:09.309: %PIM−5−DRCHG: DR change from neighbor 10.10.23.3 to 10.10.23.2
 on interface Ethernet0/1
*Sep  1 13:17:09.938: %SYS−5−CONFIG_I: Configured from console by console

R2#show ip mroute 224.0.1.40

(*, 224.0.1.40), 01:02:12/stopped, RP 0.0.0.0, flags: DCL
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Ethernet0/1, Forward/Sparse, 00:01:45/00:02:11
    Ethernet0/0, Forward/Sparse, 00:53:52/00:02:43

(172.16.1.1, 224.0.1.40), 00:54:31/00:02:05, flags: LT
  Incoming interface: Ethernet0/0, RPF nbr 10.10.12.1
  Outgoing interface list:
    Ethernet0/1, Forward/Sparse, 00:01:45/00:02:35
```

It causes the interface Eth0/1 to be listed in outgoing interface list for 224.0.1.40 on router R2 and hence Auto−RP messages are sent from R2 to R3, although PIM SM is enabled on the interfaces and "ip pim autorp listener" is not enabled.

With this configuration, the dynamic RP information is preferred over Static RP and hence R3 will not use its Static RP. Instead it will use RP mapping via Auto−RP.

```
R3#show ip pim autorp

  AutoRP is enabled.
  RP Discovery packet MTU is 0.
  224.0.1.40 is joined on Ethernet0/1.

PIM AutoRP Statistics: Sent/Received
  RP Announce: 0/0, RP Discovery: 0/187

R3#show ip pim rp mapping
PIM Group−to−RP Mappings

Group(s) 224.0.0.0/4
  RP 172.16.1.1 (?), v2v1
    Info source: 172.16.1.1 (?), elected via Auto−RP
         Uptime: 00:03:38, expires: 00:02:18
Group(s): 224.0.0.0/4, Static
    RP: 172.17.1.1 (?)
```

Further, if the configuration for R3 is modified so that R3 becomes the DR for the segment between R3−R4 as shown here:

```
R3(config)#interface Ethernet0/2
R3(config−if)#ip pim dr−priority 100
R3(config−if)#end


*Sep  1 13:32:43.224: %PIM−5−DRCHG: DR change from neighbor 10.10.34.3 to 10.10.34.4 on
 interface Ethernet0/2


R3#show ip mroute 224.0.1.40

(*, 224.0.1.40), 01:37:33/stopped, RP 172.17.1.1, flags: SJPCL
  Incoming interface: Ethernet0/2, RPF nbr 10.10.34.4
  Outgoing interface list: Null

(172.16.1.1, 224.0.1.40), 00:17:00/00:02:49, flags: LT
  Incoming interface: Ethernet0/1, RPF nbr 10.10.23.2
  Outgoing interface list:
    Ethernet0/2, Forward/Sparse, 00:11:38/00:02:22
```

It causes the PIM Auto−RP messages to be sent from R3 to R4.

```
R4#show ip pim autorp
AutoRP Information:
  AutoRP is enabled.
  RP Discovery packet MTU is 0.
  224.0.1.40 is joined on Ethernet0/2.

PIM AutoRP Statistics: Sent/Received
  RP Announce: 0/0, RP Discovery: 0/10

R4#show ip pim rp map
PIM Group−to−RP Mappings

Group(s) 224.0.0.0/4
  RP 172.16.1.1 (?), v2v1
    Info source: 172.16.1.1 (?), elected via Auto−RP
         Uptime: 00:09:42, expires: 00:02:10
Group(s): 224.0.0.0/4, Static
```

```
    RP: 172.17.1.1 (?)
```

Now the router R4 also learns Auto−RP messages and prefers dynamic learned RP via Auto−RP over Static RP.

Workarounds

Configure IP PIM Multicast Boundary on R2

R2#

```
access−list 10 deny   224.0.1.40>
access−list 10 permit any

interface Ethernet0/1
 ip multicast boundary 10 out
```

R3#

```
R3#show ip pim rp map
PIM Group−to−RP Mappings

Group(s): 224.0.0.0/4, Static
    RP: 172.17.1.1 (?)

*Sep  1 13:45:47.254: Auto−RP(0): Mapping (224.0.0.0/4, RP:172.16.1.1) expired,
*Sep  1 13:45:47.255: Auto−RP(0): Mapping for (224.0.0.0/4) deleted
```

Configure Static RP with Override Keyword to Override Dynamically Learned RP Mappings on R2 and R3

```
R3(config)#ip pim rp−address 172.17.1.1 override
```

Enter the ***no ip pim autorp*** commnd in order to disable PIM Auto−RP.

```
R3(config)#no ip pim autorp
```

```
R3#show ip pim autorp
AutoRP Information:
  AutoRP is disabled.
```

This command disallows joining 224.0.1.40 upon PIM configured on an interface.

Note: Further evaluation of the Mcast Core Design is needed before you implement this knob. This should be consistent across all the Mcast enabled routers in order to avoid any unusual behavior.

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