

Multicast Observation Lab – Receiver Side (IGMP)

Objective

The purpose of this lab is to observe multicast from the receiver side and examine **Internet Group Management Protocol (IGMP)** behavior. This is an **observation-focused lab**. The learner should focus on how receiver membership is learned and how that membership changes the multicast forwarding state.

Topology Overview

RTR1 is a multicast-enabled router. Source and hosts A and B are routers with IP routing disabled. They will serve as PCs.

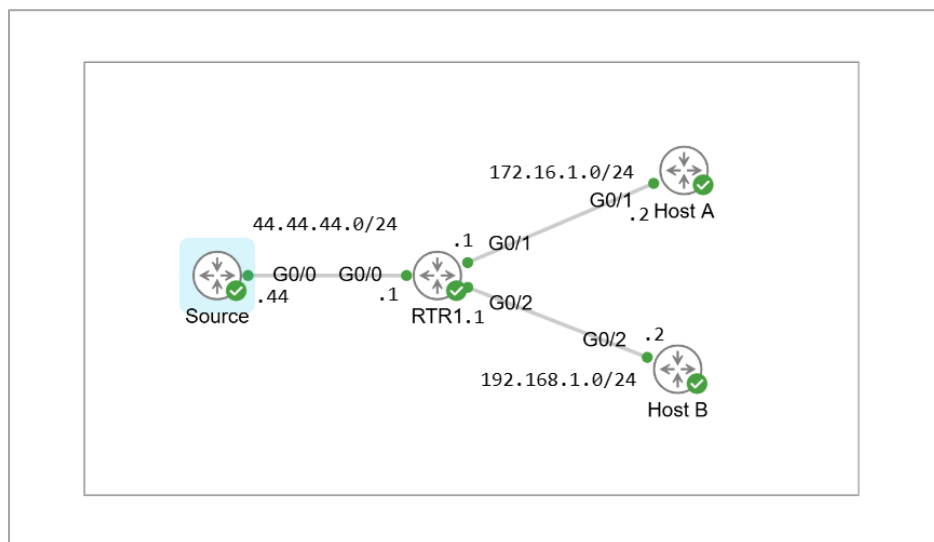


Figure 1 – Topology

Task 1 – Explore IGMP

- a. On RTR1, observe the IGMP groups and mroute table.

```
RTR1# show ip igmp groups
```

```
RTR1# show ip mroute
```

Observe: The output of the *show ip igmp groups* command reveals RTR1 has not yet learned of multicast interest from any receivers. The output of *show ip mroute* shows RTR1 has not learned of any multicast streams. The entries for 224.1.1.40 that you see are for a multicast technology outside the scope of this lab.

```
RTR1#sh ip igmp groups
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter  Group Accounted
224.0.1.40         GigabitEthernet0/0 00:06:38  00:02:31   44.44.44.1
RTR1#
```

Figure 2 – RTR1 show ip igmp groups output

```
(*, 224.0.1.40), 00:07:54/00:02:11, RP 0.0.0.0, flags: DCL
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/0, Forward/Dense, 00:07:54/stopped
RTR1#
```

Figure 3 – RTR1 show ip mroute output

Engineer Insight: A multicast stream is uniquely identified by the combination of a **source IP address (S)** and a **multicast group address (G)**, commonly represented as **(S,G)**.

- b. On Host A, join group 239.1.1.1.

```
HostA# configure terminal
HostA(config)# interface GigabitEthernet0/1
HostA(config-if)# ip igmp join-group 239.1.1.1
```

Note: In this lab, ip igmp join-group makes the Cisco device act as a local multicast receiver. A multicast application normally requests group membership through the host IP stack, which then uses IGMP to report that membership to the local multicast router.

- c. On RTR1, observe the learned IGMP membership, then observe the mroute table.

```
RTR1# show ip igmp groups
```

```
RTR1# show ip mroute
```

Observe: RTR1 has learned membership interest for group 239.1.1.1 on the interface connected to Host A. The multicast routing table now contains forwarding state associated with group 239.1.1.1 and Gi0/1 appears in the Outgoing Interface List (OIL).

```
RTR1#sh ip igmp groups
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter  Group Accounted
239.1.1.1          GigabitEthernet0/1 00:00:18  00:02:41   172.16.1.2
224.0.1.40         GigabitEthernet0/0 00:16:27  00:02:36   44.44.44.1
RTR1#
```

Figure 4 – RTR1 show ip igmp groups output

```
(*, 239.1.1.1), 00:01:01/00:02:49, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/1, Forward/Dense, 00:01:01/stopped
```

Figure 5 – RTR1 show ip mroute output

Engineer Insight: To join group 239.1.1.1, Host A generated an **Internet Group Management Protocol (IGMP) Membership Report (MR)**. IGMP is the signaling method receivers and their local multicast routers (Gateways) use to communicate multicast group interest.

RTR1 records membership for each multicast group by downstream interface rather than by individual receiver. Interfaces with interested receivers are placed in the **Outgoing Interface List (OIL)** for a specific group entry within the mroute table. When multicast traffic arrives, RTR1 uses the OIL to identify the receiver-facing interfaces eligible to receive that traffic.

Notice that no source is recorded in the mroute entry. Host A requested **any-source** membership by not specifying a specific source in its MR. This means it wants multicast traffic sent to group 239.1.1.1 regardless of the source. The asterisk acts as a wildcard. The (*, G) entry, read as “star comma G,” represents interest in a group. In this topology, (*, 239.1.1.1) shows that RTR1 has receiver interest for group 239.1.1.1 and includes the

receiver-facing interface in the OIL. Multicast platforms and modes may create or display this state differently.

- d. On RTR1, view the IGMP interface information.

```
RTR1# show ip igmp interface gi0/1
```

```
RTR1#sh ip igmp interface gi0/1
GigabitEthernet0/1 is up, line protocol is up
Internet address is 172.16.1.1/24
IGMP is enabled on interface
Current IGMP host version is 2
Current IGMP router version is 2
```

Figure 6 – RTR1 show ip igmp interface output

Something to think about: The host and router IGMP versions are recorded independently. There must be significance behind this behavior.

Engineer Insight: There are **three** versions of IGMP: versions 1 through 3. **IGMPv2 is the default on the IOS platform** used in this lab. IGMP includes compatibility procedures for older hosts and routers. After detecting older-version messages on an interface, a device may temporarily use older-version behavior. The versions will be explored in more detail in a future lab or video.

- e. On hosts A and B, join group 239.1.1.2 then view group information.

```
HostA(config-if)# ip igmp join-group 239.1.1.2
```

```
HostB# configure terminal
HostB(config)# interface GigabitEthernet0/2
HostB(config-if)# ip igmp join-group 239.1.1.2
```

```
RTR1# show ip igmp groups
```

```
RTR1# show ip mroute
```

Observe: Group 239.1.1.2 is in the IGMP group membership table once for each of the interfaces with an interested receiver. In simple terms, there is backwards capability. The mroute table shows, Gi0/1 appears in the OIL for groups 239.1.1.1 and 239.1.1.2, while only Gi0/2 appears in the OIL for 239.1.1.2

```
RTR1#sh ip igmp groups
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter  Group Accounted
239.1.1.1          GigabitEthernet0/1 00:20:46  00:02:42   172.16.1.2
239.1.1.2          GigabitEthernet0/2 00:01:43  00:02:40   192.168.1.2
239.1.1.2          GigabitEthernet0/1 00:01:55  00:02:42   172.16.1.2
224.0.1.40         GigabitEthernet0/0 01:00:25  00:02:42   44.44.44.1
RTR1#
```

Figure 7 – RTR1 show ip igmp groups output

```
(*, 239.1.1.1), 00:00:01/00:02:58, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/1, Forward/Dense, 00:00:01/stopped
(*, 239.1.1.2), 00:00:01/00:02:57, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/2, Forward/Dense, 00:00:01/stopped
  GigabitEthernet0/1, Forward/Dense, 00:00:01/stopped
```

Figure 8 – RTR1 show ip mroute output

Engineer Insight: Each group with interested receivers receives a corresponding (*, G) state in the multicast routing table. Membership is associated with downstream interfaces, and one interface may be associated with multiple multicast groups.

- f. On Source, generate multicast traffic for group 239.1.1.1. Then observe the resulting forwarding state on RTR1.

```
Source# ping 239.1.1.1 re 2
```

```
RTR1# show ip mroute
```

Observe: RTR1 now has an (S, G), read as "source comma G," entry for (44.44.44.44, 239.1.1.1).

```
(* , 239.1.1.1), 00:42:42/stopped, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/1, Forward/Dense, 00:19:11/stopped

(44.44.44.44, 239.1.1.1), 00:01:06/00:01:53, flags: T
Incoming interface: GigabitEthernet0/0, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/1, Forward/Dense, 00:01:06/stopped

(* , 239.1.1.2), 00:00:21/00:02:51, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/2, Forward/Dense, 00:00:08/stopped
  GigabitEthernet0/1, Forward/Dense, 00:00:21/stopped
```

Figure 9 – RTR1 show ip mroute output

Engineer Insight: The (S, G) entry shows that RTR1 is aware of a multicast stream. The **Incoming Interface (IIF)** is the interface where traffic from the source is expected according to the Reverse Path Forwarding (RPF) check. The OIL identifies the receiver-facing interfaces that are eligible to receive the traffic.

Task 2 – Explore IGMP Cont'd

- a. On Host B, remove its membership for 239.1.1.2.

```
HostB(config-if)# no ip igmp join-group 239.1.1.2
```

```
RTR1# show ip igmp groups
```

```
RTR1# show ip mroute
```

Observe: The interface connected to Host B, Gi0/2, is no longer associated with group 239.1.1.2.

```
RTR1#sh ip igmp groups
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter  Group Accounted
239.1.1.1          GigabitEthernet0/1 01:09:15   00:02:05   172.16.1.2
239.1.1.2          GigabitEthernet0/1 00:50:24   00:02:07   172.16.1.2
224.0.1.40         GigabitEthernet0/0 01:48:54   00:02:08   44.44.44.1
RTR1#
```

Figure 10 – RTR1 show ip igmp groups output

```
(*, 239.1.1.2), 00:46:19/00:02:41, RP 0.0.0.0, flags: DC
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
GigabitEthernet0/1, Forward/Dense, 00:46:19/stopped
```

Figure 11 – RTR1 show ip mroute output

Engineer Insight: When Host B removes its membership RTR1 removes that interface from the group membership and forwarding state. The source may continue transmitting even though RTR1 no longer forwards the stream onto an interface with no known receivers. There are more detailed actions associated with this that will be discussed in future labs.