

Multicast Observation Lab – Multiple Routers (PIM Sparse Mode)

Objective

The objective is to observe how **interconnected multicast routers** use **PIM Sparse Mode (PIM-SM)** to distribute multicast traffic. The focus should be on the changes in the multicast routing table. This is an observation lab. No troubleshooting is required.

Topology Overview

RTR1, RTR2, RTR3 and RTR4 are multicast-enabled routers. Source and Host A are routers with IP routing disabled. They will serve as PCs. Host A is configured to join group 239.1.1.1.

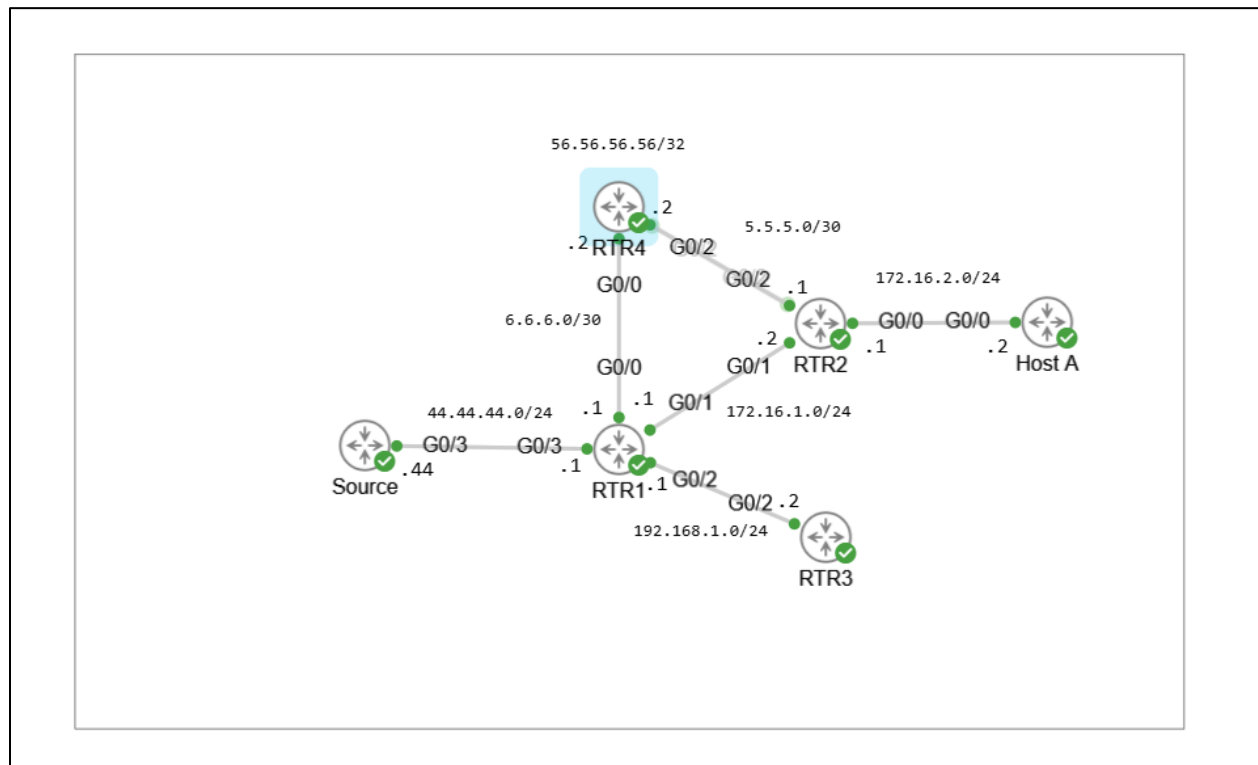


Figure 1 – Topology

Task 1 – Configure PIM-SM

- a. View PIM interfaces on RTR1.

```
RTR# show ip pim interface
```

Observe: PIM-DM is configured on all RTR1's interfaces.

```
RTR1#sh ip pim interface
```

Address	Interface	Ver/ Mode	Nbr Count	Query Intvl	DR Prior	DR
6.6.6.1	GigabitEthernet0/0	v2/D	1	30	1	6.6.6.2
172.16.1.1	GigabitEthernet0/1	v2/D	1	30	1	172.16.1.2
192.168.1.1	GigabitEthernet0/2	v2/D	1	30	1	192.168.1.2
44.44.44.1	GigabitEthernet0/3	v2/D	0	30	1	44.44.44.1

```
RTR1#
```

Figure 2 – RTR1 show ip pim interface output

Engineer Insight: The **Mode** column identifies the PIM mode configured on each interface. A value of **D** indicates PIM-DM.

- b. Configure PIM-SM on both sides of all inter-router connections. View RTR1's PIM interfaces.

```
RTR(config-if)# ip pim sparse-mode
```

Observe: The value of the Mode column has changed to **S** signifying **PIM-SM** has been configured on the interfaces.

```
RTR1#sh ip pim interface
```

Address	Interface	Ver/ Mode	Nbr Count	Query Intvl	DR Prior	DR
6.6.6.1	GigabitEthernet0/0	v2/S	1	30	1	6.6.6.2
172.16.1.1	GigabitEthernet0/1	v2/S	1	30	1	172.16.1.2
192.168.1.1	GigabitEthernet0/2	v2/S	1	30	1	192.168.1.2
44.44.44.1	GigabitEthernet0/3	v2/S	0	30	1	44.44.44.1

```
RTR1#
```

Figure 3 – RTR1 show ip pim interface output

- c. On Source, begin sending multicast traffic to group 239.1.1.1. On RTR1 and RTR2 view mroute tables.

Observe: Host A does not reply to the ping. RTR1 has not created a forwarding state for (44.44.44.44, 239.1.1.1). One possible explanation is that RTR1 never received the multicast traffic from Source; however, that is not the cause in this lab.

RTR2 has not created a forwarding state for (44.44.44.44, 239.1.1.1) which is expected because it would have learned of the stream from RTR1.

Engineer Insight: In PIM-DM, the router initially behaves as though every PIM-DM-enabled interface leads to interested receivers. As a result, multicast traffic is flooded out all PIM-DM-enabled interfaces. Interfaces discovered to not have interested receivers are temporarily pruned

Unlike PIM-DM, PIM-SM does not assume multicast traffic should be distributed throughout the entire network. Instead, routers first establish where multicast traffic should be sent before forwarding it. To accomplish this, PIM-SM uses a **Rendezvous Point (RP)**, which serves as a common reference point that helps multicast routers discover where multicast traffic is needed before it is distributed.

The RP is typically another multicast-enabled router in the network and is identified by an IP address. All routers participating in the PIM-SM domain must know the RP address, and the RP must be reachable. Multicast routers interact with the RP to create the state information needed to initially forward a multicast stream from its source toward interested receivers. The detailed mechanics of this process are outside the scope of this lab and will be covered in a future lab.

RTR1 is configured to use PIM-SM, but it has not been configured with an RP address. As a result, RTR1 receives the multicast stream from source 44.44.44.44 for group 239.1.1.1, but it does not create the forwarding state needed to distribute the stream through the PIM-SM network

Task 2 – Configure Rendezvous Point (RP)

- a. On RTR1, view information about the RP.

```
RTR1# show ip pim rp
```

Observe: RTR1 is unaware of an RP for group 239.1.1.1.

```
RTR1#sh ip pim rp
RTR1#
```

Figure 4 – RTR1 show ip pim rp output

- b. On RTR1, RTR2, RTR3, and RTR4 configure 56.56.56.56, RTR4, as the RP. View RP information on RTR1 and RTR2.

```
RTR(config)# ip pim rp-address 56.56.56.56
```

Observe: The show ip pim rp output on RTR1 does not display an RP entry for group 239.1.1.1 although RTR1 was configured with the RP address. RTR2 displays an RP entry for group 239.1.1.1.

```
RTR1#sh ip pim rp
Group: 224.0.1.40, RP: 56.56.56.56, uptime 00:00:05, expires never
RTR1#
```

Figure 5 – RTR1 show ip pim rp output

```
RTR2#sh ip pim rp
Group: 239.1.1.1, RP: 56.56.56.56, uptime 03:29:38, expires never
Group: 224.0.1.40, RP: 56.56.56.56, uptime 03:29:48, expires never
RTR2#
```

Figure 6 – RTR2 show ip pim rp output

Question:

- Why does RTR2 know of the RP group for 239.1.1.1 and RTR1 does not?

- c. On Source, begin sending multicast traffic to group 239.1.1.1. On RTR1 and RTR2 view mroute tables. On RTR1, view RP information.

Observe: Host A replies to the ping. RTR1 has created forwarding state for (44.44.44.44, 239.1.1.1) and populated the OIL with Gi0/1. RTR2 has created forwarding state for (44.44.44.44, 239.1.1.1) and populated the OIL with Gi0/1. RTR3 has no forwarding state for (44.44.44.44, 239.1.1.1) or (*, 239.1.1.1).

```
RTR1#sh ip pim rp
Group: 239.1.1.1, RP: 56.56.56.56, uptime 00:00:16, expires never
Group: 224.0.1.40, RP: 56.56.56.56, uptime 00:03:08, expires never
RTR1#
```

Figure 7 – RTR1 show ip pim rp output

```
(*, 239.1.1.1), 00:05:28/stopped, RP 56.56.56.56, flags: SPF
Incoming interface: GigabitEthernet0/0, RPF nbr 6.6.6.2
Outgoing interface list: Null

(44.44.44.44, 239.1.1.1), 00:00:10/00:02:49, flags: FT
Incoming interface: GigabitEthernet0/3, RPF nbr 0.0.0.0, Registering
Outgoing interface list:
GigabitEthernet0/1, Forward/Sparse, 00:00:10/00:03:19
```

Figure 8 – RTR1 show ip mroute output

```
(*, 239.1.1.1), 00:29:41/stopped, RP 56.56.56.56, flags: SJC
Incoming interface: GigabitEthernet0/2, RPF nbr 5.5.5.2
Outgoing interface list:
GigabitEthernet0/1, Forward/Sparse, 00:29:16/stopped
GigabitEthernet0/0, Forward/Sparse, 00:29:41/00:02:18

(44.44.44.44, 239.1.1.1), 00:01:30/00:01:29, flags: JT
Incoming interface: GigabitEthernet0/1, RPF nbr 172.16.1.1
Outgoing interface list:
GigabitEthernet0/0, Forward/Sparse, 00:01:30/00:02:18
```

Figure 9 – RTR2 show ip mroute output

```
(*, 224.0.1.40), 00:31:32/00:02:55, RP 0.0.0.0, flags: DCL
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/2, Forward/Sparse, 00:31:32/00:02:55
```

Figure 10 – RTR3 show ip mroute output

Engineer Insight: Figure 10 shows RTR3's lack of multicast state information for group 239.1.1.1. Unlike with PIM-DM, RTR3 never received multicast traffic simply because it was connected to another multicast router. Since no receivers exist behind RTR3, no multicast traffic was forwarded to the RTR3, and no multicast forwarding state was created by RTR3.

This eliminates the inefficiency of PIM-DM, where multicast traffic is initially flooded to routers that ultimately do not require it.

When RTR1 was unaware of the RP, it did not create forwarding state for (44.44.44.44, 239.1.1.1). After RTR1 was configured with the RP, the show ip pim rp output remained unchanged until RTR1 learned of the multicast stream from source 44.44.44.44 to group 239.1.1.1