

Multicast Observation Lab – Source Side (RPF)

Objective

The purpose of this lab is to observe multicast from the source side and observe **Reverse Path Forwarding (RPF)** behavior. This is an **observation-focused lab**. The learner should focus on what changes in the **multicast routing table**.

Topology Overview

Source, RTR1, RTR2, and RTR3 are multicast enabled routers. Source serve as a router and multicast source. Host A is a router with ip routing disabled. It serves as the multicast receiver.

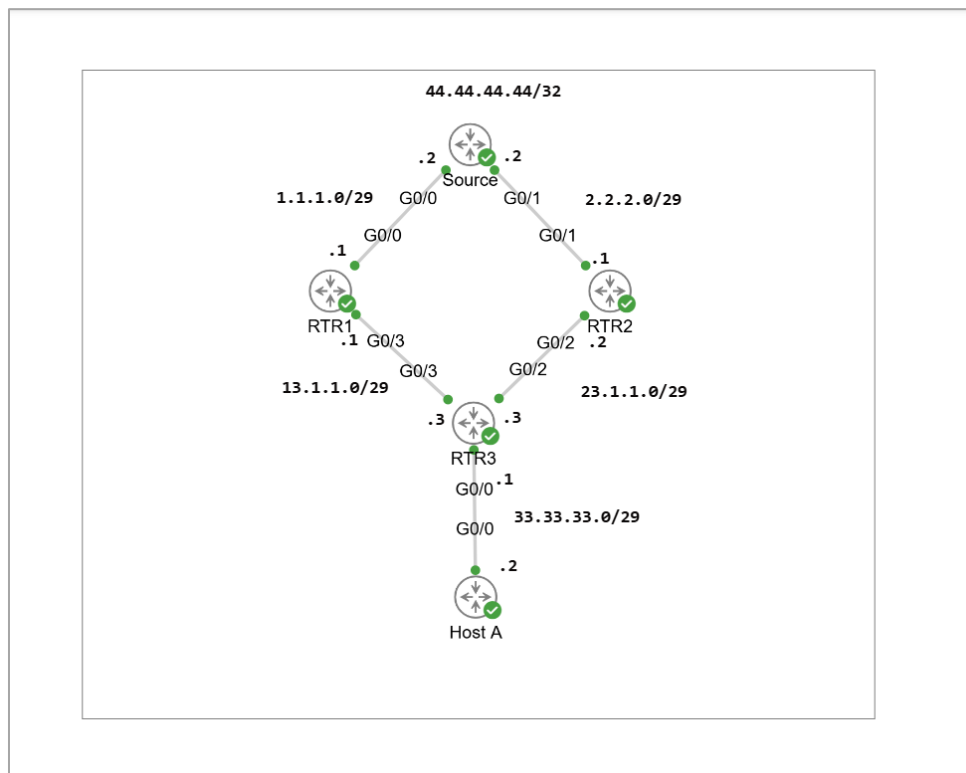


Figure 1 – Topology

Task 1 – Explore Reverse Path Forwarding (RPF) Check

- a. On Source, issue the ping as outlined in the command box. Host A, **33.33.33.2**, will respond.

```
ping 239.1.1.1 source 44.44.44.44 re 2
```

- b. On RTR3, view the status of multicast interfaces. By default, multicast is **not enabled** globally or on interfaces.

Note: **PLEASE** do not concern yourself with the mechanism for enabling multicast. That will be discussed in a future lab.

```
sh ip multicast interface
```

```
RTR3#sh ip multicast interface
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 33.33.33.1/29
  Multicast routing: enabled
  Multicast switching: fast
  Multicast packets in/out: 0/0
  Multicast TTL threshold: 0
  Multicast Tagswitching: disabled
GigabitEthernet0/2 is up, line protocol is up
  Internet address is 23.1.1.3/29
  Multicast routing: enabled
  Multicast switching: fast
  Multicast packets in/out: 2/2
  Multicast TTL threshold: 0
  Multicast Tagswitching: disabled
GigabitEthernet0/3 is up, line protocol is up
  Internet address is 13.1.1.3/29
  Multicast routing: enabled
  Multicast switching: fast
  Multicast packets in/out: 2/0
  Multicast TTL threshold: 0
  Multicast Tagswitching: disabled
RTR3#
```

Figure 2 – RTR3 show ip multicast interface output

- c. On RTR3, view the multicast routing table.

Question 1: What is the incoming interface for the multicast stream from 44.44.44.44 to 239.1.1.1?

Something to think about: If RTR3 is receiving the multicast stream from both RTR1 and RTR2, why is there only one incoming interface recorded?

```
(*, 239.1.1.1), 00:00:14/stopped, RP 0.0.0.0, flags: D
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
  GigabitEthernet0/3, Forward/Dense, 00:00:14/stopped
  GigabitEthernet0/2, Forward/Dense, 00:00:14/stopped

(44.44.44.44, 239.1.1.1), 00:00:14/00:02:45, flags: PT
Incoming interface: GigabitEthernet0/3, RPF nbr 13.1.1.1
Outgoing interface list:
  GigabitEthernet0/2, Prune/Dense, 00:00:14/00:02:45, A
```

Figure 3 – RTR3 show ip mroute output

- d. On RTR3, view the routing table.

Question 3: What interface would be used to forward a packet destined to the source, 44.44.44.44?

```
S* 0.0.0.0/0 [1/0] via 23.1.1.2
    13.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    13.1.1.0/29 is directly connected, GigabitEthernet0/3
L    13.1.1.3/32 is directly connected, GigabitEthernet0/3
    23.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    23.1.1.0/29 is directly connected, GigabitEthernet0/2
L    23.1.1.3/32 is directly connected, GigabitEthernet0/2
    33.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C    33.33.33.0/29 is directly connected, GigabitEthernet0/0
L    33.33.33.1/32 is directly connected, GigabitEthernet0/0
    44.0.0.0/32 is subnetted, 1 subnets
S    44.44.44.44 [1/0] via 13.1.1.1
RTR3#
```

Figure 4 – RTR3 show ip route output

- e. On RTR3, view the RPF check for source 44.44.44.44.

Question 4: What is the RPF interface value?

```
sh ip rpf 44.44.44.44
```

```
RTR3#sh ip rpf 44.44.44.44
RPF information for ? (44.44.44.44)
RPF interface: GigabitEthernet0/3
RPF neighbor: ? (13.1.1.1)
RPF route/mask: 44.44.44.44/32
RPF type: unicast (static)
Doing distance-preferred lookups across tables
RPF topology: ipv4 multicast base, originated from ipv4 unicast base
RTR3#
```

Figure 5 – RTR3 show ip rpf output

Engineer Insight

Unicast routing is centered on locating the destination. Multicast, on the other hand, is centered on locating the multicast **source**. Multicast uses the unicast routing table to locate the reverse path to the source. This is known as **reverse path forwarding**. The reverse path is the interface and next-hop that would be used to send unicast traffic back toward the multicast source.

RTR3 receives the multicast stream from both RTR1 and RTR2. RTR3 could send both streams to Host A; however, that would result in unwanted **duplication**. In other situations, the result could be a **loop**. For RTR3 to forward only one stream, it requires a mechanism to make a forwarding decision about which stream to select. This mechanism is known as the **Reverse Path Forwarding (RPF) check**.

The RPF check answers one question: **Would unicast traffic destined for the multicast source be sent out the interface receiving the multicast stream?** If the answer is yes, the check passes. If the answer is no, the check fails.

The logic is that if the source can be reached through an interface, it is safe to accept multicast traffic received on that interface.

In this case, RTR3 would forward traffic destined to 44.44.44.44 out GigabitEthernet0/3, based on the routing table. Interface Gi0/3 is therefore the **reverse path for multicast traffic sourced from 44.44.44.44**. As a result, RTR3 accepts multicast traffic received on Gi0/3 and ignores multicast traffic received on Gi0/2.

Task 2 – Cause Reverse Path Forwarding Check Failure

- a. On RTR3, issue the following commands.

```
interface GigabitEthernet 0/3  
no ip pim dense-mode
```

Note: PLEASE do not concern yourself with this specific command. It will be discussed in a future lab.

- b. On Source, ping using the following command. Host A will not respond. The ping fails.

```
ping 239.1.1.1 source 44.44.44.44 re 2
```

- c. On RTR3, view the multicast routing table. The incoming interface value of Null signifies that the multicast stream from RTR2 is being ignored. The **Incoming Interface (IIF)** list is a record of all valid interfaces receiving and specific stream.

```
(44.44.44.44, 239.1.1.1), 00:00:16/00:02:42, flags:  
  Incoming interface: Null, RPF nbr 0.0.0.0  
  Outgoing interface list:  
    GigabitEthernet0/2, Forward/Dense, 00:00:16/stopped
```

Figure 6 – RTR3 show ip mroute output

- d. On RTR3, view the RPF check for 44.44.44.44. The RPF check has failed. The reason is that interface Gi 0/2 is not recorded in the IIF list is because the interface is not valid.

```
RTR3#sh ip rpf 44.44.44.44  
failed, no route exists  
RTR3#
```

Figure 7 – RTR3 show ip rpf output

- e. On RTR3, view the routing table and observe that there is still a route to the source.

Question: Why is the RPF check failing due to no existing route when a route is present in the unicast routing table?

- f. On RTR3, view the status of multicast interfaces. Interface GigabitEthernet Gi0/3 is no longer enabled for multicast.

```
RTR3#sh ip multicast interface
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 33.33.33.1/29
  Multicast routing: enabled
  Multicast switching: fast
  Multicast packets in/out: 0/0
  Multicast TTL threshold: 0
  Multicast Tagswitching: disabled
GigabitEthernet0/2 is up, line protocol is up
  Internet address is 23.1.1.3/29
  Multicast routing: enabled
  Multicast switching: fast
  Multicast packets in/out: 2/2
  Multicast TTL threshold: 0
  Multicast Tagswitching: disabled
RTR3#
```

Figure 8 – RTR3 show ip multicast interface output

Engineer Insight

A requirement for a path to be considered a valid reverse path is that the associated interface is enabled for multicast. Although a unicast route still exists, no multicast-enabled reverse path exists. Therefore, the RPF check fails. Multicast traffic arriving on Gi0/2 will continue to be ignored and the interface not recorded as incoming.

Task 3 – Correct Reverse Path Forwarding Check Failure

- a. On RTR3, modify the static route, to the source so that it points toward RTR2.

Note: There is a default route that would be enough for the reverse path check to pass once the static route to RTR3 is removed.

```
RTR3(config)#
RTR3(config)#no ip route 44.44.44.44 255.255.255.255 13.1.1.1
RTR3(config)#ip route 44.44.44.44 255.255.255.255 23.1.1.2
RTR3(config)#
```

Figure 9 – RTR3 static route modification

- b. On RTR3, view the RPF status for 44.44.44.44 .

```
RTR3#sh ip rpf 44.44.44.44
RPF information for ? (44.44.44.44)
  RPF interface: GigabitEthernet0/2
  RPF neighbor: ? (23.1.1.2)
  RPF route/mask: 44.44.44.44/32
  RPF type: unicast (static)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv4 unicast base
RTR3#
```

Figure 10 – RTR3 show ip rpf 44.44.44.44 output

- c. Generate traffic from the source, then view RTR3's multicast table. Host A will respond.

Question 5: What is the incoming interface?

```
(44.44.44.44, 239.1.1.1), 00:00:10/00:02:49, flags: PT
  Incoming interface: GigabitEthernet0/2, RPF nbr 23.1.1.2
  Outgoing interface list: Null
```

Figure 11– RTR3 show ip mroute output

Engineer Insight

With the static route pointed towards RTR2, multicast once again has a multicast enabled reverse path to the source. A multicast stream can now be received and accepted.